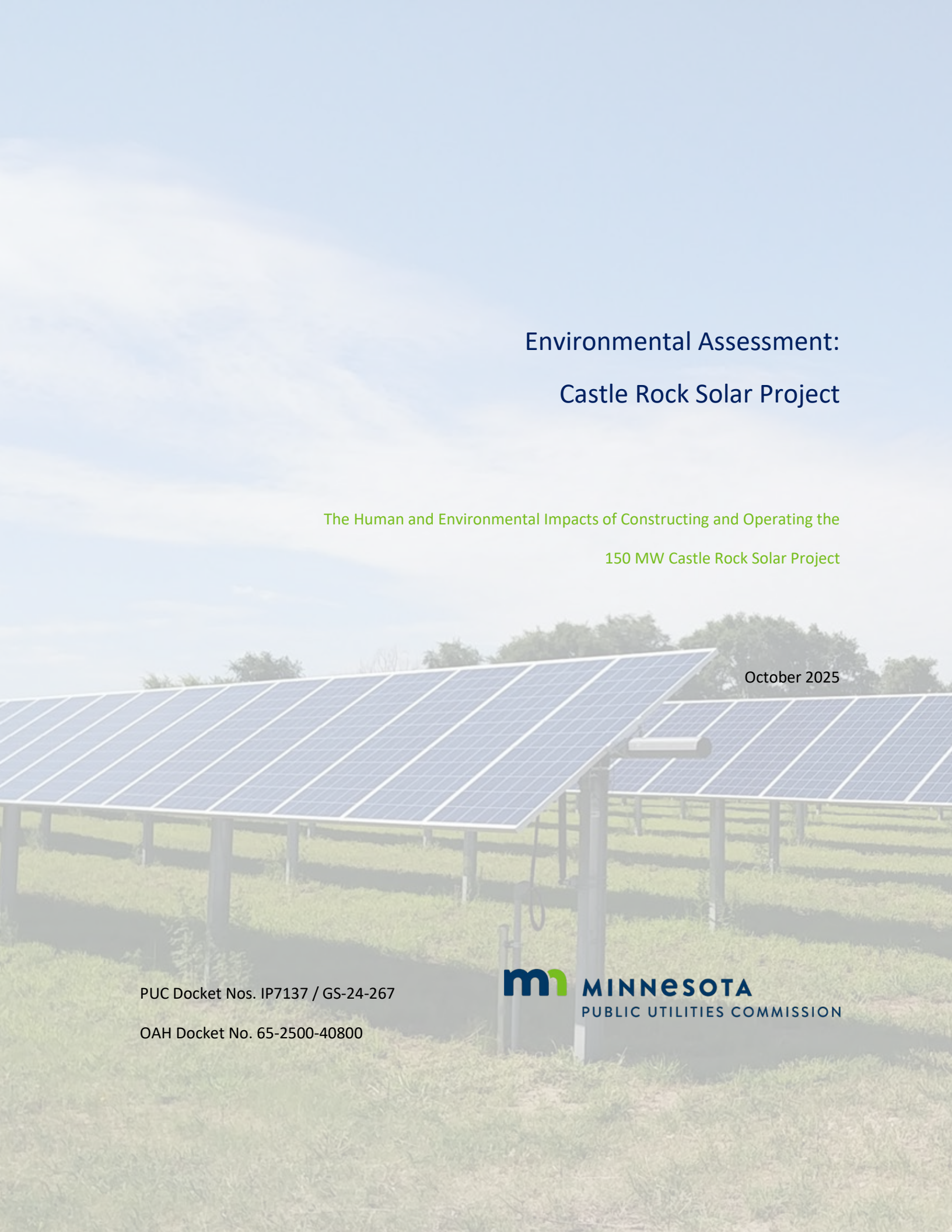

Environmental Assessment:

Castle Rock Solar Project

The Human and Environmental Impacts of Constructing and Operating the

150 MW Castle Rock Solar Project

October 2025

PUC Docket Nos. IP7137 / GS-24-267

OAH Docket No. 65-2500-40800

MINNESOTA
PUBLIC UTILITIES COMMISSION

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Castle Rock Solar LLC (Castle Rock Solar), owned by Atlantica North America, LLC (Atlantica), a wholly-owned subsidiary of Atlantic Sustainable Infrastructure, PLC (ASI), proposes to construct, own, and operate a 150 megawatt solar energy generating system and associated facilities in Dakota County, Minnesota. Castle Rock Solar must obtain a site permit from the Minnesota Public Utilities Commission before it can construct the proposed Castle Rock Solar Project.

Sources

Much of the information used to prepare this environmental assessment comes from Castle Rock's site permit application. Additional sources include information from relevant federal and state environmental review documents for similar projects, spatial data and site visits. Unless otherwise noted, all URL addresses were current as of October 10, 2025.

Project Mailing List

To place your name on the project mailing list contact docketing.puc@state.mn.us or (651) 201-2246 and provide the docket number (24-267), your name, email address, and mailing address. Please indicate whether you would like to receive notices by email or U.S. mail.

Alternative Formats

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

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Description
AADT	average annual daily traffic counts
AC	alternating current
AIMP	Agricultural Impact Mitigation Plan
ALJ	administrative law judge
applicant	Castle Rock Solar
application	site permit application
AQI	Air Quality Index
BESS	Battery Energy Storage System
BMP	best management practice
BWSR	Board of Water and Soil Resources
CO	carbon monoxide
Commerce	Department of Commerce
Commission	Public Utilities Commission
CR 78	County Road 78
CR 79	County Road 79/Blaine Avenue
CSW PERMIT	Construction Stormwater Permit
dBA	A-weighted sound level recorded in units of decibels
DC	direct current
DNR	Department of Natural Resources
DSP	draft site permit
DWSMA	Drinking Water Supply Management Area
EA	environmental assessment
EERA	Energy Environmental Review and Analysis Unit
EIP	Energy Infrastructure Permitting Unit
EJ	environmental justice
EMF	electromagnetic fields
EPA	United States Environmental Protection Agency
EPC	engineering, procurement, and construction
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FTP	Farmington Technology Park
GHG	greenhouse gas
HVTL	high voltage transmission line
IPAC	Information for Planning and Consulting
kV	Kilovolt
MBS	Minnesota Biological Survey
MDA	Minnesota Department of Agriculture
MDH	Minnesota Department of Health
mG	milligauss
MIAC	Minnesota Indian Affairs Council
MISO	Midcontinent Independent System Operator
MN 50	Minnesota State Highway 50

MnDOT	Minnesota Department of Transportation
MnSHIP	Minnesota Statewide Historic Inventory Portal
MOSA	Midwest Organic Services Association
MPCA	Minnesota Pollution Control Agency
MW	megawatt
MWh	megawatt hour
MWI	Minnesota Well Index
National List	The National List of Allowed and Prohibited Substances
NAC	noise area classification
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESC	National Electric Safety Code
NHIS	Natural Heritage Information System
NLEB	Northern Long Eared Bat
NO_2	nitrogen dioxide
NOX	nitrogen oxides
NPDES	National Pollution Discharge Elimination System
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O_3	ozone
O&M	operations and maintenance
OAH	Office of Administrative Hearings
OSA	Office of the State Archeologist
OSHA	Occupational Safety and Health Administration
PM	particulate matter
POI	point of interconnection
Project	Castle Rock Solar Project
PV	photovoltaic
PWI	Public Waters Inventory
RIM	Reinvest in Minnesota
ROI	region of influence
ROW	right-of-way
RPBB	Rusty Patched Bumble Bee
SCADA	supervisory control and data acquisition
SDS	State Disposal System
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office
SO_2	sulfur dioxide
SPCCP	Spill Prevention, Control, and Countermeasures Plan
SWCD	Soil and Water Conservation District
SWPPP	Stormwater Pollution Prevention Plan
THPO	Tribal Historic Preservation Officer
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDA-NOP	U.S. Department of Agriculture National Organic Program
USFWS	U.S. Fish and Wildlife Service

VMP	Vegetation Management Plan
VMU	Vegetation Management Unit
WCA	Wetland Conservation Act
WHAF	Watershed Health Assessment Framework
WHPA	Wellhead Protection Area
WMA	Wildlife Management Area
WPA	Waterfowl Production Area

DEFINITIONS

Several terms used in this document have specific meaning in Minnesota law or regulation. Other terms are defined for clarity.

associated facilities means buildings, equipment, and other physical structures that are necessary to the operation of a large electric power generating plant or high voltage transmission line (Minnesota Rule 7850.1000, subpart 3).

construction means any clearing of land, excavation, or other action that would adversely affect the natural environment of the site or route but does not include changes needed for temporary use of sites or routes for nonutility purposes, or uses in securing survey or geological data, including necessary borings to ascertain foundation conditions (Minnesota Statute 216E.01, subdivision 3, Edition Year 2023).

distribution line means power lines that operate below 69 kilovolts.

easement means a grant of one or more of the property rights by the property owner to and /or for the use by the public, a corporation, or another person or entity

high voltage transmission line means 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, subdivision 4, Edition Year 2023).

land control area means the 1,442-acre area for which Castle Rock Solar is assumed to have site control through ownership, a lease agreement, or an easement. The site permit application refers to this as the "Site Control Area." For this document, it applies to the area for the solar facility as well as area for collection corridors, substation and transmission lines. The term is used to bound a review area and should not be understood to imply the applicant has secured, or will definitely secure, the necessary land rights.

large electric power generating plant means 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, subdivision 5, Edition Year 2023).

local vicinity means 1,600 feet from the land control area and collection line corridor.

mitigation means to avoid, minimize, correct, or compensate for a potential impact.

power line means a distribution, transmission, or high voltage transmission line.

preliminary development area means the 972.24-acre area within the land control area where Castle Rock Solar proposes to build the solar facilities. This area does not include the collection corridors or required setbacks. This area is also referred to as the project boundary. The site permit application refers to this as the "Development Area."

project area means one mile from the land control area and collection line corridor.

solar facility means ground-mounted photovoltaic equipment capable of operation at 50,000 kilowatts or more connected directly to the electrical grid and the associated facilities such as access roads and collector lines.

solar energy generation system means a set of devices whose primary purpose is to produce electricity by means of any combination of collecting, transferring, or converting solar-generated energy (Minnesota Statute 216E.01, subdivision 9a, Edition Year 2023).

transmission line means power lines that operate at 69 kilovolts and above.

1 Introduction

Castle Rock Solar LLC (Castle Rock Solar, applicant) is proposing to construct and operate the Castle Rock Solar Project (project), an up to 150 megawatt (MW) solar farm in Dakota County, Minnesota. Castle Rock Solar must obtain a site permit from the Minnesota Public Utilities Commission (Commission) before it can construct and operate the project. The project will connect to the electric transmission grid through the existing 345 kV Chub Lake to Hampton Corners transmission line via a switchyard and short (approximately 200 feet) 345 kV transmission line that bisects the project.

The applicant filed a site permit application (application) on January 16, 2025,[1] and the Commission found the application to be substantially complete on March 18, 2025.[2]

Minnesota Public Utilities Commission Energy Infrastructure Permitting (EIP) staff have prepared this environmental assessment (EA) for the proposed project.[3] The EA describes the project, highlights resources affected by the project, and discusses potential human and environmental impacts to these resources. It also discusses ways to mitigate potential impacts. These mitigation strategies can become enforceable conditions of the Commission's site permit.

An EA is not a decision-making document, but rather an information document. The EA is intended to facilitate informed decisions by state agencies, particularly with respect to the goals of the Minnesota Power Plant Siting Act to "minimize adverse human and environmental impacts while insuring continuing electric power system reliability and integrity and ensuring that electric energy needs are met and fulfilled in an orderly and timely fashion".[4]

1.1 How is this document organized?

The EA addresses the matters identified in the scoping decision.

This EA is based on the applicant's site permit application and public scoping comments. It addresses the matters identified in the EA scoping decision (**Appendix A**).

- **Chapter 1** briefly describes the state of Minnesota's role; discusses how this EA is organized; and provides a summary of potential impacts and mitigation.

[1] Castle Rock Solar, Application to the Minnesota Public Utilities Commission for a Site Permit for a Large Electric Generating Facility, January 16, 2025, eDocket No. 20251-214065-02 (through -19). (Site Permit Application, SPA).

[2] Minnesota Public Utilities Commission, Order, March 18, 2025, eDocket No. 20253-216516-01.

[3] On July 1, 2025, Department of Commerce (Commerce) Energy Environmental Review and Analysis (EERA) unit staff moved to the Minnesota Public Utilities Commission Energy Infrastructure Permitting (EIP) unit as directed by state law (Laws of Minn. 2024, ch.126, art. 7). While EERA staff initiated environmental review of this proposal prior to July 1, 2025, the environmental review is now being completed by EIP staff. For accuracy related to procedural history, references to previous filings and actions by Commerce and/or EERA will be identified as such, and "EIP" will be referenced throughout the remainder of this document.

[4] Minnesota Statute 216E.02, subd. 1, Edition Year 2023.

- **Chapter 2** describes the project—design, construction, operation, and decommissioning.
- **Chapter 3** summarizes the regulatory framework, including the site permit process, the environmental review process, other approvals that might be required for the project, and the criteria the Commission uses to make its decisions.
- **Chapter 4** describes the environmental setting; details potential human and environmental impacts from the Castle Rock Solar Project; and identifies measures to mitigate adverse impacts. It summarizes the cumulative potential effects of the project and other projects and lists unavoidable impacts and irreversible and irretrievable commitments of resources.
- **Chapter 5** identifies the sources used to prepare the document.

1.2 What does the applicant propose to construct?

Castle Rock Solar proposes to construct an up to 150 megawatt solar energy generating system and associated facilities on a site of approximately 1,442 acres within Castle Rock Township in Dakota County, Minnesota.

The project will consist of photovoltaic (PV) panels, trackers, inverters, transformers, approximately 5.9 miles of gravel access roads,[5] security fencing, below-ground electric collection lines, a project substation, a switchyard, an approximately 200-foot long 345 kV transmission line, and associated facilities (Figure 1). A finer-scale visual of the project design is shown in the project detail maps (**Appendix B**).

Castle Rock Solar proposes to locate the solar facilities in circuits and blocks within the 1,442 acres of land under lease or easement agreement with the applicant.[6] Based on preliminary design, Castle Rock Solar anticipates approximately 972.24 acres within the 1,442.34 acre land control area will be developed for the solar facilities.[7] The solar facilities will connect to the project substation via 34.5 kilovolt (kV) underground electric collection lines. The collection corridor is estimated to comprise approximately 2.31 acres of the project.[8] A short (approximately 200 feet), aboveground 345 kV transmission line will run from the project switchyard immediately adjacent to the project substation to the existing 345 kV Chub Lake to Hampton Corners transmission line.

On April 22, 2025, Castle Rock Solar provided an updated project description that added two additional parcels to the land control area.[9] The two additional parcels have been surveyed – for example, for potential archaeological resources – and results are now being reviewed by the applicable local, state, and federal authorities. Castle Rock Solar will file the survey results for the two additional parcels upon receiving results of the review. For the purposes of this EA, human and environmental resources currently undergoing review are identified.

[5] EA, Appendix D, Question 2.
[6] Castle Rock Solar LLC, Updated on Project Area Description, April 22, 2025, eDocket No. 20254-218004-01.
[7] EA, Appendix D, Question 1.
[8] EA, Appendix D, Question 7.
[9] Castle Rock Solar LLC, Updated on Project Area Description, April 22, 2025, eDocket No. 20254-218004-01.

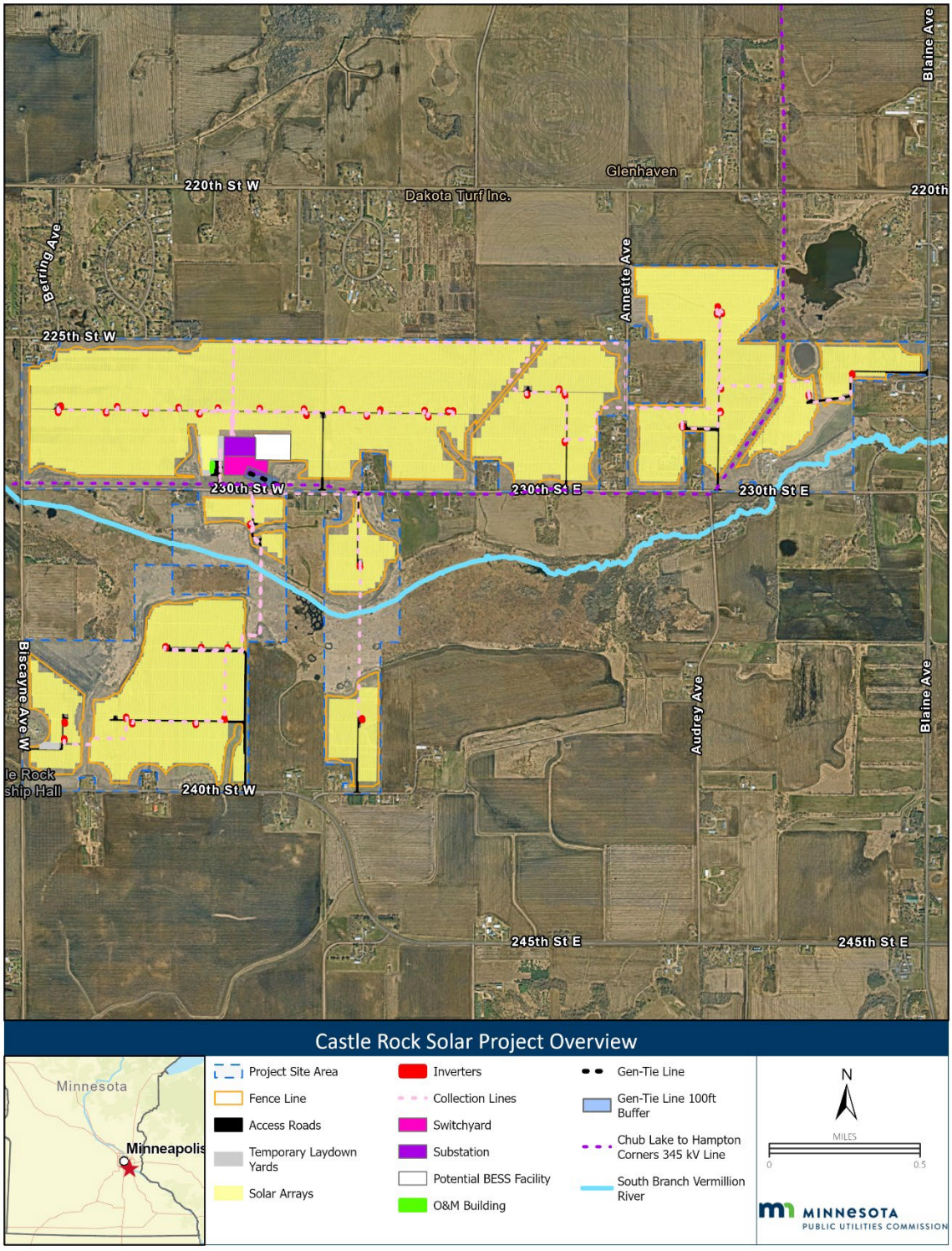
Chapter 1
Introduction

On September 15, 2025, Castle Rock Solar provided an updated project design that includes an undeveloped area near the substation and switchyard. The undeveloped space is planned for siting a future battery energy storage system (BESS) facility. Castle Rock Solar will seek Commission permission separately, in a future proceeding, to site a BESS in this location.[10] For the purposes of this EA, the discussion of the proposed project, potential impacts, and mitigation will not include the future BESS facility. Maps may designate the boundaries of the area that is reserved for the potential BESS facility based on the updated project design for visualization purposes, and tables may include the size of the area for informational purposes. Should Castle Rock Solar pursue siting a BESS within the project, an additional environmental document discussing the BESS facility would be prepared.

Construction is anticipated to begin in 2027 with completion and operation anticipated in 2028.[11]

[10] Castle Rock Solar LLC, Site Plan Update, September 15, 2025, eDocket No. 20259-223007-01.
[11] SPA, p. 5, Table 2: Project Schedule.

Figure 1. Proposed Castle Rock Solar Project



1.3 What is the state of Minnesota's role?

The applicant needs a site permit from the Commission to construct the project. EIP staff prepared this EA. An administrative law judge will oversee a public hearing.

To build the project, the applicant needs a site permit from the Commission. The project may also require additional approvals from other federal and state agencies and local governments, for example, a driveway permit from Dakota County or a Construction Stormwater Permit from the Minnesota Pollution Control Agency (MPCA). A site permit supersedes local zoning, building, and land use rules.[12] The Commission's site permit decision must be guided, in part, however, by consideration of impacts to local zoning and land use in accordance with the legislative goal to "minimize human settlement and other land use conflicts."[13]

Castle Rock Solar applied to the Commission for a site permit for the project on January 16, 2025.[14] The Commission must consider whether the record supports issuing a site permit, and what conditions should be placed on the site permit.[15]

To ensure a fair and robust airing of the issues, the Minnesota Legislature set out a process for the Commission to follow when considering site permit applications.[16] In this instance, an EA has been prepared, and a public hearing will be held. The goal of the EA is to describe potential human and environmental impacts of the project (*the facts*), whereas the intent of the public hearing is to allow interested persons the opportunity to advocate, question, and debate what the Commission should decide about the project (*what the facts mean*). The record developed during this process—including all public input—will be considered by the Commission when it makes its decisions on the applicant's site permit application.

1.4 What is the public's role?

Minnesota needs your help to make informed decisions.

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

1.5 What is an Environmental Assessment?

[12] Minnesota Statute 216E.10, subd. 1, Edition Year 2023.
[13] Minnesota Statute 216E.03, subd. 7, Edition Year 2023.
[14] Castle Rock Solar, Application to the Minnesota Public Utilities Commission for a Site Permit for a Large Electric Generating Facility, January 16, 2025, eDocket No. 20251-214065-02 (through -19). (Site Permit Application, SPA).
[15] If the Commission grants a site or route permit, it chooses which of the studied locations is most appropriate. In this matter only one site location is studied.
[16] *See generally* Minnesota Statute 216E, Edition Year 2023.

This document is an Environmental Assessment. The Commission will use the information in this document to inform their decisions about issuing a site permit for the project.

This Environmental Assessment (EA) contains an overview of affected resources and discusses potential human and environmental impacts and mitigation measures. Commission Energy Infrastructure Permitting (EIP) staff prepared this document as part of the environmental review process. Scoping is the first step in the process. It provides opportunities to provide comments on the content of this environmental assessment, suggest alternatives, and to mitigate potential impacts.

1.6 Where do I get more information?

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

If you would like more information or if you have questions, please contact Commission staff: Lauren Agnew (lauren.agnew@state.mn.us), (651) 201-2198 or Jacques Harvieux (jacques.harvieux@state.mn.us) (651) 201-2233.

Information about the project, including the site permit application, notices, and public comments, can be found on eDockets: https://efiling.web.commerce.state.mn.us/documents by searching Docket #s "24-267". Information is also available on the Commission EIP webpage for the project: https://puc.eip.mn.gov/web/project/16068.

1.7 What permits are needed?

A site permit, from the Commission is required. Federal, state, and local permits may also be necessary to construct the project.

The project requires a site permit from the Commission because it meets the definition of *large electric power generating plant*, which is any electric power generating equipment designed for or capable of operation at a capacity of 50 MW or more.

Various federal, state, and local approvals will be required for activities related to the construction and operation of the project. These permits are referred to as "downstream permits" and must be obtained by the applicant prior to constructing the project.

1.8 What are the potential impacts of the project?

The project will impact human and environmental resources. Impacts will occur during construction and operation.

A potential impact is the anticipated change to an existing condition caused directly or indirectly by the project. Potential impacts can be positive or negative, short- or long-term, and can accumulate incrementally. Impacts vary in duration and size, by resource, and across locations. The impacts of constructing and operating a project can be mitigated by avoiding, minimizing, or compensating for the adverse effects and environmental impacts of a project.

The context of an impact—in combination with its anticipated on-the-ground effect and mitigation measures—is used to determine an impact intensity level, which can range from highly beneficial to highly harmful. Discussions of potential impacts in this EA are organized by type: human settlement, human health and safety, land-based economies, archeological and historic resources, and natural resources.

Select resource topics received abbreviated study because potential impacts to these resources are anticipated to be negligible. These resource topics include: displacement, communications, implantable medical devices, forestry, mining, and topography.

1.8.1 Human Settlement

Large energy projects can impact human settlement. Impacts range from short-term, such as increased local expenditures during construction, to long-term, such as changes to viewsheds.

Aesthetics The impact intensity level is expected to be moderate and long-term. Locations where visual impacts may potentially be the greatest are adjacent to residences and along public roadways. The solar arrays will be visible from nearby residences and adjacent roadways.

Cultural Values The impact intensity level is anticipated to be minimal to moderate and long-term. The project is not anticipated to impact or alter the work and leisure pursuits of residents in such a way as to impact the underlying culture of the area. Differences between cultural values related to renewable energy and rural character has the potential to create tradeoffs that are difficult to address. The cumulative impacts of additional projects in close proximity to the solar facility may augment the perceived impacts to cultural values.

Environmental Justice The project will not have disproportionately high and adverse human health or environmental effects on low-income, minority, or tribal populations.

Land Use and Zoning The impact intensity level is anticipated to be moderate due to the conversion of agricultural land to land used for energy generation. Land use impacts are anticipated to be long-term and localized. Constructing the project will change land use from agricultural to solar energy production for a minimum of 30 years. After the project's useful life, the land control area could be restored to agricultural or other planned land uses by implementing appropriate restoration measures. Impacts can be minimized by using best practices to protect land and water quality.

Noise Distinct noises are associated with the different phases of project construction. The impact intensity level during construction will range from negligible to significant depending on the activity. Potential impacts are anticipated to be intermittent and short-term. These localized impacts may affect nearby residences and might exceed state noise standards. Impacts are unavoidable but can be minimized. Operational impacts are anticipated to be negligible.

Property Values Impacts in the local vicinity are anticipated to be minimal to moderate and decrease with distance and over time. Impacts to the value of specific properties within the local vicinity are difficult to determine but could occur.

Tourism and Recreation The impact intensity level to tourism and recreation resources is anticipated to be minimal to moderate. Most impacts will be short-term and related to construction. The re-route of snowmobile trail 123 is a long-term impact from this project.

Public Services Potential impacts to the electrical grid, roads, and railroads are anticipated to be short-term, intermittent, and localized during construction. Potential impacts to wells and pipelines could be moderate to significant, but can be mitigated through planning and project design. Overall, construction-related impacts are expected to be minimal, and are associated with possible traffic

delays. During operation, negligible traffic increases would occur for maintenance. Impacts are unavoidable but can be minimized.

Socioeconomics The impact intensity level is anticipated to be minimal to significant and positive. Effects associated with construction will, overall, be short-term and minimal. Significant positive effects may occur for individuals. Impacts from operation will be long-term and significant. Adverse impacts are not anticipated.

1.8.2 Human Health and Safety

Large energy projects have potential to impact human health and safety. Most concerns are related to the construction phase.

Electronic and Magnetic Fields (EMF) Impacts to human health from possible exposure to EMFs are not anticipated. Potential impacts will be long-term and localized. These unavoidable impacts will be of a small size. Impacts can be mitigated.

Public Safety and Emergency Services Like any construction project, there are risks to workers. These include potential injury from falls, equipment and vehicle use, electrical accidents, etc. Public risks involve electrocution. Electrocution risks could also result from unauthorized entry into the fenced area. There is the potential to encounter land has previously been impacted by hazardous substances, and if this occurs, hazardous materials must be documented, monitored, and disposed in coordination with MPCA. Additional public risks include construction-related impacts reducing motorist safety on state highways. Potential impacts during construction are anticipated to be minimal. Potential impacts during operation are anticipated to be minimal. Impacts would be short- and long-term and can be minimized.

1.8.3 Land-based Economies

Large energy projects can impact land-based economies by limiting land use for other purposes.

Agriculture Potential impacts to agricultural producers are anticipated to be minimal to significant—lost farming revenues will be offset by easement agreements and, when applicable, financial compensation for damages. A negligible loss of farmland in Dakota County would occur for the life of the project. With respect to prime farmland, the applicant indicates that no feasible or prudent alternatives to the project exist. Potential impacts are localized and unavoidable but can be minimized.

Tourism Impact intensity is expected to be minimal, and short-term in duration. There may be potential for impacts to local recreational activities during construction, however impacts will be temporary. Long-term impacts are anticipated due to the re-routing of snowmobile trail 123 that is located within the project.

1.8.4 Archeological and Historic Resources

The impact intensity level is anticipated to be negligible to minimal. Impacts would be localized. Impacts can be mitigated through siting and construction monitoring.

1.8.5 Natural Resources

Large energy projects can impact the natural environment. Impacts are dependent upon many factors, such as how the project is designed, constructed, maintained, and decommissioned. Other factors, such as the environmental setting, influence potential impacts. Impacts vary significantly within and across projects.

Air Quality Potential impacts to air quality during construction would be intermittent, localized, short-term, and minimal. Impacts are associated with fugitive dust and exhaust. Impacts can be mitigated. Once operational, the solar array will not generate criteria pollutants or carbon dioxide. Negligible fugitive dust and exhaust emissions would occur as part of routine maintenance activities. Impacts are unavoidable and do not affect a unique resource. Impacts can be minimized.

Geology and Groundwater Because of the presence of potential karst in the project, there is potential for both direct and indirect impacts to groundwater. Direct and indirect impacts are anticipated to be minimal to significant, as domestic water wells and the high vulnerability Hastings DWSMA occur within the site. Impacts to geology could occur from bedrock excavation and are anticipated to be minimal to moderate. Impacts can be mitigated through adherence to Best Management Practices (BMPs) for construction and stormwater management in karst areas.

Soils Impacts to soils will occur during construction and decommissioning of the project. The impact intensity level is expected to be minimal to moderate. Potential impacts will both positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur. Because the soil at the solar facility will be covered with perennial vegetation for the life of the project, soil health is likely to improve; however, success of the native vegetation will depend, in part, on final design of the project's solar panels. The extent of positive and negative impacts is dependent upon the abundance of native perennial vegetation within the project.

Surface Water The impact intensity level is anticipated to be minimal to moderate. Direct impacts to surface waters are not expected. Indirect impacts to surface waters may occur. These impacts will be short- and long-term and could extend to the South Branch Vermillion River and the main stem of the Vermillion River. Impacts can be mitigated. Significant impacts to floodplains are not anticipated. However, the project site has increased risk for flooding events due to the presence of water features.

Wetlands The impact intensity level is anticipated to be minimal to moderate. Direct impacts to wetlands are expected as some construction will occur in wetland areas. There is also a potential for wetlands to be indirectly affected. These impacts will be short- or long-term, of a small size, and localized. Impact can be mitigated.

Vegetation The solar facility will convert row crop farmland to perennial vegetation for the life of the project. Potential impacts of the solar facility are anticipated to be minimal to moderate and can be mitigated through development of a vegetation management plan (VMP).

Wildlife and Habitat Potential impacts may be positive or negative and are species dependent. Long-term, positive impacts to small mammals, insects, snakes, etc. would likely occur; impact intensity would depend on the amount and quality of habitat created by the project. Impacts to large wildlife species, for example, deer, will be negligible. Significant negative impacts could occur to individuals during construction and operation of the project. Once restored, the land control area will provide habitat for the life of the project. The project does not contribute to significant habitat loss or

degradation or create new habitat edge effects. The introduction of PV panels, collection lines, and fencing, creates the potential for bird collisions. Potential impacts can be mitigated in part through design and BMPs. The impact intensity level is expected to be minimal to moderate.

Rare and Unique Resources The impact intensity level is anticipated to be minimal to moderate during construction, and minimal during operation. Impacts could be both short and long term and could be positive (e.g., through introduction of habitat), or negative (e.g., by removing trees during breeding or migratory season). Impacts can be mitigated through design and BMPs, and through consultation with local government agencies who have expertise on the rare and unique resources in the area.

Climate Change Construction emissions will have a short- term negligible increase in greenhouse gases (GHG) that contribute to climate change. Overall, the project will generate energy that can be used to displace energy otherwise generated by carbon-fueled sources. The total GHG emissions produced by construction and operation of the project will be minimal when compared to the reduction in GHG emissions long-term. The project's design incorporates design elements that minimize impacts from the increase in extreme weather events such as increase flooding, storms, and heat wave events that are expected to accompany a warming climate.

1.9 What factors guide the Commission's decision?

Minnesota statute and rule identify the factors the Commission must consider when determining whether to issue a site permit.

After reviewing the project record—including public comments—the Commission will determine whether to issue a site permit and, if a site permit is issued, where the solar facility will be located and what permit conditions are appropriate.

Minnesota Statutes 216E.03 lists considerations that guide the study, evaluation, and designation of site permits.[17] Minnesota Rule 7850.4100 lists the factors the Commission must consider when making a site permit decision.

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.

[17] Minnesota Statute 216E.03, Edition Year 2023.

G. Application of design options that maximize energy efficiencies, mitigate adverse environmental effects, and could accommodate expansion of transmission or generating capacity.

H. Use or paralleling of existing rights-of-way, survey lines, natural division lines, and agricultural field boundaries.

I. Use of existing large electric power generating plant sites.

J. Use of existing transportation, pipeline, and electrical transmission systems or rights-of-way.

K. Electrical system reliability.

L. Costs of constructing, operating, and maintaining the facility which are dependent on design and route.

M. Adverse human and natural environmental effects which cannot be avoided.

N. Irreversible and irretrievable commitments of resources.

The Commission is also guided by the "state's goals to conserve resources, minimize environmental impacts, minimize human settlement and other land use conflicts, and ensure the state's electric energy security through efficient, cost-effective power supply and electric transmission infrastructure."[18]

A proposed draft site permit (DSP) for the project is included in **Appendix C**.

1.10 Solar Facility Siting Factors – Analysis and Discussion

This analysis applies the siting factors to the project. Some factors are described in just a few words. Other factors are more descriptive and include a list of elements that, when grouped, make up the factor. Finally, certain factors are relatively succinct, but the scoping process identified elements to be analyzed in this EA. For example, the public safety factor includes an EMF element.

Factor M (unavoidable impacts) and **Factor N** (irreversible and irretrievable resource commitments) are discussed in Section 4.8 and Section 4.9, respectively, of this EA. **Factor G** (application of design options) and **Factor L** (costs dependent on design) do not apply as the design of the proposed project is the only design under consideration.

Other factors are ranked as follows:

[18] Minnesota Statute 216E.03, subd. 7(a), Edition Year 2023.

●	Impacts are anticipated to be negligible to minimal and able to be mitigated or consistent with factor
○	Impacts are anticipated to be minimal to moderate and able to be mitigated in part or less consistent with factor, but nonetheless consistent
⊘	Impacts are anticipated to be moderate to significant and unable to be mitigated fully or consistent in part or not consistent with factor

Table 1. Application of Siting Factors – Solar Facility

Factor A: Human Settlement		
Element	**Construction**	**Operation**
Aesthetics	○	○
Displacement	●	●
Cultural Values	○	○
Electric Interference	●	●
Environmental Justice	●	●
Land Use and Zoning	○	○
Noise	⊘	●
Property Values	○	○
Tourism and Recreation	○	○
Socioeconomics	●	●
Factor A: Public Services		
Element	**Construction**	**Operation**
Airports	●	●
Roads	○	●
Utilities	○	●
Factor B: Public Safety		
Element	**Construction**	**Operation**
EMF	●	●
Emergency Services	●	●
Medical Devices	●	●
Public Safety	●	●
Stray Voltage	●	●
Worker Safety	●	●
Factor C: Land-based Economies		
Element	**Construction**	**Operation**
Agriculture	○	○

Forestry	●	●
Mining	●	●
Tourism	●	●
Factor D: Archaeological and Historic Resources		
Element	**Construction**	**Operation**
Archeological	●	●
Historic	●	●
Factor E: Natural Resources		
Element	**Construction**	**Operation**
Air Quality	●	●
Climate Change	●	●
Geology and Groundwater	○	○
Soils	○	○
Surface Water and Floodplains	○	●
Topography	●	●
Vegetation	●	●
Wetlands	○	○
Wildlife	○	○
Wildlife Habitat	●	●
Factor F: Rare and Unique Resources		
Element	**Construction**	**Operation**
Fauna	○	●
Flora	○	●
Factor I: Use of Existing Generating Plants		
Element	**Construction**	**Operation**
Existing Plants	⊘	⊘

1.10.1 Discussion

The following discussion highlights potential impacts to factor elements that are anticipated to be moderate to significant, and factors determined less consistent, consistent in part, or not consistent.

FACTOR A: HUMAN SETTLEMENT

Aesthetics Visual impacts are subjective. Thus, potential impacts are unique to the individual and can vary widely. Because there are existing energy and infrastructure facilities nearby (Figure 22), the project will not be an entirely new type of feature on the landscape. For those with high viewer sensitivity, for example, neighboring landowners, visual impacts are anticipated to be moderate to

significant, while for those that travel through the project area, visual impacts are likely to be minimal, although noticeable. Impacts can be mitigated through development of vegetative screening plans with affected residents.

Cultural Values The project is not anticipated to impact or alter the work and leisure pursuits of residents in such a way as to impact the underlying culture of the area. Differences between cultural values related to renewable energy and rural character has the potential to create tradeoffs that are difficult to address. Cumulative impacts from additional projects in the area will amplify perceived impacts to cultural values.

Land Use and Zoning Land use impacts are anticipated to be long-term and localized. Constructing the project will change land use from agricultural to solar energy production for a minimum of 30 years. After the project's useful life, the land control area could be restored to agricultural or other planned land uses by implementing appropriate restoration measures. Impacts can be minimized.

Noise Distinct noises are associated with the different phases of project construction. These impacts will be temporary and intermittent and range from negligible to significant depending on the construction equipment used and the location of the listener.

Property Values On whole, impacts to property values are anticipated to be minimal and to decrease with distance and over time. However, impacts to a specific property's value are difficult to determine. Because of this uncertainty, impacts to specific properties could be minimal to moderate.

Tourism and Recreation Most impacts will be short-term and related to construction. The re-route of snowmobile trail 123 is a long-term impact from this project.

Transportation Potential impacts to roads and highways associated with construction are anticipated to be short-term, intermittent, and localized. The impact intensity level is expected to be minimal to moderate. Impacts can be mitigated through development of a road use agreement with local government units. During operation, no impacts to roads are anticipated; negligible traffic increases would occur for maintenance.

Utilities On whole, potential impacts to wells and pipelines associated with construction are anticipated to be minimal, short-term, intermittent, and localized. However, the existence of active wells and pipelines within the site means that damage to well or pipeline structures could occur. In such cases, the impact intensity level is expected to be moderate to significant. Proper planning and site design can minimize the potential risk to wells. Siting, planning, and emergency preparedness can minimize the potential risk from pipeline events.

FACTOR C: LAND-BASED ECONOMICS

Agriculture Potential impacts to agricultural producers are anticipated to be minimal to significant — lost farming revenues will be offset by easement agreements and, when applicable, financial compensation for damages. A negligible loss of farmland in Dakota County would occur for the life of the project. Nearly all of the solar facility is located on land classified as prime farmland, prime farmland if drained, or farmland of statewide importance. The applicant indicates that no feasible or prudent alternatives to the project exist. Potential impacts are localized and unavoidable but can be minimized.

FACTOR E: NATURAL RESOURCES

Geology and Groundwater Because of the presence of potential karst in the project area, there is potential for both direct and indirect impacts to groundwater due to construction and operation of the project. Due to the presence of domestic water wells and the high vulnerability Hastings DWSMA within the site, direct and indirect impacts are anticipated to be minimal to significant. Impacts can be mitigated through adherence to best management practices (BMPs) for construction in karst areas and BMPs for stormwater management, incorporating recommendations on project design and construction in areas of karst geology from a knowledgeable geotechnical engineer, and avoiding construction activity and location of project infrastructure within at least 150 feet from documented active karst features.

Soils Impacts to soils will occur during construction and decommissioning of the project. The impact intensity level is expected to be minimal to moderate. Potential impacts will be both positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur but can be mitigated with erosion prevention and sediment control BMPs. Because the soil at the solar facility will be covered with perennial vegetation for the life of the project, soil health is likely to improve. The extent of positive and negative impacts is dependent upon the abundance of native perennial vegetation within the project.

Surface Water Indirect impacts from surface waters might occur during construction. Impacts to surface waters are anticipated to be minimal to moderate. Drainage systems within the land control area extend the impact range to adjacent waterways. Impacts can be mitigated through the use of BMPs for stormwater management and utilizing erosion control materials appropriate for aquatic systems. The project site has increased risk for flooding events as portions of the site are within designated floodway and floodplains and could potentially be impacted in the event of a severe storm. Impacts can be mitigated by following appropriate BMPs. Proper planning and emergency preparedness can minimize the potential risk from severe storm and flooding events.

Wetlands Impacts to wetlands are anticipated to be moderate to significant during construction and operation of the project since some project infrastructure is proposed in wetland areas. Additional BMPs can be implemented to avoid impacts to local and rare and unique wildlife (e.g., migratory birds.) and aquatic wildlife in connected waterways.

Wildlife and Habitat Impacts wildlife are anticipated to be minimal to moderate during construction and operation of the project. Additional BMPs can be implemented to avoid impacts to local and rare and unique wildlife (e.g., migratory birds.) and aquatic wildlife in connected waterways.

Rare and Unique Resources Indirect impacts to rare and unique resources may occur during construction. These impacts will likely be minimal to moderate and would be short-term in length. Minimal impacts are anticipated during operation of the project. There is one Native Plant Community and one Wildlife Action Network corridor within the site, both will be crossed by collection lines in two separate areas. The Loggerhead Shrike has the potential to be found in the vicinity of the project. Potential impacts can be mitigated by adhering to state agency recommendations provided in the Natural Heritage Review Letter, project design, and further consultation with agencies.

FACTOR I: POWER PLANTS

Because the solar facility is not constructed at an existing power plant, the solar facility is inconsistent with this siting factor.

1.11 What's next?

A public hearing will be held in the project area; you can provide comments at the hearing. The Commission will then review the record and decide whether to grant a site permit.

An administrative law judge (ALJ) from the Office of Administrative Hearings will hold a public hearing after the EA is complete and available. At the hearing you may ask questions and submit comments about the project. After the close of the comment period, the ALJ will provide a written report to the Commission with findings, conclusions, and recommendations for the Commission.

The Commission reviews all the information in the project record in determining whether to issue a site permit. Site permits define the location of the project and include conditions specifying mitigation measures. The Commission is expected to make a site permit decision in the first half of 2026.

2 Proposed Project

Castle Rock Solar proposes to construct and operate an up to 150 MW solar farm within Castle Rock Township in Dakota County, Minnesota. The developed portion of the project will occupy approximately 972 acres of the 1,442 acres under lease or easement agreements. The project will interconnect to the electrical grid through a short (approximately 200 feet) 345 kV transmission line to the existing 345 kV Chub Lake to Hampton Corners transmission line that bisects the project. This chapter describes the project and how it would be constructed, operated, and decommissioned.

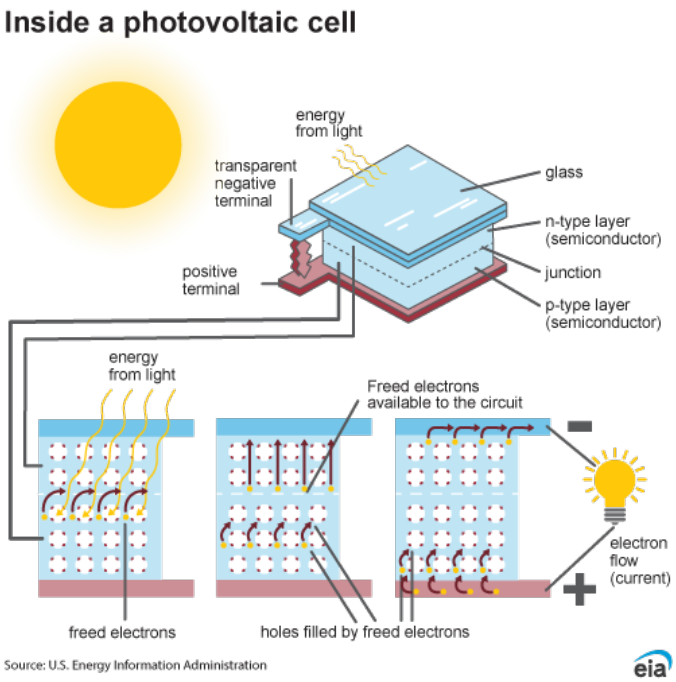
2.1 Solar Facility

2.1.1 How do solar facilities generate electricity?

The *photovoltaic effect* is the physical process through which a PV cell coverts sunlight directly into electricity by capitalizing on nature's inherent desire to keep electrical charges in balance.

When solar radiation (sunlight) strikes a photovoltaic (PV) cell, some radiation is absorbed, which excites electrons within the cell. This results in a continuous flow of electrons from the front to the back of the panel through electrical connections, which results in a continuous flow of electric current as depicted in Figure 2.[19]

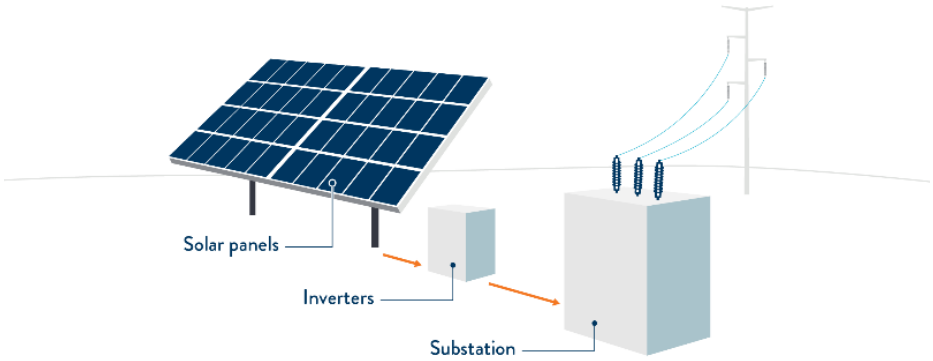
Figure 2. Photovoltaic Cell



Solar panels (sometimes referred to as solar modules) are made up of PV cells that generate direct current (DC) electricity, which must be converted to alternating current (AC) electricity before reaching the electrical grid. Solar panels are arranged into electrically connected blocks and connected to inverters. An inverter converts DC electricity to AC electricity. Transformers then step up the electrical voltage before the electrical power is collected through an above- or below-ground collection system. Collection systems combine the electricity from across the array and deliver it to a project substation. Figure 3 shows a simplified schematic of the major components of the solar generating facility.

[19] U.S, Energy Information Administration (May 26, 2023) *Solar Explained: Photovoltaics and Electricity*. https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php

Figure 3. Solar Facility Schematic



2.1.2 Where is the Project located?

The Project is located within Castle Rock Township in Dakota County, Minnesota.

The proposed solar facility is located within Castle Rock Township in Dakota County. Table 2 summarizes the project location by township, range, and section. The solar facility would be located on approximately 972 acres within an area of approximately 1,442 acres of land leased or in easement by the applicant. Approximately 87 percent of the site is currently used as cultivated farmland or hay/pastureland, with the remaining 13 percent consisting of minimal tree cover, wetlands/open water, farmsteads, and township and county roads.

Castle Rock Solar selected the project site based on grid access, sufficient solar resource, landowner participation, topography, and limited factors of environmental concern.[20]

Table 2. Project Location

Township	Range	Sections	Township	County
113N	19W	2-4, 9, 10	Castle Rock	Dakota

2.1.3 How is the solar facility designed?

The project will consist of will consist of PV panels, trackers, inverters, transformers, access roads, security fencing and gates, below-ground electric collection and communication lines, a project substation, switchyard, and interconnection facilities, metering equipment, step-up transformers,

[20] SPA, pp. 15-17.

supervisory control and data acquisition (SCADA) system, an operation and maintenance (O&M) building, several permanent weather stations, a stormwater management system, temporary laydown yards and a permanent parking area, and a short (approximately 200 feet) aboveground 345 kV transmission line.

Table 3. Estimated Project Facility Acreages[21]

Project Facilities	Acres
Solar panels (within fence)	284.68
Inverters	0.17
Project Substation	4.29
Switchyard	5.70
O&M Building	0.11
Laydown Areas	5.90
Access Roads	12.82
Collection Lines	2.31
Fence	653.79
Gen-Tie	1.89
Potential BESS Location	6.49
Total	**978.15**

2.1.3.1 Solar Arrays

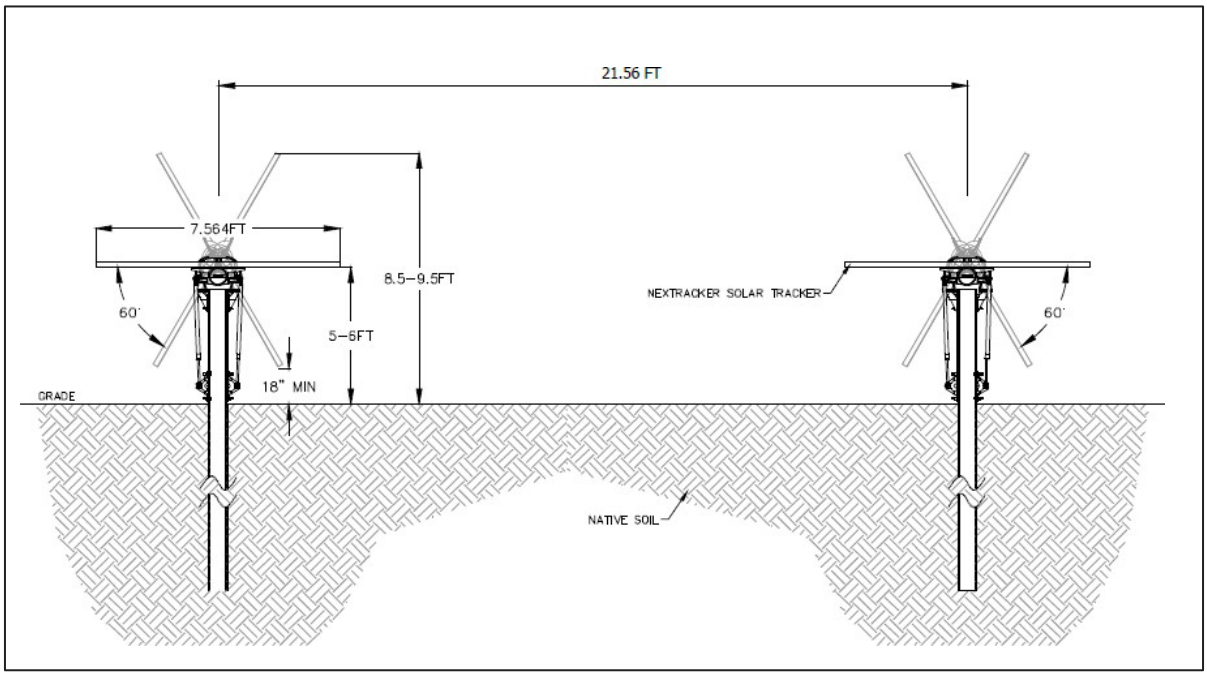
Although design and equipment specifications have not been finalized, Castle Rock Solar's current design anticipates using PV panels with a tilt angle range of up to 60 degrees, and approximately 18 inches of ground clearance. Individual panels will be approximately four feet long by seven and a half feet wide. The First Solar Series 7 540-Watt module was used as the basis of the preliminary design, and the final module selected is expected to have similar physical construction and electrical characteristics. Depending on the final technology selected, panels may either be thin-film technology (cadmium telluride) or crystalline plate glass modules with an aluminum frame.

Figure 4. Typical Solar Array

[21] EA, Appendix D, Question 7.

The panels will be affixed to single-axis, horizontal, linear tracker racking systems supported by vertical steel piles driven into the ground to a minimum depth of five feet below ground surface, with roughly 14 feet between trackers when panels are in the horizontal position.[22] Arrays are anticipated to be arranged in north-south oriented rows, allowing the panels to track the sun from east to west (Figure 4). Small electric motors on the racking system rotate the panels on a single point to follow the sun throughout the day, tilting east in the morning, paralleling the ground at zero degrees mid-day, and tilting west in the afternoon (Figure 5[23]). This tracking of the sun maximizes the project's electrical production. The project will require approximately 392,052 PV panels to establish the up to 150 MW capacity mounted on an estimated 5,043 single axis trackers.[24]

Figure 5. Typical Solar Tracking Profile



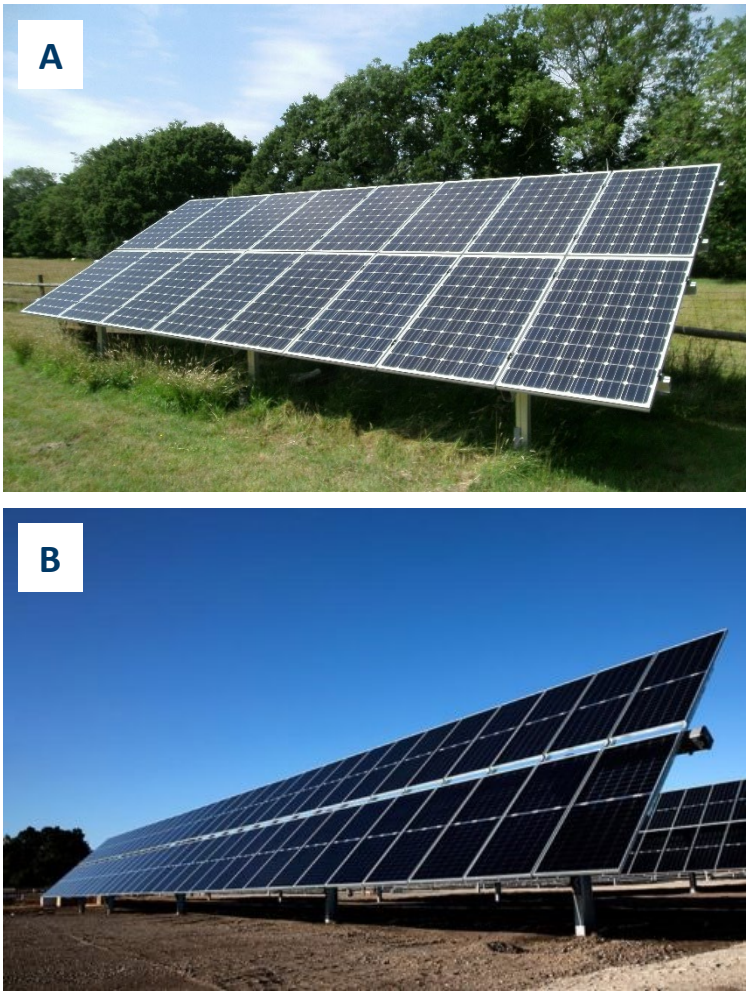
Castle Rock Solar is considering two portrait orientation racking system designs for the project. A portrait configuration racking design has a single row of panels along the tracker rack, with the long axis of the panels perpendicular to the axis of the racking system (Figure 6 - A[25]). When level to the ground, portrait configuration solar panels would be 4.75 to 6 feet above grade, and when tilted to

[22] EA, Appendix D, Question 8.
[23] SPA, p. 22, Figure 4: Typical Solar Tracker Profile.
[24] EA, Appendix D, Question 2.
[25] SolarAge, Ground Mounted Arrays, retrieved from: https://solarage.co.uk/wp-content/uploads/2017/06/PICT0052.jpg?gid=3.

their highest position (early and late in the day), the top edge of the portrait configuration solar panels would be a maximum of 9 to 12 feet above the ground surface.

A two in-portrait racking design holds panels in portrait configuration with a long axis perpendicular to the tracker (Figure 6 - B[26]). When tilted to their highest position (early and late in the day), the top edge of the portrait configuration solar panels would be a maximum of 18 feet above the ground surface. The two in-portrait system requires taller piles and results in a taller overall system. Final racking system design will be selected prior to construction. [27,28]

Figure 6. Portrait Orientation Racking Design Options



[26] Solar Power World, Two-In-Portrait Single-Axis Solar Tracker, retrieved from: https://www.solarpowerworldonline.com/2019/09/nextracker-unveils-nx-gemini-two-in-portrait-single-axis-solar-tracker/
[27] SPA, pp. 21-23.
[28] SPA, Appendix H: Decommissioning Plan.

2.1.3.2 Electrical Collection System

The direct current (DC) electrical energy generated by the solar panels (about 1,500 volts DC) will be delivered to approximately 41 inverters[29] through an electrical collector system consisting of three single conductor cables running in a bundle (one circuit) or a single cable containing all three conductors. The preliminary design assumes the conductor will be aluminum, and insulation will consist of 35 kV TRXLPE, 100 percent insulation with a PVC jacket. The collection system is planned as an underground system. Cables will be directly buried or installed in buried ducts (Figure 7).

Figure 7. Underground Cabling System

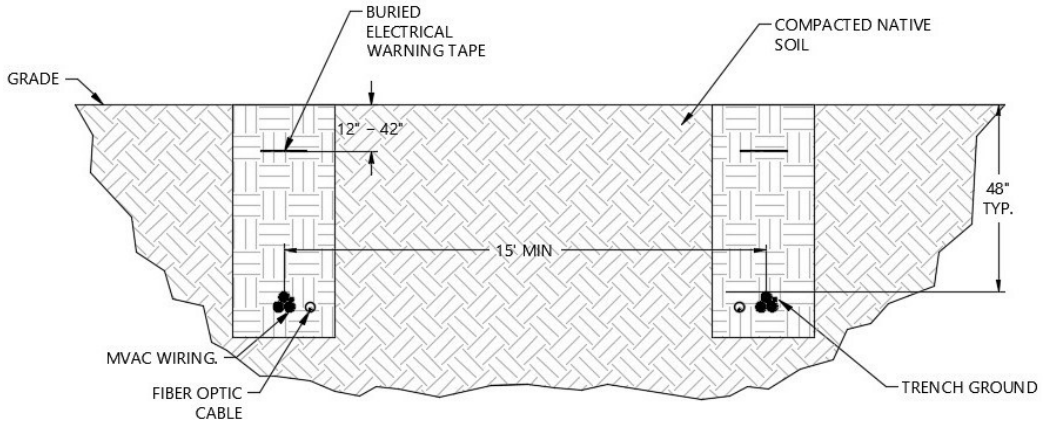


Figure 8. Underhung Cabling System

Castle Rock Solar notes that cables may be underhung on the tracking racks in a hanging harness system (Figure 8[30]) and would be buried where they commence from the racks to the inverter and on to the substation. If an underhung design is chosen, the steel racking structure will include an integrated cable management system to support the insulated copper DC string wire that interconnects each of the PV modules.[31]

The inverters convert approximately 1,500 volts of DC output to about 4,400 kilovolt-amperes per kilowatt (kVA/kW) (depending upon inverter specifications) alternating current (AC). Then, the transformer steps up the power to 34.5 kV for

[29] EA, Appendix D, Question 2.
[30] SPA, p. 30, Figure 11: Typical Underhung Cable Scenario.
[31] EA, Appendix D, Question 3.

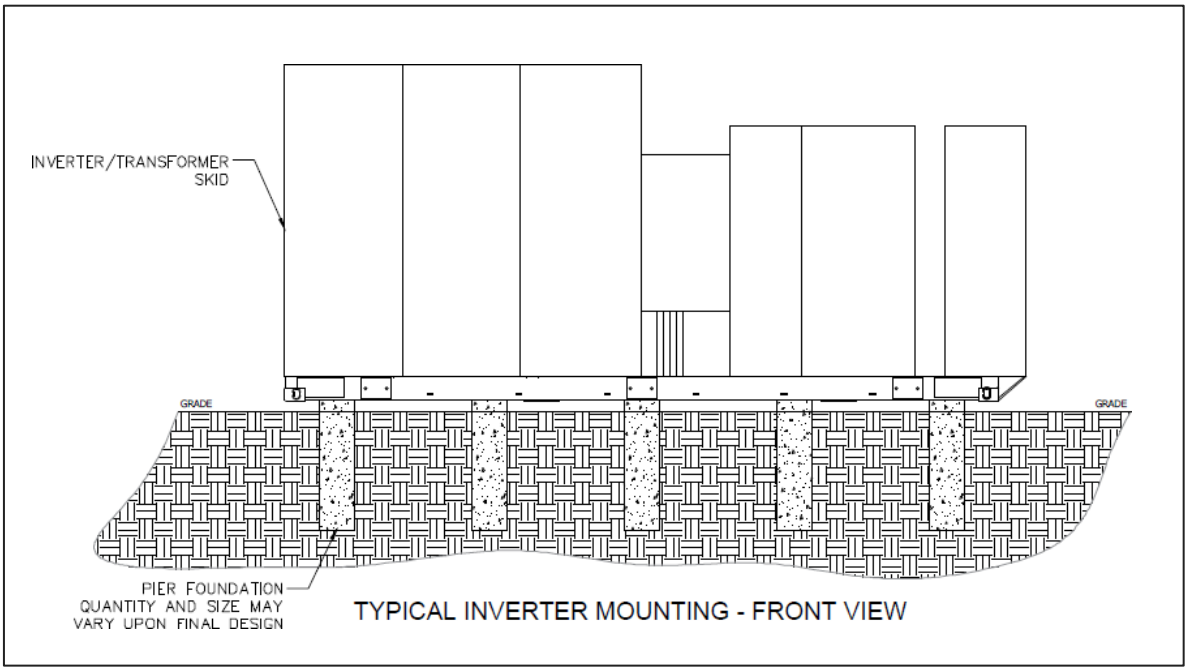
transmission through an underground collector system to the project substation. Power inverters and transformers will be housed on inverter "skids." The project has been designed using the Solarware Ninja 4.2VA central inverters, which are approximately 3.6 feet wide, 3.6 feet long, and 6.5 feet tall. From a distance, inverters skids will look like one-half of a semi-trailer box (Figure 9[32]). The final number of inverters, currently anticipated to be 41, will depend on the inverters selected for the project as well as the final solar panel configuration.

Figure 9. Inverter

The preliminary design proposes inverters mounted on driven piers (Figure 10[33]) and will not require concrete foundations. However, the use of concrete slabs or driven piers for inverter skids will be determined during final design. Driven pier foundations typically measure 6 inches wide by 9 feet long, driven to a depth of 8 to 15 feet of embedment with approximately 8 inches above grade for the skid support.[34] The height of a skid would be a minimum of 7 feet above grade. The number of piers needed for each inverter skid will be determined by geotechnical investigations conducted prior to construction.

[32] EA, Appendix D, Question 9, Solar Ware Ninja PV and Energy Storage Solutions Brochure.
[33] SPA, p. 29, Figure 10: Typical Inverter Mounting – Front View.
[34] EA, Appendix D, Question 9.

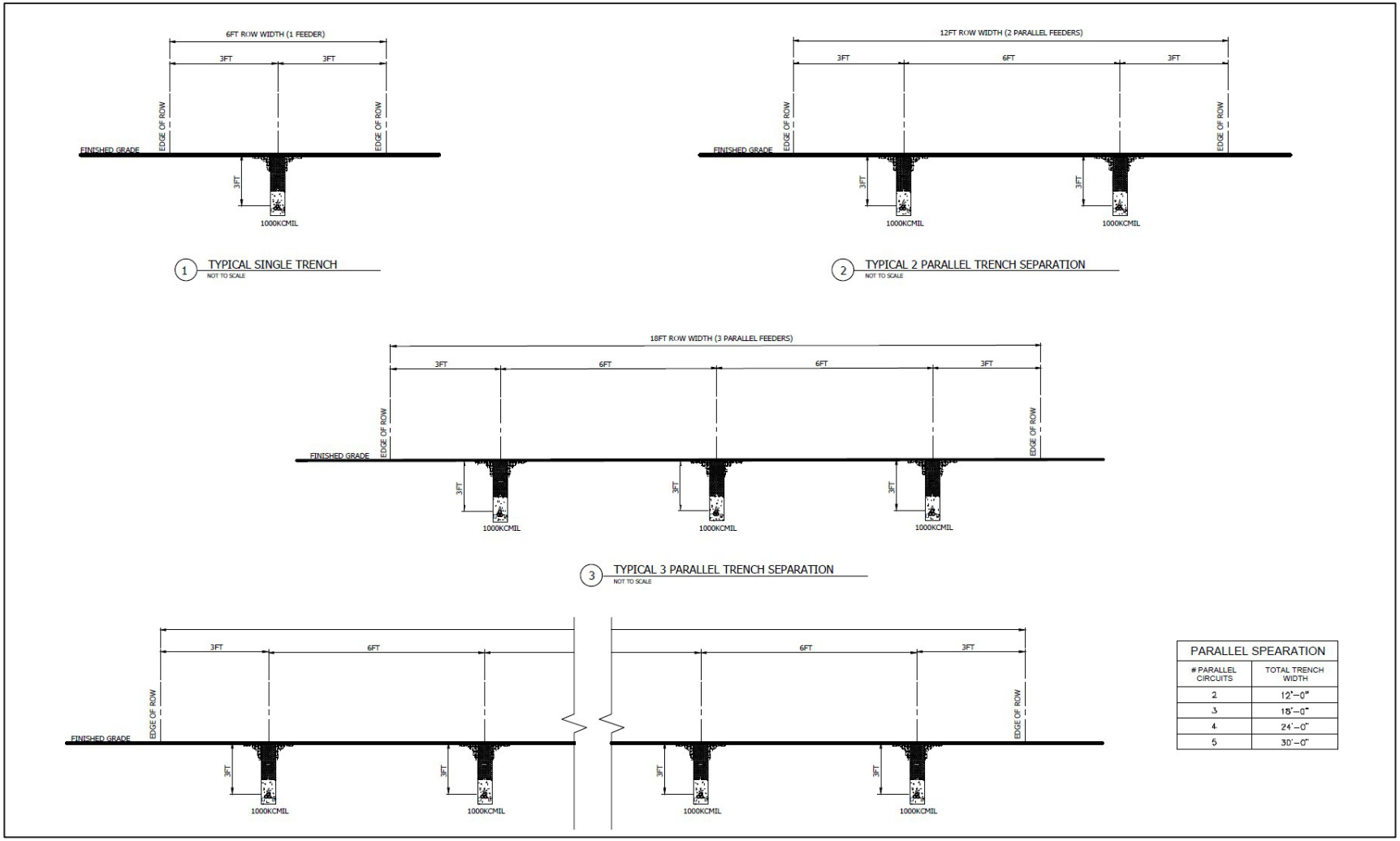
Figure 10. Pier Foundation Inverter Mounting



Electrical energy (34.5 kV AC) will be transmitted from inverter skids to the project substation through underground cables (Figure 11[35]). Cabling will be trenched or buried into place to a depth of at least three feet to the top of the cables, or cabling will be enclosed within a conduit and buried at a depth of at least 2 feet. Trenches will be backfilled with suitable native subsoil followed by trench spoil and compacted, after which topsoil will be used to return the surface to its finished grade. Cables installed via the trench method will be placed in trenches that are 18 inches wide. When multiple cables are installed parallel to one another, cable separation will be up to 8 feet apart and the width of the trench will vary based on the number of circuits within the trench. A typical two feeder trench has a width of three to six feet, and a typical four feeder trench has a width of 15 to 16 feet. Castle Rock Solar estimates that approximately 13.2 miles of below-ground electrical collection lines[36] will be installed throughout the project to connect all inverters to the project substation.[37,38]

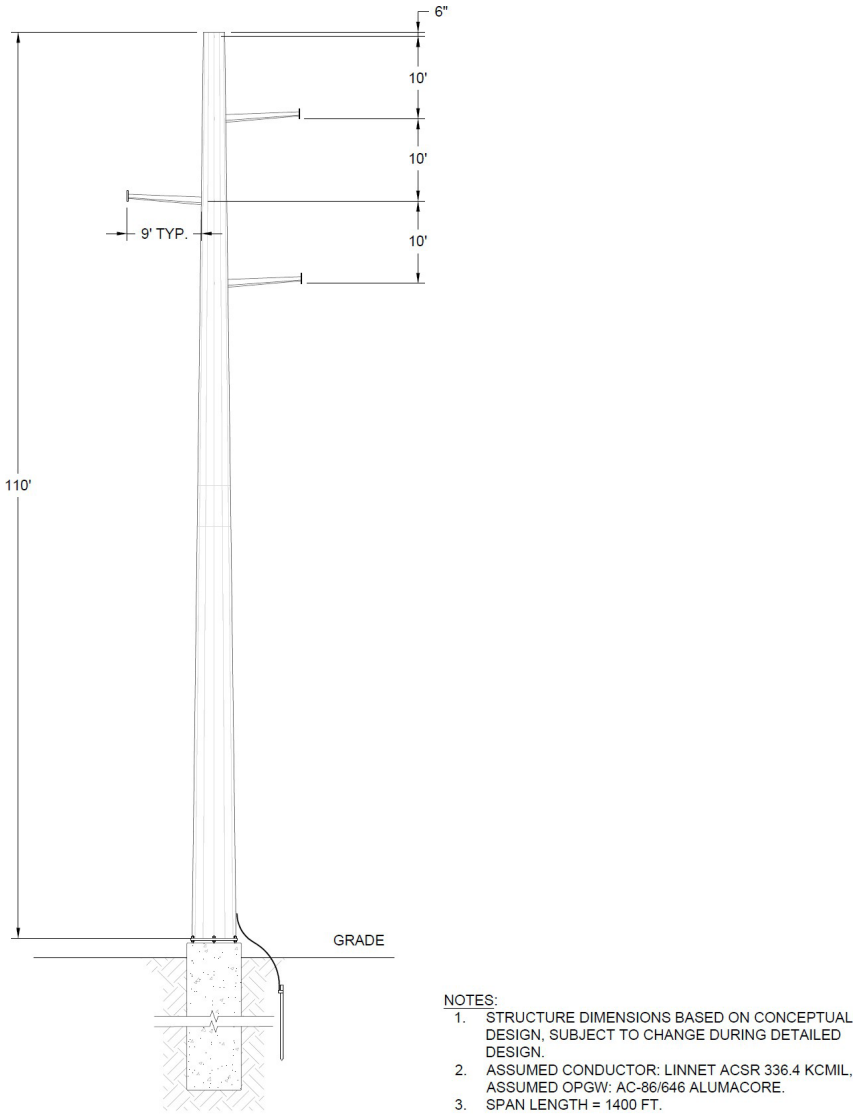
[35] SPA, p. 24, Figure 5: Typical Multiple Parallel Trench Separation.
[36] EA, Appendix D, Question 2.
[37] SPA, pp. 23-26, 28, 29.
[38] SPA, Appendix D: Agricultural Impact Mitigation Plan.

Figure 11. Typical Multiple Parallel Separation Trench Design



Castle Rock Solar will use the horizontal directional drill method to install the collection system under crossed public roadways, wetlands, and waterways. Any bore pits will be setback at least 10 feet from wetland boundaries or ordinary highwater mark of waterways. There are two locations where the collection system will cross the South Branch Vermillion River (Figure 1). Cables may be installed via aerial span, rather than directionally drilled, over the South Branch Vermillion River at the crossing locations (Figure 12[39]). A typical aerial span pole for 34.5 kV cables is approximately 110 feet in height, which accommodates the approximate 1,400-foot to 1,450-foot crossings.

Figure 12. Aerial Span Pole for 34.5 kV Cables



[39] SPA, p. 25, Figure 7: Typical Aerial Span Pole for 34.5 kV Collection Line.

2.1.3.3 FENCING

Castle Rock Solar will install approximately 19.9 miles (104,944 feet) of permanent security fencing along the perimeter of the solar arrays and preliminary development area for security and to prevent public and larger wildlife access.[40] Arrays will be fenced in groupings and will not impact public access to any roads running through the land control area. Wooden fence posts along the fence line are anticipated to be directly embedded into the soil.[41] No concrete foundations will be used for the fenceposts. Castle Rock Solar states that Minnesota Department of Natural Resources (DNR) recommendations for fence height are being considered, however the proposed perimeter fencing around the solar arrays is 8 feet tall woven wire and will not include strands of smooth wire on top.[42, 43] Either the construction contractor or a subcontracted fencing company will be engaged to install the perimeter security fencing. Signage will be installed on the fencing,[44] and the perimeter security fence will have locked gates to secure the project and prevent unauthorized entry (Table 4).[45] The solar facility will be accessed through locked gates at ten locations:

- The southwestern portion will be accessed from Biscayne Avenue West, 240th Street West, and CR 78/240th Street;
- the central portion will be accessed from 230th Street West and 230th Street East; and
- the northeastern portion will be accessed from 230th Street East and CR 79/Blaine Avenue.

Table 4. Project Access Points

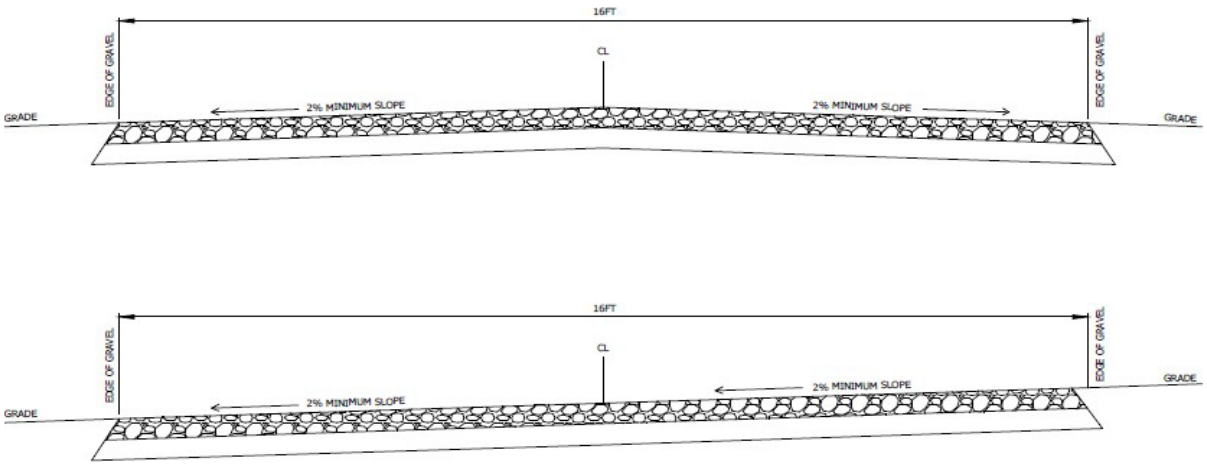
Road	Permanent Access Points
230th Street East	6
Biscayne Avenue West	1
240th Street West	1
CR 78/ 240th Street West	1
CR 79/Blaine Avenue	1
Total Permanent Access Points	**10**

[40] EA, Appendix D, Question 2.
[41] SPA, Appendix E: Vegetation Management Plan.
[42] SPA, p. 44.
[43] EA, Appendix D, Question 11.
[44] SPA, p. 44.
[45] EA, Appendix D, Question 12.

2.1.3.4 Access Roads

Access roads will consist of either gravel or the existing compacted, vegetated soil surface. These roads will be used for access during construction and operations and maintenance activities. Roads will be approximately 16 feet wide with approximately 2-foot-wide shoulders on either side (Figure 13[46]). Roads will be constructed as close to grade as possible to maintain existing sheet flow and drainage patterns. Permanent access roads will be maintained for the life of the project.[47,48] The current design anticipates approximately 5.9 miles of internal access roads.[49]

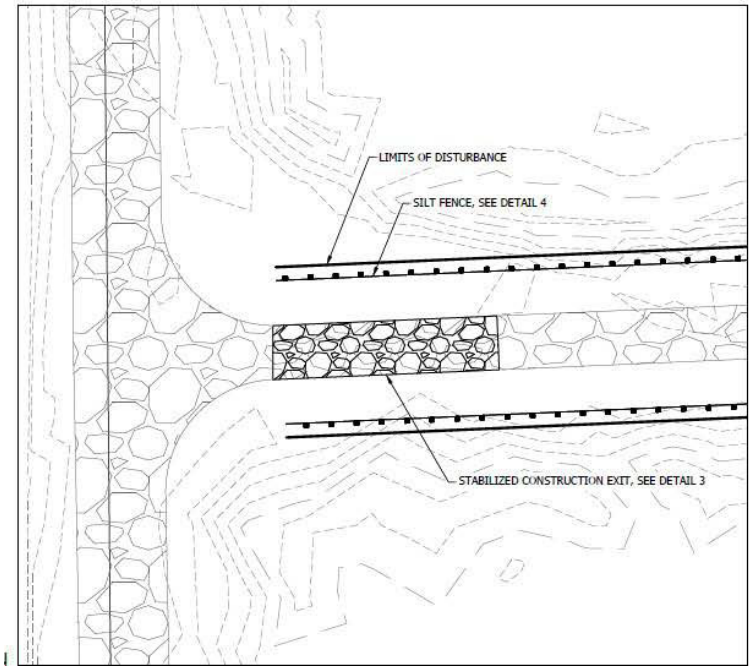
Figure 13. Project Access Road Design

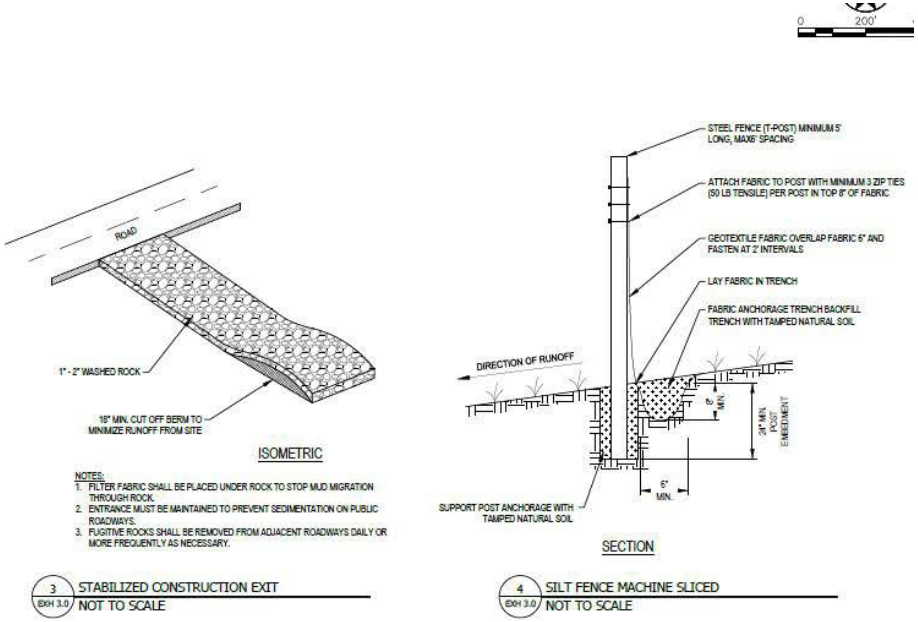


Roads may be temporarily wider during construction to accommodate equipment access where necessary. Road width at site entrances will be approximately 106 feet to accommodate the wider construction vehicle turning radius of 45 to 55 feet. The greater road width at site entrances will remain during the life of the project. Figure 14 provides a visual perspective of the anticipated scale of road width flare onto public roadways at site access points.[50]

[46] SPA, p. 31, Figure 12: Typical Solar Access Road Profile.
[47] SPA, pp. 30-31.
[48] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[49] EA, Appendix D, Question 2.
[50] EA, Appendix D, Question: 4.

Figure 14. Access Road Dimensions at Site Entrances





2.1.3.5 LAYDOWN YARDS

Castle Rock Solar anticipates installing approximately two temporary laydown yards on 5.9 acres of the site.[51] These areas will be used for material storage, equipment parking, and delivery unloading during the construction phase. The O&M building will also be used for parking during project construction. The laydown yards will be located inside the fenced preliminary development area. Following construction, the laydown yards will either be developed as the solar array area or reclaimed and revegetated.

2.1.3.6 PROJECT SUBSTATION AND SWITCHYARD

The project substation is proposed to be located in the central portion of the project, adjacent to the existing Chub Lake to Hampton Corners 345 kV line (Figure 1). The substation will be located inside the project fence on crushed rock and is estimated to occupy approximately 4.29 acres of agricultural land.[52] The project substation will include a 34.5/345 kV step-up substation with metering equipment required for interconnection to the transmission grid. Other components of the substation include supporting structures for high voltage electrical structures, breakers, transformers, lightning protection, and control equipment. Underground 34.5 kV collector lines from the inverters will deliver energy to the project substation.

The project substation will connect to the switchyard by a short overhead transmission line that will connect the substation dead end structure to the switchyard ring bus.[53] The proposed switchyard is anticipated to occupy approximately 5.7 acres of agricultural land in the central portion of the project, just south of the project substation.[54] The proposed 345kV switchyard will be arranged in an initial three (3) position, future four (4) position ultimate ring bus configuration with a single generator incoming line position and two transmission line positions. The switchyard also includes a control building that will have control and protections panels, IT Comm/Remote Terminal Unit (RTU) panels, main termination cabinets, and AC/DC station service equipment including battery and charger. The design and appearance of a typical 345 kV substation and switchyard are shown in Figure 15.[55,56]

[51] EA, Appendix D, Question 7.
[52] EA, Appendix D, Question 7.
[53] EA, Appendix D, Question 13.
[54] EA, Appendix D, Question 7.
[55] SPA, p. 28, Figure 9: Typical 345 kV Switchyard.
[56] EA, Appendix D, Question 7.

Figure 15. Typical 345 kV Switchyard and Substation

The collector system voltage will be stepped up from 34.5 kV to 345kV at the substation and transmitted to Xcel Energy's existing Chub Lake to Hampton Corners 345 kV transmission line via a proposed 200-foot long 345 kV gen-tie line that will be adjacent to the proposed switchyard.

The project substation will be designed in compliance with the National Electrical Safety Code (NESC) and other applicable practices, standards, and codes.[57]

FENCING

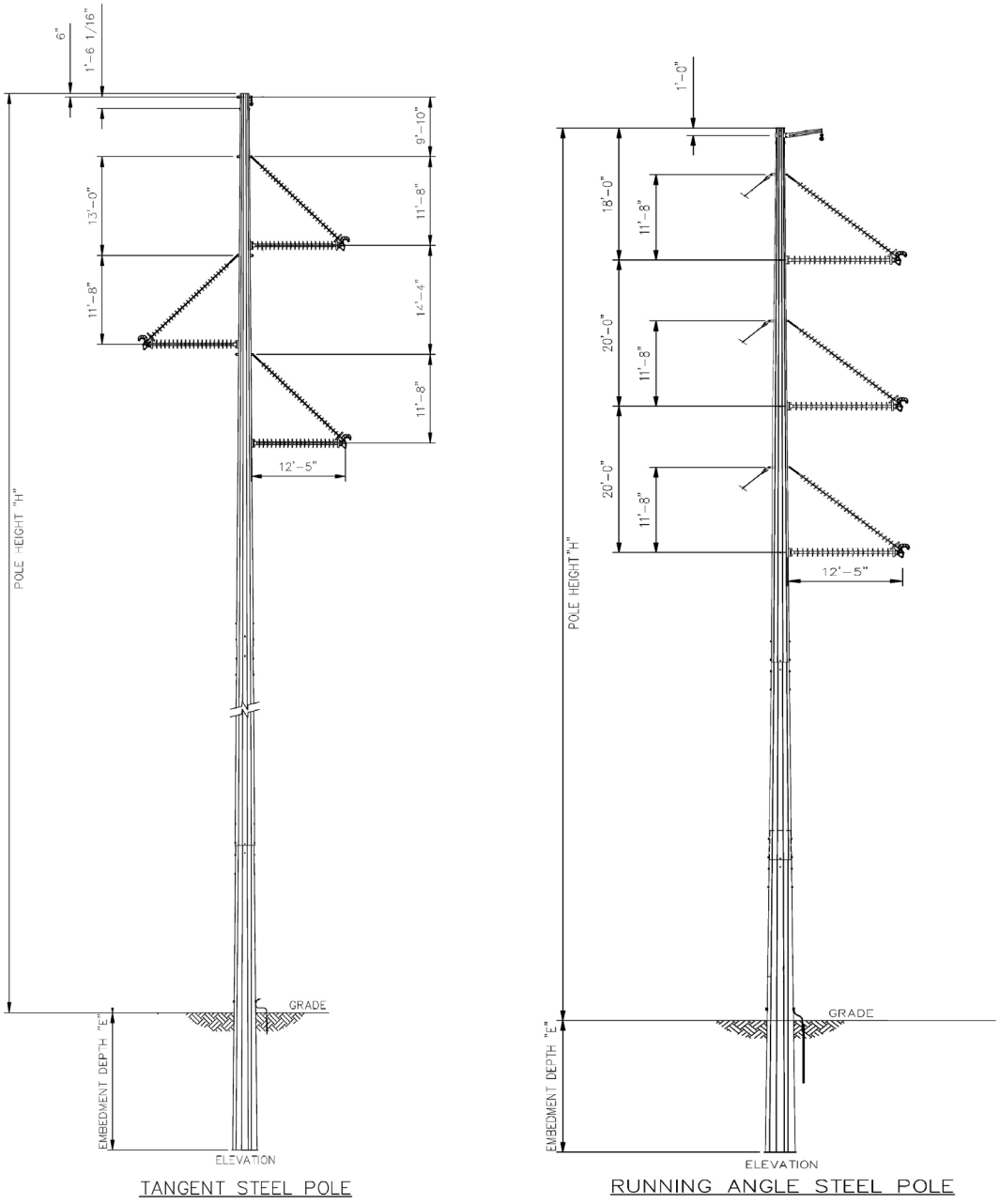
The fenced area of the project substation and switchyard is expected to be a 7 to 8 ft high chain link security fence and may be topped with 3 strands of barbed wire in compliance with electrical codes and the NESC. The fenced in area is expected to be approximately 680 feet by 775 feet in size. The project substation fencing will include gates with security locks and may have security cameras mounted at gates.

2.1.3.7 GEN-TIE LINE

Castle Rock Solar will construct an approximately 200-foot gen-tie line to connect the switchyard to the existing 345 kV Chub Lake to Hampton Corners transmission line. The preliminary design uses a typical steel framing pole structure configuration for the project gen-tie line. Castle Rock Solar is considering using a single circuit tangle pole design or a single circuit angle pole design (Figure 16[58]). Two poles will be needed for the gen-tie line. Pole height is anticipated to be approximately 100 to 150 feet.[59]

[57] SPA, p. 20.
[58] SPA, Appendix L: Electro-Magnetic Field Calculations, B.3 – Typical 345 kV Tower Structure.
[59] EA, Appendix D, Question 32.

Figure 16. Gen-Tie Line Pole Design Options



2.1.3.8 Operations and Maintenance Building

An O&M building will be used to conduct maintenance and repair of project equipment and components, store parts, tools, and equipment, provide a meeting space and parking for personnel, and may house the SCADA system used to remotely monitor project facilities. If the O&M building does not house the SCADA system, the SCADA system will be housed at the substation.

The O&M building will be placed on footers with gravel pad foundations designed to meet local geotechnical conditions. Castle Rock Solar will locate the O&M building, along with a rock base parking lot of approximately 55 feet by 18 feet,[60] near the substation and switchyard area on approximately 0.11 acres.[61] A 25-foot by 56-foot area will be leveled to accommodate a building footprint of approximately 40 feet by 16 feet. The O&M building will be a modular building supported using concrete or steel support beams, as necessary, per building and local county standards. Final design decisions on the O&M building will follow all applicable state/local laws regarding water use and waste disposal. The O&M building will be located within the perimeter fence, which will have gated access points with security locks.[62,63,64]

2.1.3.9 Stormwater Drainage

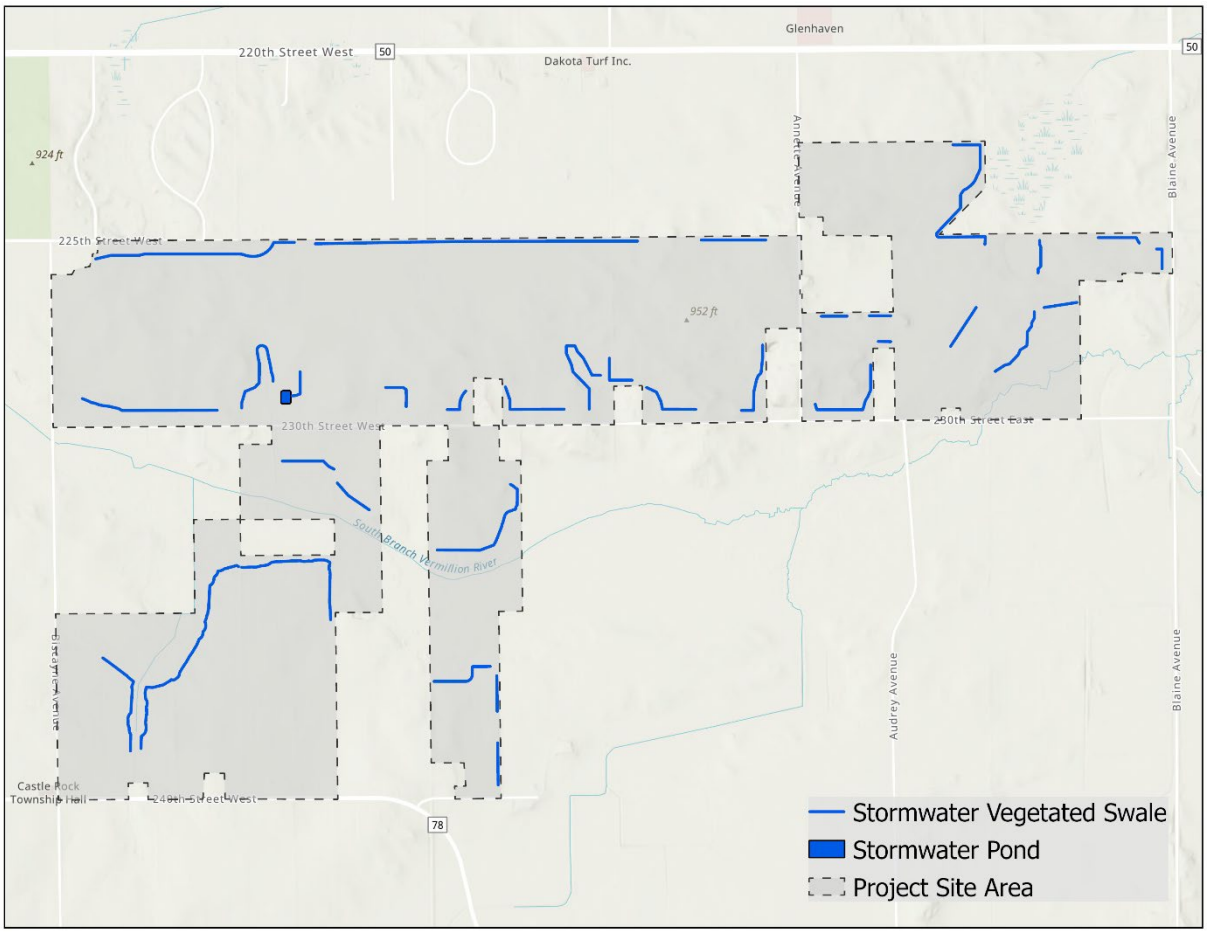
Castle Rock Solar provided a preliminary stormwater management plan as Appendix G of the site permit application. The preliminary plan divides the land control area into 14 drainage basins and proposes vegetated swales with ditch checks and land cover improvements to reduce runoff (Figure 17). This design would be finalized in the applicant's Stormwater Management Pollution Prevention Plan (SWPPP). The vegetated swales will be designed to meet the rate control requirements regulated by the Vermillion River Watershed Joint Powers Organization and provide the necessary treatment, in compliance with the NPDES/SDS Construction Stormwater General Permit.[65] The vegetated swales will be seeded with a wet seed mix suitable for the site.[66]

A construction stormwater permit, and associated SWPPP, will be developed prior to construction and implemented during construction. The SWPPP will be in accordance with MPCA standards and guidance specific to solar projects and will include erosion and sediment control BMPs. The BMPs detailed in the SWPPP will minimize the potential for downstream water quality impacts throughout project construction and operation. This stormwater system will be designed to capture, route, and treat stormwater runoff for volume control and water quality per Minnesota's Construction Stormwater General Permit. The applicant acknowledges that because the project contains a

[60] EA, Appendix D, Question 14.
[61] EA, Appendix D, Question 7.
[62] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[63] SPA, p. 30.
[64] EA, Appendix D, Question 14.
[65] SPA, Appendix G: Preliminary Stormwater Management Plan.
[66] SPA, Appendix E: Vegetation Management Plan.

discharge point within one mile to special waters, the SWPPP would be submitted to MPCA for review and approval prior to construction.[67]

Figure 17. Preliminary Stormwater Management System



2.1.3.10 LIGHTING

Castle Rock Solar will install permanent lighting at the substation, switchyard, and O&M building. Lighting will be downlit, motion activated, and shielded to limit blue hue, backlight, and glare, and to direct light away from adjacent properties and public rights-of-way. This permanent lighting design follows the DNR's Commercial Solar Siting Guidance standards for facility lighting.[68] Temporary lighting may be necessary during the construction, and is primarily proposed in the main laydown area. Temporary construction lighting in the main laydown area would be mounted on poles or construction trailers to provide adequate lighting for safety and security. If temporary lighting is

[67] SPA, Appendix G: Preliminary Stormwater Management Plan.
[68] DNR. *Commercial Solar Siting Guidance*. Retrieved from: https://files.dnr.state.mn.us/publications/ewr/commercial_solar_siting_guidance.pdf.

needed within the site to accommodate safe working conditions during construction, portable lighting and generators would be used as needed. Temporary lighting used during construction would also follow the DNR's Commercial Solar Siting Guidance lighting standards.[69]

2.1.3.11 Weather Stations

Castle Rock Solar plans to install up to 5 weather stations (one for every 30 MWdc proposed[70]) throughout the site to gather weather data such as wind speed and direction, ambient temperature, solar irradiance, etc. during the operation of the project. The final locations of the weather stations will be determined following final engineering; weather stations will be placed on grass or stone and likely near inverters. Weather stations will be steel structures anchored to a foundation with mounted sensors and instrumentation. The weather stations will be self-powered with a small PV panel and battery as their main power source and will be connected to the low voltage collection system as a secondary power source. The weather station anemometer, a sensor that measures wind speed and direction, will extend to a height of approximately 33 feet above ground level (Figure 18[71]).[72]

Figure 18. Typical Solar Weather Station

2.1.4 How would the solar facility be constructed?

Castle Rock Solar anticipates that construction of the solar facility will begin in 2027 with an in-service date of 2028. This section summarizes construction activities. Unless otherwise noted, this summary has been adapted from Section 4.3.1 and Appendix D, the *Agricultural Impact Mitigation Plan* (AIMP), of the site permit application.

Castle Rock Solar anticipates that construction will begin in the second or third quarter of 2027 to meet an in-service goal of 2028.[73] The actual construction schedule is dependent upon permitting, final design, delivery of equipment, workforce availability, and winter weather conditions. Castle Rock Solar has provided an anticipated construction activity schedule that includes approximate durations (Table 5), noting that construction will be sequenced (i.e. construction activities will occur simultaneously in different sections of the preliminary development area). Ultimately, construction is anticipated to take approximately 14- 20 months, likely over two construction seasons.[74]

[69] EA, Appendix D, Question 15.
[70] SPA, p. 28.
[71] EA, Appendix D, Question 30.
[72] EA, Appendix D, Question 16.
[73] SPA, p. 5.
[74] EA, Appendix D, Question 17.

Table 5. Construction Phase Timelines

Phase	Length
Site Clearing	1.5-2 months
Earthwork	2-3 months
Access Road Construction	2-3 months
Solar Array Construction	5-7 months
Electrical Collection System Construction	7-9 months
Substation and Switchyard Construction	5-6 months

Construction will begin after all necessary permits and approvals have been received.

Project construction will begin with workforce and equipment mobilization and initial site preparation activities including construction entrance stabilization, surveying and marking of project facilities, installation of necessary security fencing, vegetation removal, installation of erosion control and stormwater BMPs, and grading. Castle Rock Solar anticipates that some grading will be required in areas where elevations need to be modified for tracker racking system slope tolerances, site drainage, access roads, laydown areas, and foundations for the O&M building, switchyard and inverters, but it will be minimized as roads will be constructed at grade when possible and panel arrays will be designed and constructed to conform to the existing topography.

Typical construction equipment will be used for the project – bulldozers, trailers, plows, trenchers, and pile drivers. Additional specialty equipment could include a skid steer loader, a high reach bucket truck, a rough-terrain crane, forklifts, graders, excavators, and a directional boring rig. Equipment will be transported from the laydown yards to the construction areas as needed.

The majority of traffic volume during construction will consist of passenger vehicles for worker travel to the construction site. Semi-trucks, flat-bed trucks and dump trucks will also need to access the project. Semi-truck equipment delivery will vary based on the timing of construction and equipment delivery. Truck traffic will be lower prior to the peak of construction. A period of high semi-truck traffic volume, estimated at a rate of 10 truck deliveries per day, will occur when the piles, racking, and panels are delivered to the site. Truck traffic will decrease once these components have been delivered.[75]

Castle Rock Solar anticipates that the project will generate approximately 200-375 temporary jobs during the construction and installation phases. Once operational, the project will employ one full-time O&M manager and between two to six solar technicians. On site construction staff levels will depend upon the stage of construction, the timing of equipment deliveries, and weather conditions. Generally, there will be fewer construction workers on site in the early stages of the pre-construction activities. During peak construction, there will be approximately 200-375 workers on-site at any one

[75] EA, Appendix D, Question 18.

time, with 150 employee vehicles used for daily travel to/from the project. Once project components have been installed and the project enters the commissioning and restoration phases, onsite worker numbers are anticipated to decrease.[76]

Following initial site preparation, the access roads, trackers, modules, inverters, collection system, communication lines, gen-tie line, switchyard, and project substation will be constructed. When feasible, construction tasks will be performed concurrently.

Access Roads

Construction of permanent site entrances and graveled access roads will start with removing the topsoil and organic material from the roadbeds to a depth of at least 12 inches. Topsoil will be windrowed to the edges of the roadbed and distributed along the road edge after fill and aggregate installation. Topsoil materials will be pushed into stockpiles, loose compaction, and/or "tracking" with stormwater and wind erosion best management practices (BMPs). The sub-grade materials will then be compacted to the specified requirements. After the sub-grade materials are suitably compacted, the road will be installed according to civil design. Geotextile matting will be installed first, to prevent aggregate mixing with native subsoil, followed by a road surface of 6-15 inches of gravel.[77] The gravel will be installed level to the existing grade to allow for existing sheet flow, which maintains existing drainage patterns and minimizes ponding.

After the access road gravel has been installed and compacted to the engineers' requirements, the project drainage ditches will be shaped according to the final grading plan. The previously stripped and windrowed topsoil will then be re-spread along the new gravel material along road shoulders. Erosion control devices will be maintained throughout access road grading and stabilization according to the Stormwater Management Plan. Aggregate or fill will be local pit run aggregate material. Aggregate specification will be available for quality assurance following completion of engineering.

Access roads constructed on native compacted soil will use existing site soils unless soils are not suitable for road construction. Native soil compacted access roads will be constructed using similar methods to aggregate access road construction. Topsoil will be returned to cut and fill areas where applicable, and cut and fill areas will be seeded within 14 days of the completion of cut and fill grading activities.

Solar Arrays

Solar array foundations will be installed after road construction. Multiple construction crew and various vehicle types will be working within the preliminary development area during array and racking assembly, including flatbed trucks for transporting array components, small all-terrain vehicles, and pick-up trucks for transporting equipment and workers.

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[76] EA, Appendix D, Question 19.
[77] EA, Appendix D, Question 4.

Foundations are typically galvanized steel piles driven into the ground to a minimum depth of 5 feet below the surface by a hydraulic ram pile-driver. In areas with soil limitations, helical screw foundation posts may be used instead. The hydraulic ram machinery, about the size of a small tractor, would temporarily disturb soil at each pile insertion location and while driving between insertion locations.

After foundations have been installed, racking installation will begin. Tracker mounting assemblies can be assembled at laydown yards and transported the waiting array blocks for installation, or they can be assembled at the array blocks prior to installation. Crews will use forklifts and tractors to fix tracker mounts to support foundations.

After the racking is installed, PV modules will be installed by multiple crews using hand tools. Panels will be staged in advance throughout the preliminary development area and brought to the specific work area by wagon-type trailers pulled by skid steers.

Project Substation and Switchyard

Substation and switchyard construction will partially overlap solar array construction, as many aspects of construction are anticipated to occur concurrently. Similarly, security fencing will be installed in advance of or in conjunction with site preparation activities, and in advance of large component deliveries. A typical construction sequence for the substation and switchyard involves, in order: site grading work, below-grade foundation installation, above-grade physical construction of buswork and installation of major electrical equipment, wiring and completion of all terminations, followed by testing, commissioning, and ultimately energization.[78]

A contractor or subcontractor will begin with site preparation for the substation and switchyard by scraping, segregating, and placing topsoil in a designated storage location outside of the work area. All topsoil stripped from these areas will be pushed outside of the work area and collected into designated spots for later use. These topsoil piles will be windrowed or piled and loosely compacted and/or "tracked" with stormwater and wind erosion BMPs in place.[79]

The substation and switchyard foundations have yet to be determined, as they are dependent on soil and geotechnical conditions. The switchyard will likely be installed on either driven pier foundations or concrete foundations. The switchyard and substation will be placed on footers with gravel pad foundations designed to meet the site's geotechnical conditions, and will sit on top of a slab foundation. The skids for the substation and switchyard will likely be installed on concrete or driven pier foundations. The main power transformer will be placed on 42 feet by 29 feet concrete foundation.[80]

[78] SPA, pp. 28.
[79] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[80] EA, Appendix D, Question 13.

If pier foundations are used, the contractor will install the foundations on the prepared site, compact sub-grade materials, regrade spoils around the foundation area, and install clean washed gravel on the surface. Pier foundation quantity and size may vary upon final designs. If concrete foundations are used, a rubber tire backhoe will be used to dig out the foundations on the prepared site prior to placing rebar and pouring the concrete.[81] This method limits the amount of disturbance to the footprint of the substation for the foundation equipment and concrete trucks.

Both the substation and switchyard will be graded and overlain with crushed rock to minimize vegetation growth and reduce fire risk. Once construction is complete, the topsoil piles would be distributed in a thin layer adjacent to the foundation area.[82]

The proposed switchyard also includes a control building that will have control and protections panels, IT Comm/RTU panels, main termination cabinets, and AC/DC station service equipment including battery and charger.[83]

Inverters and Step-up Transformers

The panels deliver direct current (DC) power to the inverters, where the power is converted to alternating current (AC). Electrical collection cables connect the inverters to the substation, where the power is then stepped up at the main transformer from 34.5kV to 345 kV. The power is then transmitted by the proposed 345 kV gen-tie line to Xcel Energy's Chub Lake to Hampton Corners 345 kV transmission line.

Inverter skids will be mounted on driven pier foundations or concrete foundations depending on soil and geotechnical conditions. The typical pier foundation is driven five to ten feet deep. A total of 41 inverters are proposed to be installed for the project. Grading may be required prior to installation of inverters to meet racking tolerances. The topsoil on the installation site will be stripped and stockpiled at a designated storage location. If concrete foundations are used, the inverter foundations will be excavated using an excavator and rebar and concrete will be installed. Following concrete curing and strength testing, the subgrade soils around the inverters will be compacted. Once the concrete is set, the adjacent topsoil will be respread around the inverter. The inverter units will be placed on foundations of either frost-footing supported concrete pads or driven pier foundations. The premanufactured skids containing the inverter, step-up transformer, and SCADA equipment will be delivered to each foundation by a truck with a flatbed trailer. Skids are typically set in place upon foundations using a rough-terrain type hydraulic crane.[84]

Electrical Collection System

[81] Id.
[82] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[83] SPA, p. 27.
[84] SPA, Appendix D: Agricultural Impact Mitigation Plan.

Castle Rock Solar anticipates using belowground 34.5 kV collection systems, but may also use an underhung 34.5 kV collection systems. Additionally, collection systems may be installed via aerial span over the South Branch Vermillion River.

Cabling will be done in accordance with the agricultural impact mitigation plan (AIMP) and multiple installation methods may be used for belowground cabling (e.g., trenching, plow method). Prior to trenching, typical excavating equipment or small backhoes will strip a maximum depth of 12 inches of topsoil and subgrade materials for temporary stockpiling in a designated location.[85] The trenching equipment will cut an approximately 1 foot wide by 3 to 4 feet deep trench, depending on the type of cable installation. Any soil disturbance from the trenching machine activity would be restricted to the trenching machine tracks. The bottom of each trench may be lined with clean fill to surround the cables. Castle Rock Solar anticipates that the native subsoil will be largely rock free, and that foreign fill will not be necessary.

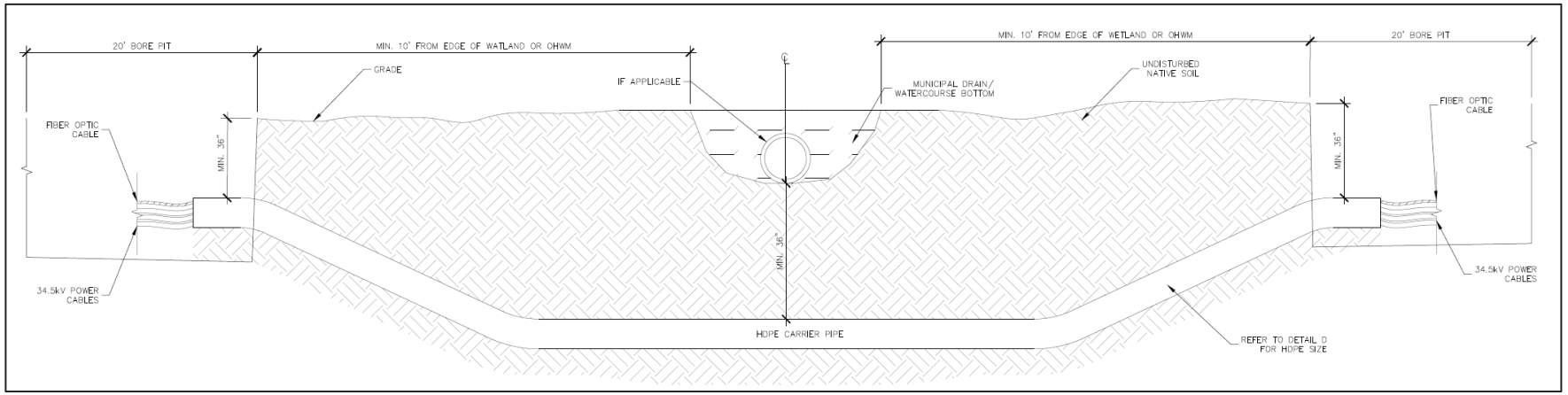
Once underground cables have been installed, a grader or small bulldozer and compaction machine will backfill the trenches. Trenches will be backfilled with 1 foot of screened, native backfill, followed by 2 feet of unscreened native backfill trench spoil. The backfilled material will be compacted as necessary, and the last 1 foot of the trench will be backfilled with topsoil to return the surface to its finished grade. Erosion BMPs in the form of silt fences, straw bales, surface roughness, and temporary seeding will be used to stabilize disturbed areas during construction following the completion of trench work. These areas will be monitored until they have stabilized to 70 percent vegetative cover. The same construction methods would be used for a multiple parallel separation trench design.[86]

If an underhung design is chosen, the collection lines within the tracking racks will be installed within an integrated cable management system that supports the insulated copper DC string wire that interconnects the PV modules. The underhung system would terminate at the inverters, and cables would be buried where they commence from the racks to the inverter and on to the substation using the methods discussed above.

Where the collection system crosses public roadways, non-farmed wetlands, and waterways, the horizontal directional drill method will be used to install cables underground (Figure 19[87]). Drilling equipment will be stored in laydown yards or near the boring location. When boring cannot be completed in one day, drilling equipment will be stored within 50 feet of the bore pits overnight. Prior to leaving the boring location, BMPs and contaminant management (oil absorbent booms, etc.) materials will be put in place.

[85] EA, Appendix D, Question 10.
[86] Id.
[87] SPA, p. 24, Figure 6: Typical Bored Water Crossing.

Figure 19. Horizontal Boring



Typical bore pits measure approximately 10 feet by 20 feet by 6 feet deep, and approximately 1,200 cubic feet (45 cubic yards) of material may be excavated for each pit. Each boring will require two bore pits, one on each side of the roadway, wetland, or waterway being crossed. Materials excavated from bore pits will be stored adjacent to the pit using appropriate BMPs. Excavated material will be used as backfill of the bore pit once boring is completed. When the bore area reaches final grade, the bore area will be seeded with a cover crop and permanent seed mixture. Erosion control devices such as silt fences and erosion matting will be installed as necessary. Based on the current design, part of the belowground AC collection system will be horizontally directionally drilled under three wetlands, two waterways, and 230th Street West.[88,89]

If aerial span collection line crossings are used, access to pole locations will be installed and the location will be prepared. Poles would be placed in upland locations, and fill or excavation within wetlands is not proposed for pole installation at this point. If wetland fill is required, Castle Rock Solar will obtain the necessary permits from state and federal regulators. Following installation of access to the pole location, pole foundations will be developed. Foundation holes will be dug using excavators. Depending on ground conditions, specialist piling rigs may be used for foundation holes. Pre-mixed concrete is delivered to the site, followed by the steelwork for the foundation frames and bases, and then the main steelwork. Once all the steelwork has been delivered, the transmission line pole is assembled in sections. A mobile crane will life the assembled steelwork into position and put up the pole.

Following pole installation, the electric collection lines will be installed. Pilot wires will be run at ground level along the full length of the section, between the "pulling site" and the "tensioning site," where the new conductor is positioned. Next, the pilot wires will be lifted and fed through running wheels located on the cross arms of all towers in the middle of the section, and then fed through a specialized machine at the pulling site. The tensioning site has a specialized machine that will stop the pilot wire from running freely when it is being pulled. Wires will be kept off the ground and damage to property will be avoided. If it is not possible to run the wires from ground level, helicopters will be used to pull the wires through. Once the new wire has run out, it will be installed at its finished tension and height above ground.

If the collection line is strung over the South Branch of the Vermillion River and its associated wetlands, Castle Rock Solar will adhere to state and federal regulations under authority of the state and federal agencies. The crossing will be done in compliance with a crossing license from the DNR. To prevent soil compaction and reduce rutting, winter construction, construction matting, or low ground pressure equipment may be utilized. During and after construction, erosion control measures will be used to prevent runoff and sedimentation into the wetland. Poles will be assembled and installed upland before being transported to the installation location, and staging and stringing areas

[88] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[89] EA, Appendix D, Question 22.

will be sited outside of wetlands. Once construction of the aerial span crossing is complete, any disturbed wetland and/or riparian areas will be restored to pre-construction conditions.[90]

GEN-TIE LINE

Construction of the 200 foot 345 kV gen-tie line that connects the project substation and switchyard with the existing Cub Lake to Hampton Corners 345 kV transmission line will being with pole location preparation. The ground will be cleared and level as needed, and foundation holes will be excavated. Rebar will be installed for reinforcement to ensure structure strength, and concrete for the foundations and anchors will be poured. The steel framework that supports the electrical equipment and the control building will be assembled, and the completed steel towers will be erected using a mobile crane. Anchor towers (dead-ends) will be installed to manage conductor tension.

Next, the high-voltage conductors that form the transmission line will be unreeled and installed. Electrical equipment will be connected to the control room, and the switchyard will be connected to the gen-tie line. All equipment and connections will be tested to ensure proper operation and safety. Once construction of the gen-tie line is complete, the surrounding area will be restored to its original condition.[91]

RESTORATION

After construction, restoration of the temporary laydown yards and other disturbed areas will occur. Restoration activities will including final grading, soil decompaction, and seeding. Disturbed areas will be seeded with regional appropriate perennial seed mixes that comply with Minnesota Noxious Weed Law regarding noxious weed seed content and labeling according to the project's VMP and SWPPP.

Castle Rock Solar has prepared a site-specific draft VMP (Appendix E of the site permit application) outlining how the site will be revegetated, maintained, and monitored over the life of the project to ensure restoration goals and objectives are met. Once vegetation at the site has been established, mowing will be done only when necessary to prevent panel shading and address problem weeds or woody species. Mechanical removal and selective spot herbicide treatments may be used to treat certain biennial and perennial noxious weeds and woody species. Currently, Castle Rock Solar is not considering utilizing grazing and haying as management tools for the project. If the utilization of grazing and haying is considered in the future, Castle Rock Solar will use current knowledge to determine suitability and identify BMPs before implementation. Castle Rock Solar will coordinate with the Minnesota Interagency Vegetation Management Planning Working Group in finalizing the VMP.[92,93]

[90] EA, Appendix D, Question 3.
[91] EA, Appendix D, Question 21.
[92] SPA, Appendix E: Vegetation Management Plan.
[93] SPA, pp. 35-36.

2.1.5 How would the solar facility be operated and maintained?

Castle Rock Solar estimates the service life of the project to be 35 to 45 years.[94] During the project's operational phase, a small maintenance crew will conduct regular maintenance and monitoring checks of the facilities. The maintenance crew will be composed of one full-time operations and maintenance manager, and two to six solar field technicians who will operate the project consistent with applicable state and federal safety regulations. The solar arrays will communicate directly with the SCADA equipment for remote monitoring, reporting, and troubleshooting. SCADA data streams will be remotely monitored in real-time.

During operation, equipment will be inspected at regular intervals noted in Table 6. Maintenance activities will be conducted based on the NREL Best Practices for Operation and Maintenance of Photovoltaic and Energy Storage Systems. Maintenance activities will include access road, perimeter fence, and access gate maintenance, lighting system checks, and if needed, PV module washing. Castle Rock Solar will also monitor for any wildlife that may be present within the facility.

Following commissioning, control of the solar facility will transfer from the construction team to the operations staff. The operations team will be responsible for ensuring operations and maintenance are conducted in compliance with all applicable permits and regulatory requirements, industry practices, and manufacturer's recommendations. It is anticipated that up to seven new full-time staff will operate and maintain the project. Operation and maintenance of the project will be conducted by Castle Rock Solar or a contractor.

Maintenance of the project will include inspection of electrical equipment, visual and noise inspections, vegetation and facilities management, performance monitoring, and snow removal (as needed). Primary maintenance tasks included scheduled inspections of electrical equipment, vegetation management, and snow removal on access drives. The electrical performance of the project will be monitored in real-time by the SCADA system. The SCADA system allows for early notification of abnormal operations, which facilitates prompt maintenance and repair. On site personnel will have ready access to facility operating data and will be notified of faults and alarms as well as abnormal operations on a real time basis.

During the project's operational phase, there will be one to two trucks and approximately three workers' commuter vehicles on-site daily, and at intervals associated with the planned maintenance schedule (Table 6[95]). The operations crew will also be responsible for performance monitoring and adjustments as well as managing any other contractors involved in the facility, such as the vegetation management services.

[94] SPA, p. 40.
[95] SPA, pp. 38-39, Table 8: Operations and Maintenance Tasks and Frequency.

Table 6. Operation and Maintenance Tasks and Frequency

Facility	Task	Frequency
General	Safety Audits	Twice yearly
	Environmental Compliance Inspections	Twice yearly
System Protection	Protection Relays	Once every 2 years or as instructed by the manufacturer
	Breaker Trip Testing	Once every 2 years or as instructed by the manufacturer
	System Protection Potential Transducers and Current Transducers Calibration	Once every 6 years or as instructed by the manufacturer
	Telecommunications Equipment Inspection	Once every 4 years or as instructed by the manufacturer
Substation	Perform thermographic scan of substation components.	Annually
	Perform a remote breaker functional test. General inspections and cleaning of the grounding system, disconnect switches, circuit breakers, insulators, surge arrestors, O/H lines, control room, and fence/gates.	Annually or as instructed by the manufacturer
	Perform insulation resistance for all equipment at substation.	Once every four years
Medium Voltage and High Voltage Breaker	Clean out dirt and debris. Perform a manual operation test. Perform an electrical test. Perform a gas leakage test.	Per manufacturer's recommendations
Generator Step-Up (GSU) Transformer	GSU Transformer	Per manufacturer's recommendations
AC Overhead Collection System	Perform infrared scan and visual inspection of the AC overhead collection system.	Annually
	Wash the phase insulators.	As needed
PCS Transformer	Perform visual and infrared scans on low side of transformer when power is >80 percent.	Per manufacturer's recommendations
	Perform oil sample analysis on PCS transformer(s). Collect PCS transformer oil sample(s) for 3rd party analysis.	Per manufacturer's recommendations
	Perform electrical test of transformer.	Per manufacturer's recommendations
Inverter	Inverter Visual and Thermal Inspections	Per manufacturer's recommendations
	Inverter Testing and Preventative Parts Replacements	Per manufacturer's recommendations
Combiner Boxes	Perform visual inspection of the physical condition of the combiner cabinet.	Annually
Harness Combiner Box	Perform visual inspections, IR scans, torque checks, and switch testing.	Annually
Tracker and Water Sensors	Perform visual inspection of tracking components; sync data with Operator's operations center. Verify stow functionality.	Per manufacturer's recommendations
	Tract Gear Box & Drive Shaft	Per manufacturer's

		recommendations
DC Wiring	Visual inspection for damage. Visual inspection wire management.	Annually
PV Modules	Perform visual inspection of twenty five percent (25 percent) of PV Modules for signs of damage, degradation, delamination, and soiling.	Annually
Weather Station	Perform visual inspection of the physical condition of the unit and associated cabling. Calibrate sensors.	Weekly
Module Surface Temperature (MST)	Perform visual inspection of the physical condition of each MST and associated cabling Plant wide. Remove dirt and debris.	Weekly
Soiling Stations	Perform visual inspection.	Weekly
Other	Insultation resistance testing DC wiring. (25 percent/year)	Annual
	Grounding check, all elements. (25 percent/year)	Annual
	Torque check, all elements. (25 percent/year)	Annual

2.1.6 What happens at the end of the solar facility's useful life?

As the project progresses through its service life and the solar market continues to produce less expensive and more efficient solar panels, Castle Rock Solar may determine that repowering the project is a viable option. The decision to initiate repowering could be triggered by aging or faulty equipment, maintenance costs, extending the useful life of the solar panels, or increasing the project's generation output. Any repowering of the Project will abide by all applicable local, state, and federal regulations. Site permits issued by the Commission specify the maximum generating capacity, so if repowering the project increased the generation capacity beyond Castle Rock Solar's interconnection request of 150 MW, the existing site permit must be amended or a new site permit sought. At the end of the project's useful life, Castle Rock Solar will either take the necessary steps to continue operation of the project (re-permitting and retrofitting) or will decommission the project.[96]

Commission-issued site permits require that the permittee be responsible for removing all project components and restore the site to pre-construction conditions at the end of a project's useful life and that the permittee is responsible for all costs associated with decommissioning the project. Castle Rock Solar provided a draft decommissioning plan as Appendix H of its site permit application.

If Castle Rock Solar does not repower the project, they will decommission and remove project facilities. Decommissioning would consist of removing the solar arrays (panels, racking, and steel posts), inverters, fencing, access roads, portions of the electrical collection system, lighting,

[96] SPA, pp. 40-41.

substation, O&M building, and gen-tie line. Any below-ground cabling and conduits will be removed in accordance with landowner lease agreements. The applicant indicates that the project switchyard would remain after decommissioning.[97]

The total estimated cost to decommission the project, offset salvage/scrap value of solar components, and resulting net estimated decommissioning costs is presented in Table 7. In the fifth year of operation, Castle Rock Solar will reassess the net decommissioning cost and provide the updated cost to the Dakota County Zoning Administrator or applicable Dakota County officer. The decommissioning surety bond or other agreed upon method of financial assurance will be posted in the tenth anniversary of operation. The cost of decommissioning will be updated every five years after the tenth year of operation.[98] Castle Rock Solar is currently revising the decommissioning plan to reflect the updated project design. The updated decommission plan will be provided to the Commission once it is complete.[99] Section 9.1 of the DSP is a standard condition that requires the permittee to update and file the decommission plan with the Commission every five years following the commercial operation date.

Table 7. Estimated Project Decommissioning Costs[100]

Estimated Cost of Decommissioning *(per MW)*	Estimated Salvage Value *(per MW)*	Net Decommissioning Cost *(per MW)*
$7,736,929 *$51,580*	**$3,171,395** *$21,143*	**$4,565,534** *$30,437*

2.2 Project Costs

Castle Rock Solar estimates the total capital costs for the project, including construction, operation, and decommissioning, to be approximately $380 million (Table 8).[101] Castle Rock Solar indicates that actual total costs may vary up to 20 percent, as costs can vary due to external factors.[102] The estimated project decommissioning cost, approximately $7.7 million, and component salvage value, approximately $3.1 million (Table 7), was created using 2024 dollars. The actual cost of decommissioning the project will be dependent on fluctuation and inflation of the labor costs and equipment at the time of decommissioning.

Castle Rock Solar estimates the annual operation cost at approximately $900,000 to $1.2 million. The project operation and maintenance costs typically breakdown into labor, spare parts, and materials

[97] SPA, Appendix H: Decommissioning Plan.
[98] Id.
[99] EA, Appendix D, Question 25.
[100] Id.
[101] SPA, p. 12.
[102] EA, Appendix D, Question 24.

(50 percent), site security (10 percent), taxes, land leases, administration, and insurance (30 percent), and other miscellaneous costs (10 percent).[103]

Table 8. Estimated Project Cost Ranges[104,105]

Project Component	Estimated Cost
Engineering, Procurement, Construction Contractor, and Equipment	$252,000,000
Development Expense (Land Acquisition, Title Work, Environmental Field Work, Project Level Support)	$10,000,000
Interconnection and Network Upgrade	$40,000,000
Financing and Transaction	$34,000,000
Project Substation and Switchyard	$44,000,000
Decommissioning	$7,736,929
Total Project Cost	**$383,736,929**
Salvage Value	($3,171,395)
Net Project Cost	**$384,565,534**

2.3 Project Schedule

Castle Rock Solar anticipates the project will begin commercial operation by the end of 2028. Table 9 shows Castle Rock Solar's estimated development and construction milestones.

Table 9. Anticipated Project Schedule[106]

Activity	Anticipated Timeframe
Site Permit	Q4 2025/Q1 2026
Generator Interconnect Agreement Execution	Q1/Q2 2026
Construction	Q2/Q3 2027
Testing and Commissioning	Q3/Q4 2028
Commercial Operation Date	Q4 2028

[103] Id.
[104] SPA, p. 12, Table 6: Estimated Project Costs.
[105] SPA, Appendix H: Decommissioning Plan.
[106] SPA, p. 5, Table 2: Project Schedule.

3 Regulatory Framework

Chapter 3 discusses the site permit approval required from the Commission. It further describes the environmental review process and lists the factors the Commission considers when making its decision. This chapter also discusses required approvals from federal and state agencies and local units of government with permitting authority for actions related to the project. Lastly, it lists topics outside the scope of this EA.

3.1 What Commission approvals are required?

The project requires a site permit from the Commission before it can be constructed.

The project requires a site permit from the Commission because it meets the definition of a *large electric power generating plant*, which means any electric power generating equipment designed for or capable of operation at a capacity of 50 MW or more (Minn. Stat. 216E.01, subd. 5, Edition Year 2023). A Certificate of Need is not required for the project because of the exemption provided under Minn. Stat. 216B.243.[107] The exemption applies to "any solar generating system…for which a Site Permit application is submitted by an independent power producer." Castle Rock Solar is an independent power producer, and therefore exempt from the Certificate of Need requirement in Minn. Stat. 216B.243.

3.2 What is environmental review?

Environmental review informs interested persons about potential impacts and possible mitigation measures associated with the project; environmental review informs Commission decisions.

Minnesota law requires that potential human and environmental impacts be analyzed before the Commission decides whether to grant a site permit. This analysis is called environmental review.

Minnesota law provides the Commission with two processes to review site permit applications. The alternative process, which applies to solar generating facilities, such as the project, requires that an EA be prepared and a public hearing be held.[108,] On October 31, 2024, Castle Rock Solar filed a Notice of Intent informing the Commission of their plan to submit a site permit application for the project under the alternative review process.[109]

3.3 What permitting steps have occurred to date?

The Commission accepted the site permit application as complete on March 18, 2025. Public information and scoping meetings were held online on April 16, 2025, and in Farmington, Minnesota on April 17, 2025.

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[107] Minnesota Statute 216B.243, subd. 8(a)(7).

[108] Minnesota Statutes 216E.04, subd. 1 and 5, Edition Year 2023; Minn. R. 7850.3700, subp. 1. Applicants are free to elect the alternative process if their project qualifies for it.

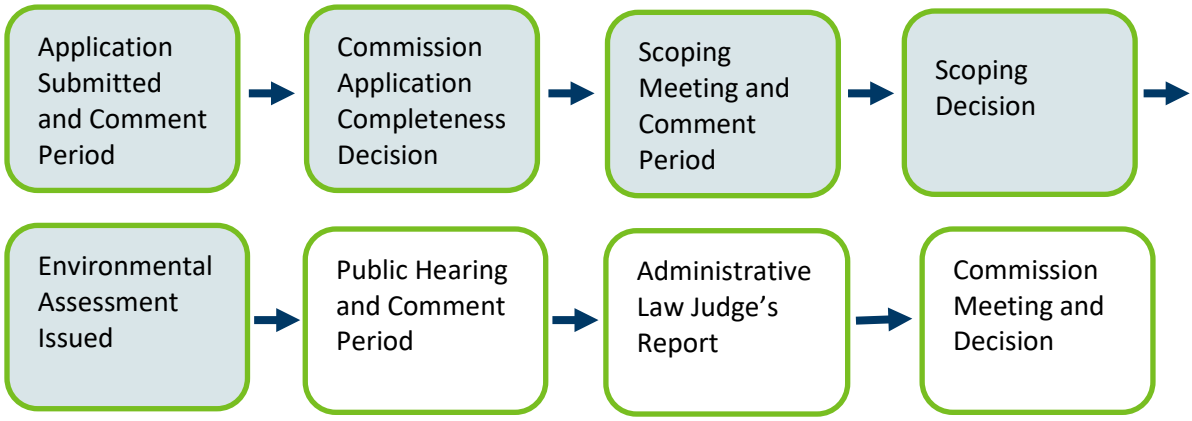
[109] Castle Rock Solar, Initial Filing, October 31, 2024, eDocket No. 202410-211493-01.

Application Filing and Acceptance

Castle Rock Solar filed an application for a site permit on January 16, 2025.[110] The Commission accepted the application as substantially complete in its order dated March 18, 2025.[111] The order also referred the matter to the Office of Administrative Hearings (OAH) for appointment of an ALJ to conduct a public hearing for the project. Commission staff provided a *Sample Site Permit for a Solar Energy Generating System* on April 15, 2025.[112]

Figure 20 outlines the permitting process as it has unfolded for this project.

Figure 20. Permitting Process Summary[113]



Scoping Process

Scoping is the first step in the environmental review process. It helps focus the EA on the most relevant information needed by the Commission to make informed decisions.

Scoping includes a public meeting and comment period that provide opportunities for interested persons to help develop the scope (or contents) of the EA.[114] The purpose of the public information and scoping meetings is to provide information and answer questions about a proposed project and the permitting process. The meeting and associated comment period also provides an opportunity to gather input regarding potential impacts and mitigative measures that should be studied in the EA.

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[110] Castle Rock Solar, Application to the Minnesota Public Utilities Commission for a Site Permit for a Large Electric Generating Facility, January 16, 2025, eDocket No. 20251-214065-02 (through -19). (Site Permit Application, SPA).
[111] Minnesota Public Utilities Commission, Order, March 18, 2025, eDocket No. 20253-216516-01.
[112] Commission Staff, Sample Solar Site Permit, April 15th, 2025, eDockets No. 20254-217651-01.
[113] Read from left to right; shaded steps are complete.
[114] Minn. R. 7850.3700, subp. 2.

On March 26, 2025, the Commission issued a joint *Notice of Public Information and Environmental Assessment Scoping Meeting* and associated public comment period.[115] The notice was sent to those individuals on the project contact list and was also available on webpage for the project.

Staff held public information and scoping meetings in Farmington, Minnesota on April 17, 2025, and an online meeting on April 16, 2025. The comment period closed on May 2, 2025. Approximately 13 people attended the Farmington meeting, and four attendees provided public comments. Two individuals provided public comments at the online meeting.[116] Written comments were received from two citizens, one state agency, one watershed organization, and the Leech Lake Band of Ojibwe.[117]

Public comments addressed a number of potential impacts and concerns related to the project including the use of local labor and employment opportunities; impacts to farmed wetlands; aesthetics; road use and trucking routes; financial surety for decommissioning; organic farming; land classification and tax revenue; recreation; EMF; impacts to air, soil, and water quality; impacts to wildlife and habitat; conservation of prime farmland; environmental contamination from panel damage; impacts to the South Branch of the Vermillion River; unanticipated discoveries; potential Karst features and pollution; rare features; native seed mixes; and the impacts of fencing, dust control, lighting, tree removal, and erosion control methods on wildlife.

SCOPING DECISION

The scoping decision identifies the issues studied in this EA.

After considering public comments and recommendations by staff, EIP issued a scoping decision on July 9th, 2025 (**Appendix A**). The scoping decision identifies the issues to be evaluated in this EA.

3.4 Are other permits or approvals required?

Yes, other permits and approvals are required for the project.

A site permit from the Commission is the only state permit required for siting the project. However, various federal, state, and local approvals might be required for activities related to construction and operation of the project. These subsequent permits are referred to as "downstream" permits and must be obtained by the permittee prior to construction.[118] Table 10 lists potential downstream permits that might be required, several of which are discussed below.

[115] Commission and Commerce, *Notice of Public Information and Environmental Review Scoping Meeting*, March 26, 2025, eDocket No. 20253-216827-01.
[116] Oral Comments on the Scope of Environmental Assessment, Public Scoping and Information Meetings, virtual meeting, April 16, 2025, and Farmington, Minnesota, April 17, 2025, eDocket No. 20255-218652-01.
[117] Written Comments on the Scope of Environmental Assessment, eDocket No. 20255-218653-01.
[118] EA, Appendix C (DSP), Section 4.5.2 (stating the permittee "shall obtain all required permits for the project and comply with the conditions of those permits").

3.4.1 Federal

The U.S. Army Corps of Engineers (USACE) "regulates the discharge of dredged or fill material into waters of the United States, including wetlands."[119] Dredged or fill material, including material that moves from construction sites into these waters, could impact water quality. A permit is required from USACE if the potential for significant adverse impacts exists. The USACE is also charged with coordinating with Indian tribes regarding potential impacts to traditional cultural properties.

The U.S. Environmental Protection Agency (USEPA) enforces the Spill Prevention, Control and Countermeasures Plan (SPCCP). "The purpose of the Spill Prevention, Control, and Countermeasure (SPCC) rule is to help facilities prevent a discharge of oil into navigable waters or adjoining shorelines. The SPCC rule requires facilities to develop, maintain, and implement an oil spill prevention plan, called an SPCC Plan." If a plan is required for this project, it would prevent oil spill, as well as control a spill should one occur. This plan may be required for power transformers within the project substation.

A permit is required from the U.S. Fish and Wildlife Service (USFWS) for the incidental taking[120] of any threatened or endangered species. As a result, USFWS encourages project proposers to consult with the agency to determine if a project has the potential to impact federally listed threatened or endangered species. Additionally, consultation can lead to the identification of measures to mitigate potential impacts associated with the project.

Table 10. Potential Downstream Permits

Unit of Government	Type of Application	Purpose	Anticipated for Project
Federal			
U.S. Army Corps of Engineers	Section 404 Clean Water Act – Dredge and Fill	Protects water quality by controlling discharges of dredged and fill material	Possible
U.S. Environmental Protection Agency	Spill Prevention, Control and Countermeasures Plan	Protect facilities with oil storage of more than 1,320 gallons	Possible
U.S. Fish and Wildlife Service	Threatened and Endangered Species Consultation	Consultation to mitigate impacts to federally listed species	Possible
	Section 10 Endangered Species Incidental Take Permit	Potential impacts on federally endangered/threatened species	Possible
Federal Aviation Administration (FAA)	Notification of Proposed Construction or Alteration	Required for construction or alteration of structures 200 ft or higher above ground level, structures near airports, or	Possible

[119] U.S. Environmental Protection Agency (October 27, 2015) *Section 404 Permit Program*, retrieved from: http://www.epa.gov/cwa-404/section-404-permit-program.

[120] 16 U.S. § 1532(19) (defining "take" to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct).

Unit of Government	Type of Application	Purpose	Anticipated for Project
		sited within line of sight of radar of an air defense facility	
State			
Department of Natural Resources	State Threatened and Endangered Species Consultation	Consultation to mitigate impacts to state-listed species	Yes
	Water Appropriation Permit	Balances competing management objectives; may be required for construction dewatering	Possible
	Public Waters Work Permit	Required to work in public waters and public waters wetlands	Possible
	Utility Cross License	Required to cross state land with utility infrastructure	Possible
Minnesota Pollution Control Agency	Construction Stormwater Permit	Minimizes temporary and permanent impacts from stormwater	Yes
	Section 401 Clean Water Act – Water Quality Certification	Ensures project will comply with state water quality standards	Possible
	Storage Tank Registration	Required for back-up generator aboveground storage tank >500 gallons and belowground storage tank >110 gallons	Possible
	State Air Registration Permit	Required for backup generators if they do not qualify for an exception	Possible
State Historic Preservation Office	National Historic Preservation Act Section 106 Consultation	Ensures adequate consideration of impacts to significant cultural resources	Yes
Department of Agriculture	Agricultural Impact Mitigation Plan	Establishes measures for protection of agricultural resources	Yes
Department of Labor and Industry	Electrical Inspection	Necessary to comply with electric code.	Yes
Department of Transportation	Utility Accommodation on Trunk Highway ROW Permit	Controls utilities being placed along or across highway rights-of-way (ROW)	Possible
	Oversize/Overweight Permit	Controls use of roads for oversize or overweight vehicles	Possible
	Access Driveway Permit	Required for access driveways off of DOT roads	Possible
	Utility Cross Permit	Required for crossing federal or state highways	Possible
Department of Health	Well Construction Permit	Installation of a water supply well	Possible
Board of Water and Soil Resources	Wetland Conservation Act	Coordination with BWSR and Dakota County to ensure conservation of wetlands	Possible

Unit of Government	Type of Application	Purpose	Anticipated for Project
Local			
Dakota County (and/or Castle Rock Township)	Overweight/Oversize Permit	Required for transporting oversized and overweight loads on County roadways.	Possible
	Access Driveway/Entrance Permit	Required for moving, widening or creation a new driveway access to County roads	Possible
	Septic System Permit	Required for installation of an individual sewage treatment system (O&M)	Possible
	Utility Permit(s)	Needed to construct or maintain electrical lines along or across county highway right-of-way	Possible
	Shoreland and Floodplain Management	Regulate the use and development of shoreland and floodplains in Dakota County	Possible
	Public Drainage Systems Permit	Required for connecting, placing utilities, or dewatering to a public drainage system (county ditch)	Possible
Dakota County Soil and Water Conservation District (SWCD)	Minnesota Wetland Conservation Act Approval	Activities affecting water resources	Possible

3.4.2 State

Potential impacts to state lands and waters, as well as fish and wildlife resources, are regulated by the DNR. Licenses are required to cross state lands or waters.[121] Projects affecting the course, current, or cross-section of lakes, wetlands, and streams that are public waters may require a *Public Waters Work Permit*.[122] Utility infrastructure that will be crossing DNR managed lands require the agency to provide a *Utility Crossing License*.[123] Not unlike the USFWS, DNR encourages project proposers to consult with the agency to determine if a project has the potential to impact state-listed threatened or endangered species. Additionally, consultation can lead to the identification of measures to mitigate potential impacts associated with the project.

Construction projects that disturb one or more acres of land require a general *National Pollutant Discharge Elimination System / State Disposal System Construction Stormwater Permit* ("CSW Permit") from the MPCA. This permit is issued to "construction site owners and their operators to prevent

[121] Minnesota Statutes 84.415.
[122] DNR (n.d.) *Requirements for Projects Involving Public Waters Work Permits*, http://www.dnr.state.mn.us/waters/watermgmt_section/pwpermits/requirements.html.
[123] DNR (2023) *Utility Crossing License,* https://www.dnr.state.mn.us/permits/utility_crossing/index.html

stormwater pollution during and after construction."[124] The CSW Permit requires use of best management practices; development of a SWPPP; and adequate stormwater treatment capacity once the project is complete. Projects must be designed so that stormwater discharged after construction does not violate state water quality standards. Specifically, projects with net increases of one acre or more to impervious surface must be designed to treat water volumes of one-inch times the net increase in impervious surface. PV panels are impervious, and are counted towards total impervious surface along with access roads, buildings, etc. The area beneath the panel, however, is pervious if properly vegetated. To account for this, MPCA developed a solar panel calculator that estimates the amount of stormwater retained by PV solar facilities. This amount can be applied as a credit towards the total amount of stormwater treatment needed for a project.[125]

A Clean Water Act Section 401 *Water Quality Certification* from MPCA might also be required. "Section 401 of the Clean Water Act requires any applicant for a federal license or permit to conduct an activity that may result in a discharge of a pollutant into waters of the United States to obtain a certification from the State in which the discharge originates that the discharge complies the applicable water quality standards."[126] The certification becomes a condition of the federal permit.

Additionally, MPCA regulates generation, handling, and storage of hazardous wastes.

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

The Minnesota Department of Agriculture (MDA) ensures the integrity of Minnesota's food supply while protecting the health of its environment and the resources required for food production. MDA assists in the development of agricultural impact mitigation plans that outline necessary steps to avoid and mitigate impacts to agricultural lands.

The Minnesota Department of Labor and Industry requires an electrical inspection as a component of an electrical permit.[127]

A permit from the Minnesota Department of Transportation (MnDOT) is required for construction, placement, or maintenance of utility lines adjacent or across trunk highway rights-of-way (ROW).[128] Coordination would be required to construct access roads or driveways from trunk highways.[129] These

[124] MPCA. *Construction Stormwater*. (2023). https://www.pca.state.mn.us/business-with-us/construction-stormwater.
[125] MPCA. *Minnesota Stormwater Manual*. (2022). https://www.pca.state.mn.us/water/minnesotas-stormwater-manual.
[126] MPCA. (n.d.) *Clean Water Act Section 401 Water Quality Certifications*, https://www.pca.state.mn.us/water/clean-water-act-section-401-water-quality-certifications.
[127] MNDLI (n.d.) Electrical Permits, Contractors, https://www.dli.mn.gov/business/electrical-contractors/electrical-permits-contractors.
[128] Minnesota. Rules, Part. 8810.3300, subp. 1.
[129] Mn DOT *Land Management*. (2022). https://www.dot.state.mn.us/utility/forms.html.

permits are required to ensure that use of the ROW does not interfere with free and safe flow of traffic, among other reasons.[130]

Minnesota's Board of Water and Soil Resources (BWSR) oversees implementation of Minnesota's *Wetland Conservation Act* (WCA). The WCA is implemented by local units of government.

3.4.3 Local

Dakota County oversees local implementation of the WCA in the project area. The WCA requires that any person "proposing to impact a wetland to first, attempt to avoid the impact; second, attempt to minimize the impact; and finally, replace any impacted area with another wetland of at least equal function and value."[131]

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

- Access/Driveway Coordination may be required to construct access roads or driveways from county or township roads.
- Overwidth Load Coordination may be required to move over-width or heavy loads on county or township roads.
- Road Crossing and Right-of-Way Coordination may be required to cross or occupy county or township road rights-of-way.

Dakota County local permits may be required as a component of this project, including[132]:

- Oversize Vehicle Permit to transport oversized and overweight loads on county roadways.
- Driveway Permits in order to create a new driveway access to county roads.
- Driveway Maintenance Permits in order to replace or extend driveways.
- Right-of-Way Work Permits (General Permit) in order to conduct excavation, grading, or other installations within the highway right-of-way.
- Installation of Object/Structures Within County Highway Right-of-Way (Utility Permit) in order to install a utility within the highway right-of-way.
- Right-of-Way Obstruction Permits in order to close a traffic lane or obstruct any part of a county road right-of-way for non-excavation activity.

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[130] MnDOT. *Utility Accommodation on Trunk Highway Right of Way: Policy OE002.* (2017). https://www.dot.state.mn.us/policy/operations/oe002.html.

[131] Minnesota. Rule. 8420.0100, subp. 2.

[132] Dakota County, Highway Permits: Highway Permits | Dakota County; Dakota County, Building and Zoning Permits: Building & Land Use Permits | Dakota County; Dakota County, Well Permits: Well Permits | Dakota County.

- Subsurface Sewage Treatment Systems Permit which must be given prior to the installation of any individual sewage treatment system in the County.
- Well Permit which must be given prior to the construction or sealing of any individual well in the County.

3.5 Do electrical codes apply?

Yes, if constructed the project must meet electrical safety code requirements.

The project must meet requirements of the NESC.[133] Utilities must comply with the most recent edition of the NESC, as published by the Institute of Electrical and Electronics Engineers, Inc., and approved by the American National Standards Institute, when constructing new facilities or upgrading existing facilities.[134] These standards are designed to safeguard human health "from hazards arising from the installation, operation, or maintenance of conductors and equipment in electric supply stations and overhead and underground electric supply lines."[135] They also ensure that facilities and all associated structures are built from materials that will withstand the operational stresses placed upon them over the expected lifespan of the equipment, provided operational maintenance is performed.

The project must be designed to meet North American Electric Reliability Corporation's requirements,[136] which define the reliability requirements for planning and operating the electrical transmission grid in North America.[137]

3.6 Are any issues outside the scope of this EA?

Yes, the scoping decision identified several issues that will not be studied.

The EA will not address following topics:

- Any site other than the project site proposed by the applicant and identified in the scoping decision.
- The manner in which landowners are compensated for the use or sale of their land for the project.

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[133] *See* Minnesota. Statute. 326B.35; Minn. R. 7826.0300, subp. 1 (requiring utilities to comply with the most recent edition of the National Electric Safety Code when constructing new facilities or reinvesting capital in existing facilities).

[134] Minnesota Statute 326B.35.

[135] IEEE Standards Association (n.d.) *2017 – National Electrical Safety Code Brochure*, retrieved from: https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/nesc_2017_brochure.pdf.

[136] EA, Appendix C (DSP), Section 4.5.1

[137] North American Electric Reliability Corporation (2017) *Standards*, http://www.nerc.com/pa/stand/Pages/default.aspx

4 Project Impacts and Mitigation

Chapter 4 describes the environmental setting, affected resources, and potential impacts from the project. It also discusses mitigation of potential impacts.

4.1 How are potential impacts measured?

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

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

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

4.1.1 Potential Impacts and Mitigation

The following terms and concepts are used to describe and analyze potential impacts:

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

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

- Negligible impacts do not alter an existing resource condition or function and are generally not noticeable to an average observer. These short-term impacts affect common resources.

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

Also discussed are opportunities to avoid, minimize, or compensate for potential impacts. Collectively, these actions are referred to as mitigation.

- To avoid an impact means to eliminate it altogether, for example, by not undertaking parts or all of a project, or relocating the project.
- To minimize an impact means to limit its intensity, for example, by reducing project size or moving a portion of the project.
- To correct an impact means to repair, rehabilitate, or restore the affected resource.
- To compensate for an impact means replacing it or providing a substitute resource elsewhere, or by fixing it by repairing, rehabilitating, or restoring the affected resource. Compensating an impact can be used when an impact cannot be avoided or further minimized.

Some impacts can be avoided or minimized; some might be unavoidable but can be minimized; others might be unavoidable and unable to be minimized, but compensation can be applied. The level at which an impact can be mitigated might change the impact intensity level.

4.1.2 Regions of Influence

Potential impacts to human and environmental resources are analyzed within specific geographic areas called regions of influence ("ROI"). This EA uses the following ROIs:

- Land control area (land control of the solar generating facility and collection corridors)
- Local vicinity (1,600 feet from the boundary of the solar generating facility)
- Project area (one mile from the boundary of the solar generating facility)
- Region (Dakota County)

Impacts to resources may extend beyond these distances but are expected to diminish quickly. ROIs vary between resources. Table 11 summarizes the ROIs used in this EA.

Table 11. Regions of Influence for Human and Environmental Resources

Resource Type	Resource Element	Region of Influence
Human Settlement	Displacement, Land Use and Zoning	Land control area
	Noise, Property Values, Tourism	Local vicinity
	Aesthetics, Cultural Values, Recreation, Transportation and Public Services	Project area
	Socioeconomics, Environmental Justice	Region
Public Health and Safety	Electric and Magnetic Fields, Implantable Medical Devices, Public Safety and Emergency Services	Land control area
Land-based Economies	Agriculture, Forestry, Mining	Land control area
	Tourism	Project area
Archaeological and Historic Resources	—	Project area
Natural Environment	Geology and Groundwater, Soils, Surface Water and Floodplains, Wetlands, Vegetation, Wildlife and Habitat (except birds)	Land control area
	Wildlife and Habitat (birds), Rare and Unique Resources	Local vicinity
	Air Quality	Region

4.2 Project Setting

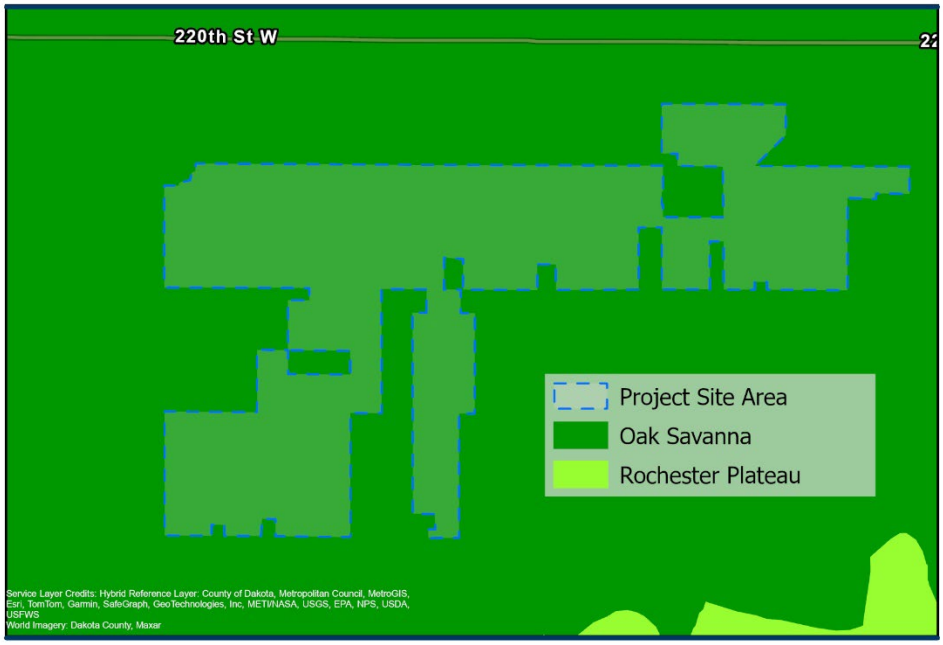
The project is in a rural area, immediately southeast of the city of Farmington in Dakota County. The project area is dominated by agricultural land uses, scattered farmsteads, and small housing developments, with developed areas in Farmington. Wooded areas are common around the farmsteads. The South Branch Vermillion River flows west to east through the project.

The proposed solar facility is located in Castle Rock Township, 500 feet southeast of the city limits of the city of Farmington in Dakota County, Minnesota. The solar facility is bisected by 230th Street East and the South Branch Vermillion River (Figure 1). Views are broad and expansive, but typically interrupted by farmsteads and residences. Many of the structures are fully or partially surrounded by wooded shelterbelts.

The topography of the project site is gently rolling, with the majority of the site in the 0 to 5 percent slope range. Site elevation ranges from 879 to 958 feet.[138] The topography is underlain by deposits of ice-deposited glacial sediment overlaying dolomite, limestone, sandstone, and shale. The glacial sediment consists largely of till and outwash which transition from shallow deposits in the east (25 feet thick) to deeper deposits in the west (greater than 150 feet thick).

The majority of the project area is in the Oak Savanna (222Me) subsection of the Minnesota & NE Iowa Morainal Section (222M) of the Eastern Broadleaf Forest Province. A small portion of the southern project area is in the Rochester Plateau Subsection (222Lf) of the Paleozoic Plateau Section (222L) of the Eastern Broadleaf Forest Province (Figure 21).[139] Pre-settlement vegetation in the majority of the project area was primarily bur oak savanna, with areas of tallgrass prairie and maple-basswood forests. Tallgrass prairies populated the level to gently rolling areas of the landscape, while bur oak savanna was found in rolling moraine ridges and dissected ravines. Maple-basswood forests were limited to steep dissected ravines or along streams, the portions of the landscapes with the greatest fire protection. The current land-use in the project area is predominately agricultural and pastureland.

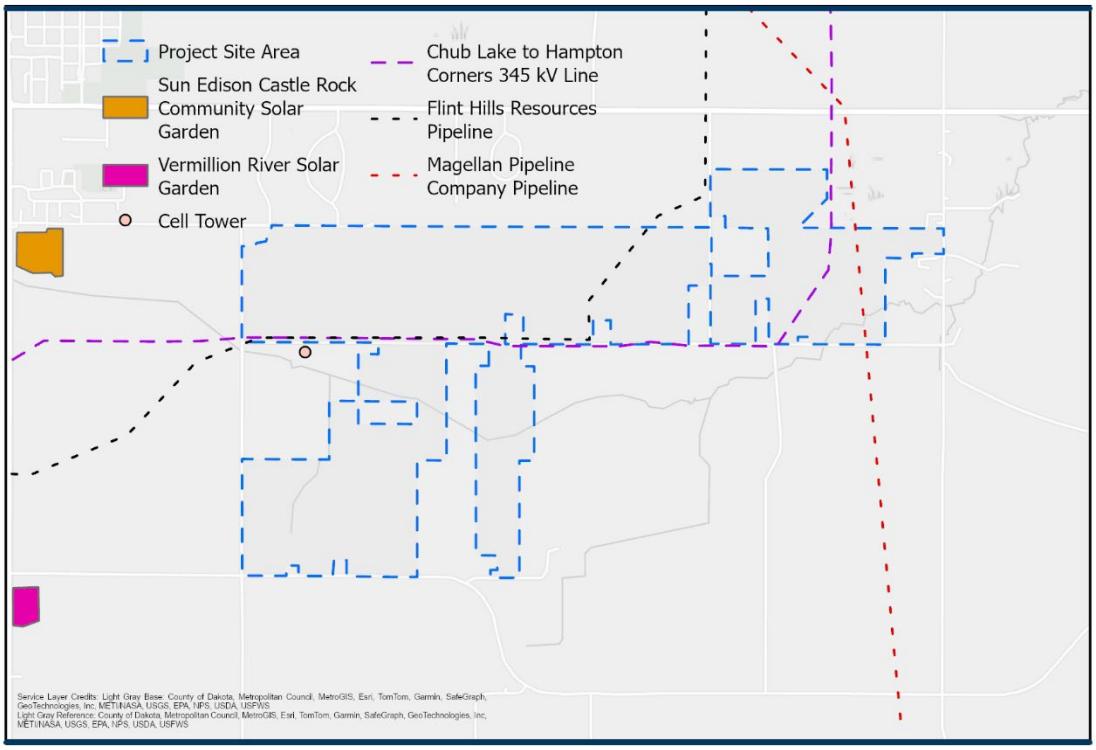
Figure 21. Project Area Ecological Classification Systems



[138] EA, Appendix D, Question 34.
[139] DNR (n.d.) *Ecological Classification System: Ecological Land Classification Hierarchy*, retrieved from: https://www.dnr.state.mn.us/ecs/index.html

Land use within the area of land control is dominated by agriculture; approximately 87 percent of the 1,442-acre land control area is currently used for cultivated agriculture (primarily corn and soybeans in rotation). Built features common to the area include residences and buildings, paved and gravel roads, and private agricultural drainage ditches. There are also several energy infrastructure projects in the region. The Sun Edison Castle Rock Community Solar Garden is approximately 0.77 miles west of the project, and the Vermillion River Solar Garden is approximately 0.88 miles southwest of the project. One 345 kV line, the Chub Lake to Hampton Corners line owned by Xcel Energy, crosses the project east-west along 230th Street, before cutting northwest through the eastern portion of the project. Two natural gas or hazardous liquid pipelines run through the project. The Flint Hills Resources pipeline runs east-west along 230th Street, before moving northeast to Annettee Ave and the Magellan Pipeline Company pipeline runs north-south on the east side of the project. [140] A 265-foot tall cell tower is located approximately 0.04 miles from the western portion of the project (Figure 22).[141,142]

Figure 22. Project Area Infrastructure



[140] National Pipeline Mapping System. *Public Viewer*. [Online] [Cited: August 25, 2025] Retrieved from: https://pvnpms.phmsa.dot.gov/PublicViewer/

[141] SPA, p. 52.

[142] Federal Communications Commission. *Antenna Structure Registration*. [Online] [Cited: August 25, 2025] Retrieved from: https://wireless2.fcc.gov/UlsApp/AsrSearch/asrRegistrationSearch.jsp.

4.3 Human Settlement

Large energy projects can impact human settlements. Impacts might be short-term, such as increased local expenditures during construction, or long-term, such as changes to viewshed.

4.3.1 Aesthetics

The ROI for aesthetics is the project area. The project will introduce new manmade structures into the existing landscape. Portions of the project will be visible from local roads, and nearby residences. For most people who pass through the project area on MN 50, CR 78, CR 79, or local roads the impact intensity level is expected to be **minimal**. For individuals with greater viewer sensitivity, such as people who live in the project area, or those visiting the recreational opportunities around the project, the impact intensity level is anticipated to be **moderate to significant**. Impacts will be short- and long-term, and localized. Potential impacts are unavoidable but can be mitigated in part.

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

A viewshed includes the natural landscape and built features visible from a specific location. Natural landscapes can include wetlands, surface waters, distinctive landforms, and vegetation patterns. Buildings, roads, bridges, and power lines are examples of built features. Generally, an intact and harmonious viewshed is considered by many to be more aesthetically pleasing. Viewsheds might be important regardless of whether they are considered beautiful by the observer, for example, a scattered stone foundation of a historical resource.

Viewer sensitivity is an individual's interest or concern for the quality of a viewshed and varies depending upon the activity viewers are engaged in, their values and expectations related to the viewshed, and their level of concern for potential changes to the viewshed. High viewer sensitivity is generally associated with individuals engaged in recreational activities; traveling to scenic sites for pleasure and to or from recreational, protected, natural, cultural, or historic areas; or experiencing viewshed from resorts, road-side pull-outs, or residences. Residents have a higher sensitivity to potential aesthetic impacts than temporary observers. Low viewer sensitivity is generally associated with individual commuting, working, or passing through an area.

Viewer exposure refers to variables associated with observing a viewshed, and can include the number of viewers, frequency and duration of views, and view location. For example, a high exposure viewshed would be observed frequently by large numbers of people. These variables, as well as other factors such as viewing angle or time of day, affect the aesthetic impact.

The existing landscape in the project area is rural and agricultural consisting of gently rolling agricultural crop fields of corn and soybeans, wooded shelterbelts, wetlands, streams, and rivers. The built environment in the project area includes the city of Farmington northwest of the project and township and city roads. Existing infrastructure includes one transmission line, two pipelines, and a

cell tower. Residences, farmsteads, and small housing developments are scattered around the nearby landscape, many surrounded by woodlands or shelterbelts. The Fountain Valley Golf Course lies northwest of the project and Dakota County Snowmobile Trail 123 runs northwest-southwest through the project.

Figure 23. Existing Viewshed of Castle Rock Solar Project – Biscayne Avenue West

Figure 23 shows the existing viewshed of gently rolling agricultural fields, the existing 345 kV Chub Lake to Hampton Corners transmission line, and the cell tower in the northwestern portion of the site off Biscayne Avenue West.

Figure 24. Existing Viewshed of Castle Rock Solar Project – CR 78/240th Street West

Figure 24 shows the existing viewshed of agricultural fields and scattered trees in the southwestern portion of the site off CR 78/240th Street West.

Figure 25. Existing Viewshed of Castle Rock Solar Project – 230th Street West

Figure 25 shows the existing viewshed of herbaceous vegetation and agricultural fields in the central portion of the site facing north (A) and south (B) off 230th Street West.

Figure 26. Existing Viewshed of Castle Rock Solar Project – Annette Avenue

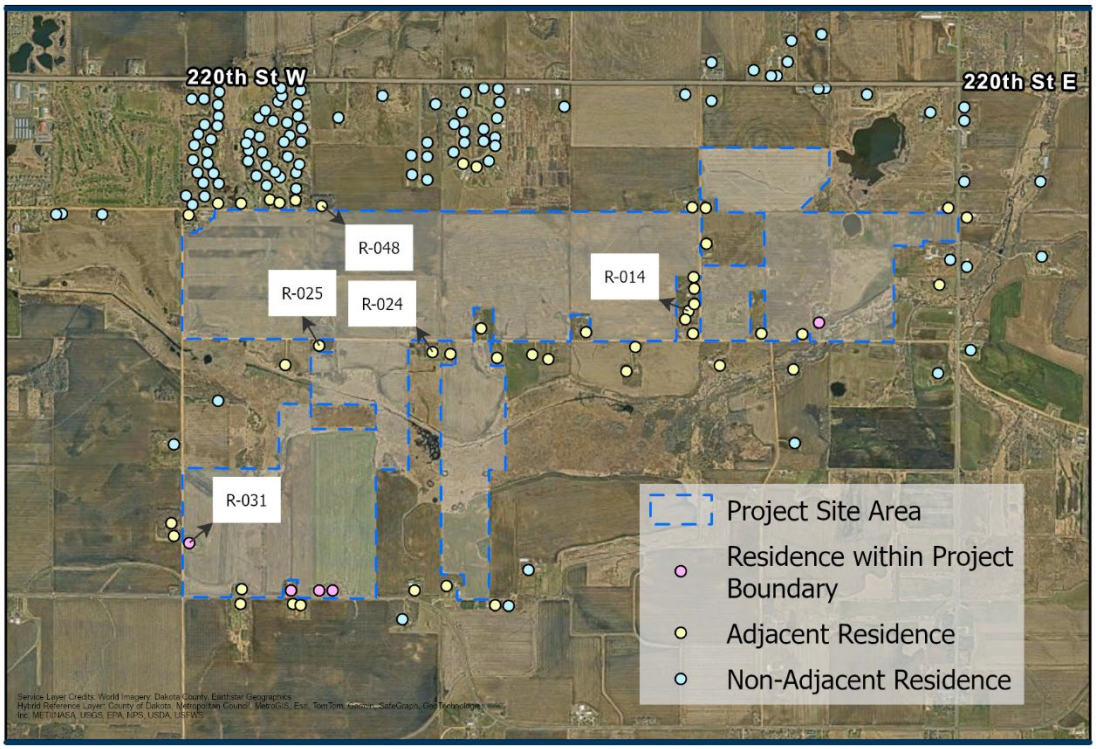
Figure 26 shows the existing viewshed of gently rolling agricultural fields in the northeastern portion of the site off Annette Avenue.

There are 154 residences within 0.5 miles of the project site. Fifty of the 154 residences are adjacent to or within the project.[143] Five of these residences, Residences #008, #031, #033, #036, and #037, are within the project boundary, but are not within the preliminary development area. Residence R-048, located on 225th Street West, is the nearest home to the solar arrays, approximately 341 feet from panels. Residence R-031, located on the east side of Biscayne Avenue West, is one of the nearest homes to solar arrays and inverters, approximately 348 feet from the nearest solar panel and 602 feet away from the nearest inverter. Residence R-014, located on the north side of 230th Street East, is another one of the nearest homes to solar arrays and inverters, approximately 353 feet from the nearest solar panel and 879 feet away from the nearest inverter. Residences R-024 and R-025, both located on the south side of 230th Street West, are the nearest homes to the project substation and

[143] EA, Appendix D, Question 33.

switchyard area, approximately 1,026 feet (R-025) and 1,331 feet (R-024) from the substation and 823 feet (R-025) and 956 feet (R-024) from the switchyard (Figure 27).[144] Built features common to the area include residences and buildings, paved and gravel roads, agricultural drainage ditches, community-scale solar facilities, and transmission lines.

Figure 27. Residences within 0.5 Miles of the Project



POTENTIAL IMPACTS

The visible elements of the solar facility will consist of new PV arrays, transformers and inverters, five permanent weather stations, an O&M building, a new substation, a new switchyard, a potential aerial span collection line crossing of the South Branch Vermillion River, a short 345 kV transmission line, and security fencing surrounding the project.

The project will be a noticeable change in the landscape, converting approximately 972 acres of agricultural fields into solar production. Although the change will be noticeable, there are other existing infrastructure features in the landscape including gravel roads, transmission lines, and a cell tower. How an individual viewer perceives the change from a field of corn or soybeans to a field of solar panels depends, in part, on how a viewer perceives solar panels. Will the viewer consider the

[144] EA, Appendix D, Question 31.

harvesting of solar energy to be like harvesting crops or will the viewer see an agricultural use be replaced by an industrial use?

For residents outside the project vicinity and for others with low viewer sensitivity, such as travelers on surrounding roads, aesthetic impacts are anticipated to be minimal. For these viewers, the solar panels would be relatively difficult to see due to fencing and vegetation or would only be visible for a very short period. For residents traveling on local roads in the project vicinity, such as CR 78 or 230th Street East, and for others with high viewer sensitivity, such as residents enjoying their backyard or using the recreational resources surrounding the project, aesthetic impacts are anticipated to be moderate to significant. The extent of visibility from each residence would vary based on factors such as the viewer's location within the property, the time of day, or the degree of foliage on the vegetation. Construction of the project may require approximately 6.9 acres of tree removal within the land control area.[145] The existing trees within the land control area may provide additional vegetative screening for residential properties. Tree clearing within the project could increase aesthetic impacts to adjacent residences by altering the viewshed they associate with their home and removing the vegetative screening bordering their property, increasing the visibility of the project.

Current fields of corn and soybeans will be replaced with acres of solar panels. Panels will have a relatively low profile; when level to the ground, panels in a portrait configuration racking design will be 5 to 8 feet tall, with a maximum height of 12 feet off the ground at maximum tilt. If a two in-portrait racking design is used, panels will have a maximum height of 18 feet off the ground at maximum tilt. Construction of the new 4.29 acre project substation, the 5.70 acre switchyard, the 345 kV gen-tie line, the 0.11 acre O&M building area, and the potential aerial span collection line crossing of the South Branch Vermillion River will also present new visual impacts. The O&M building will include a parking lot and may house the SCADA system. The 345 kV overhead transmission line will be constructed with steel monopole structures not anticipated to exceed 150 feet in height,[146] and the entire length of line will be 200 feet. In addition, an existing 345 kV transmission line is within the land control area.

Lighting will be installed at the project substation, switchyard, and O&M building. Lighting will be motion-activated, down lit, and shielded, and directed away from neighboring properties and public rights-of-way.[147] Impacts to light-sensitive land uses are not anticipated given the rural project location coupled with minimal required lighting for operations.

MITIGATION

Minimizing aesthetic impacts from solar generating facilities is primarily accomplished by locating the facilities so that they are not immediately adjacent to homes, ensuring that damage to natural landscapes during construction is minimized, and shielding the facilities from view by terrain or vegetation. Impacts from facility lighting can be minimized by using shielded and downward facing light fixtures and using lights that minimizes blue hue. Castle Rock Solar anticipates approximately 6.9

[145] EA, Appendix D, Question 33.
[146] EA, Appendix D, Question 32.
[147] EA, Appendix D, Question 15.

acres of tree clearing may be necessary for the project and would primarily occur along farmstead woodlots and fence lines.

Site-specific landscaping plans can minimize visual impacts to adjacent land uses and homes through vegetation screening, berms, or fencing. Castle Rock Solar has planned two segments of landscape screening, approximately 2,071 feet and 2,351 feet in length, along the northern boundary of the project; three segments of landscape screening, approximately 1,861 feet, 573 feet, and 589 feet in length, along 230th Street West; and one segment of landscape screening, approximately 470 feet in length, along 240th Street. Castle Rock Solar will establish a permanent seed mix consisting of native and non-native forbs and grasses in landscape screening areas within 20 feet of the fence line. Trees and shrubs will be installed within the seeded area to provide vegetative screening. A preliminary landscape plan that includes a map of the planned vegetative screening areas, design details, planting procedures, and a species list can be found in **Appendix E**.[148] Castle Rock Solar provided a visualization of vegetative screening buffering views of the solar facility along the northern project boundary (Figure 28[149]). Castle Rock Solar indicates that although the nearby residences have some natural vegetation screening from the project, they will work with adjacent landowners to determine the need for additional vegetation screening and landscaping to minimize aesthetic impacts of the project.

Figure 28. Example Vegetative Screening

[148] EA, Appendix D, Question 33.

[149] SPA, p. 62, View 2b: Project Area with proposed solar facility incorporating vegetative screening facing south from near the intersection of 225th Street West and Beaumont Avenue.

Impacts can be mitigated through standard or special permit conditions. A proposed draft site permit (DSP) for the project is included in **Appendix C** and contains several permit conditions related to aesthetic impacts.[150]

- Section 4.3.8 of the DSP is a standard condition that requires the permittee to consider landowner input with respect to visual impacts and to use care to preserve the natural landscape, minimize tree removal and prevent any unnecessary destruction of the natural surroundings in the vicinity of the project during construction and operation.

- Section 5.1 of the DSP is a special condition that requires a visual screening plan: The Permittee shall develop a site-specific Visual Screening Plan. The Visual Screening Plan shall be designed and managed to mitigate visual impacts to adjacent residences. The Visual Screening Plan shall at a minimum include:

  (a) objectives for screening of nearby residences; and
  (b) a description of the types of trees and shrub species to be used, the location of plantings, and plans for installation, establishment, and maintenance.

  The location of trees and shrubs included in the Visual Screening Plan that are located within the Permittee's site control shall be included in the Site Plan filed under Section 8.3. The Permittee is required to maintain and ensure the successful growth, health, and maintenance of the vegetation for 3 years.

  At least 14 days prior to the pre-construction meeting, the Permittee shall file:

  (a) the Visual Screening Plan;
  (b) documentation of coordination between adjacent landowners; and
  (c) an affidavit of its distribution of the Visual Screening Plan to adjacent landowners.

The specifics of the individual agreements with landowners for supplemental vegetation covering residences are not within the scope of this EA.

No additional mitigation is proposed.

4.3.2 Noise

The ROI for noise is the local vicinity. Distinct noises are associated with the different phases of project construction. The impact intensity level during construction will range from **negligible to**

[150] EA, Appendix C: Proposed Draft Site Permit.

significant depending on the activity and proximity to the activity. Potential impacts are anticipated to be intermittent and short-term. These localized impacts may affect nearby residences and might exceed state noise standards. Impacts are unavoidable but can be minimized. Operational impacts are anticipated to be **negligible to minimal**.

Noise can be defined as any undesired sound. It is measured in units of decibels on a logarithmic scale. The A-weighted scale ("dBA") is used to duplicate the sensitivity of the human ear.[151] A three dBA change in sound is barely detectable to average human hearing, whereas a five dBA change is clearly noticeable. A 10 dBA change is perceived as a sound doubling in loudness. Noise perception is dependent on a number of factors, including wind speed, wind direction, humidity, and natural and built features between the noise source and the receptor.

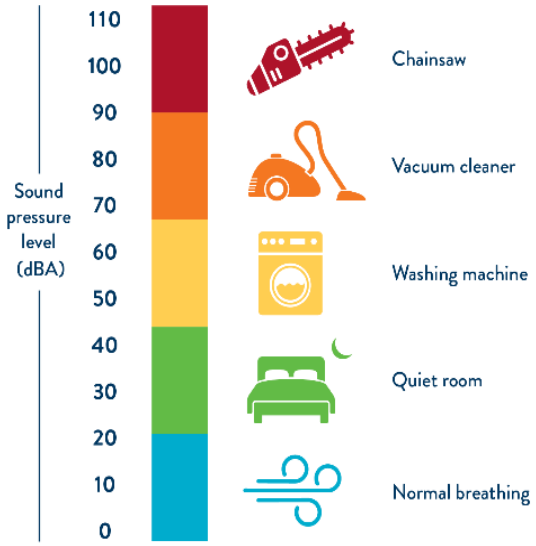


Figure 29 provides decibel levels for common indoor and outdoor activities.[152]

Because sound levels are measured on a logarithmic scale, they are not directly additive. "A doubling of sound energy yields an increase of three decibels."[153] For example, if a sound level of 50 dBA is added to another sound level of 50 dBA, the total sound level is 53 dBA, not 100 dBA. This change in sound level (three dBA) would be barely detectible.

All noises produced by the project must be within state noise standards.[154] Noise standards in Minnesota are based on *noise area classifications* ("NAC") corresponding to the location of the listener, referred to as a receptor. NACs are assigned to areas based on the type of land use activity occurring at that location. Household units, designated camping and picnicking areas, resorts and group camps are assigned to NAC 1; recreational activities (except designated camping and picnicking areas) and parks are assigned to NAC 2; agricultural and related activities are assigned to NAC 3.

Noise standards are expressed as a range of permissible dBA over a one-hour period. L_{10} may be exceeded 10 percent of the time, or six minutes per hour, while L_{50} may be exceeded 50 percent of

[151] MPCA. *A Guide to Noise Control in Minnesota.* (2015). https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf.
[152] Federal Aviation Administration (February 9, 2018) *Fundamentals of Noise and Sound*, retrieved from: https://www.faa.gov/regulations_policies/policy_guidance/noise/basics/.
[153] MPCA. *A Guide to Noise Control in Minnesota.* (2015). https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf.
[154] Minnesota Rule 7030.0050.

the time, or 30 minutes per hour. Standards vary between daytime and nighttime hours. There is no limit to the maximum loudness of a noise. Table 12 provides current Minnesota noise standards.

Table 12. Noise Area Classifications (dBA)

Noise Area Classification	Daytime (7:00 a.m. to 10:00 p.m.)		Nighttime (10:00 p.m. to 7:00 a.m.)	
	L_{10}	L_{50}	L_{10}	L_{50}
1	65	60	55	50
2	70	65	70	65
3	80	75	80	75

The MPCA noise standards are public health standards. That is, they protect people from noise generated by all sources at a specific time and place. The total sum of noise at a specific time and location cannot exceed the standards. The MPCA evaluates whether a specific noise source is in violation by determining if the source causes or significantly contributes to a violation of the standards.

Potential Impacts

The ROI for noise is the project vicinity (1,600 feet). The primary noise receptors are the local residences. Castle Rock Solar identified a total of 154 noise receptors (residences) within 0.5 miles of the project (Figure 27). There are no residences within the development area, there are five residences located outside of the fenced array area but within the project boundary that are participating landowners. An additional 149 residences are located on parcels adjacent to or near the project site.[155] The identified receptors were categorized by distance from the project (Table 13); all of the residences are at least 200 feet away from the project, and the majority of residences (62 percent) are at least 800 feet away from the project.

Table 13. Noise Receptor Distance Distribution

Distance from Project (feet)	# of Residences
<50’	0
50’ – 100’	0
100’ – 200’	0
200’ – 400’	35
400’ – 800’	24
800’ – 1600’	43
1600’ – 3200’	52

[155] SPA, pp. 53-58, Table 15: Proximity of Residences to Solar Project.

The proposed project is in a rural, agriculturally dominated area directly adjacent to city of Farmington. Rural noise levels typically range from 30-55 dBA depending on the activity, time-of-day, weather, and season. The project vicinity's existing sound character also includes audible traffic sounds from roadways[156] such as Minnesota State Highway 50 (MN 50), which is to the north of the project. Snowmobile trail 123 is currently routed through the proposed project. Prior to 1969, snowmobiles emitted sound levels as high as 102 dBA from 50 feet. The Snowmobile Safety and Certification Committee (SSCC) was formed in 1974 to provide safety regulations for the industry. Since 1976, all snowmobiles manufactured and certified must not exceed 78 dBA from 50 feet while traveling at full throttle, and no more than 73 dBA at 50 feet when traveling at 15 mph.[157] During winter seasons, the additional noise from snowmobiles is considered part of the existing sound character of the area.

The project area is classified as NAC 1. Noise receptors include individuals within their residences, working outside in the project vicinity, and using the surrounding recreational resources. Fountain Valley Golf Course is 0.1-mile northwest of the project and snowmobile trail 123 is currently routed through the proposed project; both are recreation resources open to the public that may be potentially impacted by the project. Other recreation resources are listed in Table 19 of the Site Permit Application.[158] Potential noise impacts from the project are associated with construction noise and operational noise.

Construction

Distinct noise impacts during construction are anticipated to be minimal to significant depending on the activity occurring and equipment being used. Noise from construction will be temporary, intermittent, limited to daytime hours and localized. Sound levels from grading equipment are not dissimilar from the typical tractors and larger trucks used in agricultural communities during harvest. The noise from construction activities would dissipate with distance and be audible at varying decibels, depending on the distance from the equipment to the receptor.

Major noise producing activities related to installation of the solar arrays are associated with clearing and grading, material delivery, and driving foundation posts. The intermittent noise created by the construction vehicles and equipment used for these activities will be limited by the NAC-1 L_{10} metric. The majority of the construction equipment that could be used on the site, such as grading equipment, cranes, and bulldozers, are anticipated to generate a maximum of 85 dBA.[159] Pile driving of the rack supports, or the helical pile equipment if the applicant decides to use helical piles, will be the most significant source of construction noises. The United States Department of Transportation guidance showed the noise from power hammers to be approximately 101 dBA at 50 feet.[160] Factoring in sound

[156] SPA, p. 46.
[157] Snowmobile Safety and Certification Committee, Inc. (2019). *Snowmobile Safety and Certification Program.* Retrieved from: https://www.snowmobilesafetycertification.org/committee-guides/snowmobile-safety-and-certification-program-procedural-guide-october-2019.pdf
[158] SPA, p. 69, Table 19: Recreational Resources.
[159] SPA, p. 49, Table 12: Construction Equipment Noise Levels.
[160] U.S. Department of Transportation. (2017). *Construction Noise Handbook*. Retrieved from: https://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook00.cfm

dissipation over distance, calculated as a six decibel decrease for every doubling in distance[161], the noise from power hammers would meet the NAC-1 daytime L_{10} metric (65 dBA, Table 12) at 3,200 feet (0.6 miles).

There are 154 residences within 0.5 miles of the project;[162] a table listing the distances of all 154 residences to project components can be found in **Appendix F**.[163] The closest residence to project components (R-048, Figure 27) is approximately 341 feet from the nearest solar array.[164] Residence R-025 is the closest to both the substation and switchyard (1026 feet and 823 feet, respectively) and R-031 is closest to the nearest inverter at 602 feet. Thus, construction noise would likely exceed state noise standards at select times and locations if it is continuous for at least six minutes. Exceedances would be short-term and confined to daytime hours. Even without an exceedance, noise impacts will occur. Rhythmic pounding of foundations posts would be disruptive even if the noise associated with that activity is within state standards. If the applicant elects to install a helical pile based on conditions at the site, the installation will take longer but would be quieter.

Other construction activities, for example, installation of solar panels, are anticipated to have noise impacts similar to general construction equipment (76-85 dBA). A forklift is typically used to place solar panels on the racking system. Construction activities will be sequenced, that is, site grading may occur at one location while posting driving occurs at another location while racking and panel assembly might occur at another location, at the same time. Noise related to grading is estimated to be 85 dBA at 50 feet and noise related to pile driving is estimated to be 84 dBA at 50 feet.[165] Castle Rock Solar anticipates construction will take approximately 14 to 20 months which includes mobilization, construction and installation, and commissioning and testing.[166]

Operation

Noise levels during operation of the project are anticipated to be negligible. The primary source of noise from the solar facility will be from inverters and transformers, typically characterized as a slight hum or buzz, as well as the rotation of the tracking system, although some minor noise may be generated from the short transmission line or from wind blowing through the conductors and structures.

Noise levels are expected to be constant throughout the day and lower during non-daylight hours. The steady sound of facility operation will be limited by the NAC-1 L_{50} metric. Castle Rock Solar conducted sound analyses and found the maximum project generated noise level at residences and other sensitive receptors is estimated to be equivalent to a continuous sound level of 57 dBA during daytime and 37 dBA during nighttime; this is compliant with the MPCA's noise regulations of daytime L_{50} dBA noise standard of 60 dBA and the nighttime standard of 50 dBA. Modeling indicated that the

[161] MPCA. *A Guide to Noise Control in Minnesota.* (2015). https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf.
[162] SPA, Appendix I: Noise Propagation and Modeling Assessment.
[163] EA, Appendix E
[164] SPA, pp. 53-58, Table 15: Proximity of Residences to Solar Project.
[165] SPA, pp. 49, Table 12: Construction Equipment Noise Levels.
[166] SPA, Appendix D: Agricultural Impact Mitigation Plan.

highest estimated daytime noise level was at receptor R-016, and the highest estimated nighttime noise level was at receptor R-025.[167] Thus, daytime operating noise levels experienced at the nearest residences would be similar to that of the noise produced by a washing machine (Figure 29).

Operational noise modeling demonstrates that the project will meet the NAC-1 nighttime L50 dBA noise standard when considering the noise from the substation transformer. The results of the modeling indicates that two receptors (R-024 and R-025) will be within the nighttime 35 dBA noise contour.[168] Factoring in sound dissipation over distance, calculated as a six decibel decrease for every doubling in distance[169], the receptors farther out from the substation would experience less than 35 dBA at nighttime. Thus, the nighttime operational sound levels anticipated at the nearest residences will be similar to the sound levels of a quiet room (Figure 29), and comparable to background noise levels in the area.

Operational noise for individuals using the surrounding recreational resources will also be comparable to the background noise levels in the area. Modeling of daytime operation noise indicates that the southeastern portion of the golf course will experience 45-55 dBA depending on location; this is similar to that of the noise produced by a washing machine (Figure 29). Therefore, operational sound levels will be within NAC-1 compliance levels. It is difficult to predict the impact to snowmobile trail 123 users without knowing the final placement of the re-route; however, effects are anticipated to be similar to that of the golf course due to anticipated proximity to the project. Individuals will be able to enjoy the recreational resources surrounding the project without being disturbed by operational noise from the project.

Noise from routine maintenance activities is anticipated to be negligible to minimal. Noise from the electrical collection system is not expected to be perceptible.

Mitigation

Sound control devices on vehicles and equipment (e.g., mufflers) conducting construction activities during daylight hours, and running vehicles and equipment only when necessary are common ways to mitigate noise impacts.

Section 4.3.7 of the DSP (**Appendix C**) is a standard condition that requires the permittee to comply with noise standards established under Minnesota noise standards as defined under Minnesota Rule, part 7030.010 to 7030.0080, and to limit construction and maintenance activities to daytime hours to the extent practicable.

Section 5.2 of the DSP is a special condition that requires the permittee to provide notice to adjacent residences detailing when major noise-producing construction activities are planned to occur.

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[167] SPA, Appendix I: Noise Propagation and Modeling Assessment.
[168] SPA, Appendix I: Noise Propagation and Modeling Assessment.
[169] MPCA. *A Guide to Noise Control in Minnesota.* (2015). https://www.pca.state.mn.us/sites/default/files/p-gen6-01.pdf.

No additional mitigation is proposed.

4.3.3 Cultural Values

The ROI for cultural values is the project area. Development of the project will change the character of the area, potentially changing residents' sense of place. There are tradeoffs for rural communities between renewable energy projects and retaining the rural character of an area. Construction and operation of the project is not anticipated to impact or alter the work and leisure pursuits of residents in the project area in such a way as to impact the underlying culture of the area. Impacts are anticipated to be long-term, and **minimal to moderate**. Impacts are unavoidable.

Cultural values can be defined as shared community beliefs or attitudes that define what is collectively important to the group. These values provide a framework for individuals and community thought and action. Infrastructure projects believed inconsistent with these values can deteriorate community character. Those found consistent with these values can strengthen it. Projects often invoke varying reactions and can, at times, weaken community unity.

Individual and community-based renewable energy is becoming more valued across the nation. Utility scale renewable projects—generally located far from load centers in rural areas—are also valued, but, at times, opposed by residents. The highly visible, industrial look and feel of these projects can erode the rural feeling that is part of a residents' sense of place.

Dakota County is one of the original nine counties in Minnesota. Originally vegetated with oak prairie savannas, today Dakota County has both a rural and urban character. Dakota County is within the confluence of three of the four major rivers that drain from the state of Minnesota, the Minnesota River along the northern country border, the St. Croix River along on the eastern county border, and the Mississippi River along both the northern and eastern county border. Proximity to these major rivers has greatly influenced the development and history of Dakota County.[170] Accessibility of this confluence made fur trading, lumber, and milling notable drivers of its economy in the past. Suburban growth from Minneapolis and Saint Paul has diversified the present day economy. The area within and surrounding the project is abundant in rivers, wetlands, streams, woods, and farms.

Each year in early-August, Dakota County hosts a fair in Farmington, one mile west of the project, along with other various community events throughout the year hosted by libraries, parks, and other county services. Dakota County has a Comprehensive Plan, which details the goals, objectives, and implementation tools for the county's transportation systems, parks and open spaces, natural resources, and land planning over the next 20 years. The county's plan defines a desired future for Dakota County to guide the work of the county and provide direction for staff. Dakota County strives to be a great place to live, have a healthy environment with quality natural areas, be a successful place for businesses and jobs, and demonstrate excellence in public service.[171]

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[170] Dakota County Historical Society, A Premier County. https://www.dakotahistory.org/firsts.
[171] *Dakota County, Minnesota Comprehensive Plan DC2040.* (2021). https://www.co.dakota.mn.us/Government/Planning/CompPlan/Documents/2040ComprehensivePlanAme

Cultural values in the region can also be informed by ethnic heritage. Residents of Dakota County derive primarily from white or European ancestry, which accounts for the 73.8 percent of the population, followed by 8.4 percent Hispanic of Latino, 7.2 percent Black of African American, 5.1 percent Asian American, 0.2 percent American Indian and Alaska Native, and 0.1 percent Native Hawaiian and Pacific Islander.[172] Overall, the region surrounding the project area has cultural values tied to the heritage of its residents, work and leisure pursuits, such as faming, snowmobiling, and trout fishing, and land use.

Potential Impacts

Solar energy experiences a relatively high degree of acceptance at the socio-political level and greater public favor compared to other kinds of renewable energy.[173] The project contributes to the growth of renewable energy and is likely to strengthen and reinforce this value in the area. The project is not located within areas where regional community events typically occur, so impacts on community events are not anticipated, and construction of the project is not anticipated to alter existing cultural resources. However, the support for renewable energy projects seen in the general public does not necessarily extend to the local level when it comes to project implementation.[174] Social acceptance of renewable energy projects is increasingly recognized as a significant factor to address this "social gap" seen in local communities.[175]

The development of the project will change the character of the area, converting approximately 972 acres of farmland to an energy generating facility. The value residents put on the character of the landscape within which they live is subjective, meaning its relative value depends upon the perception and philosophical or psychological responses unique to individuals. Because of this, construction of the project might—for some residents—change their perception of the area's character thus potentially eroding their sense of place. Even at a small-scale, solar projects can have a major impact on a resident's attachment to place.[176] Larger solar installations are found to evoke stronger emotions in individuals,[177] and residents may feel that a project of this size does not fit the area.[178]

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ndment.pdf#:~:text=DC%202040%20is%20Dakota%20County%E2%80%99s%2010-year%20update%20of,to%20respond%20to%20population%20growth%20and%20change%20.

[172] American Community Survey, 2023.

[173] Wüstenhagen, R., Olsink, M., & Bürer, M.J. (2007). *Social acceptance of renewable energy innovation: An introduction to the concept.* DOI: https://doi.org/10.1016/j.enpol.2006.12.001

[174] Bell, D., Gray, T., & Haggett C. (2007). *The 'Social Gap' in Wind Farm Siting Decisions: Explanations and Policy Responses.* DOI: https://doi.org/10.1080/09644010500175833

[175] Wüstenhagen, R., Olsink, M., & Bürer, M.J. (2007). *Social acceptance of renewable energy innovation: An introduction to the concept.* DOI: https://doi.org/10.1016/j.enpol.2006.12.001

[176] Shyu, C. (2025). *Energy justice-based community acceptance of local-level energy transition to solar photovoltaic energy*. DOI: https://doi.org/10.1016/j.egyr.2024.12.029

[177] Cousse, J. (2021). *Still in love with solar energy? Installation size, affect, and the social acceptance of renewable energy technologies*. DOI: https://doi.org/10.1016/j.rser.2021.111107

[178] Roddis, P., Roelich, K., Tran, K., Carver, S., Dallimer, M., & Ziv, G. (2020). *What shapes community acceptance of large-scale solar farms? A case study of the UK's first 'nationally significant' solar farm*. DOI: https://doi.org/10.1016/j.solener.2020.08.065

Dakota County strives to support development while conserving and protecting the County's productive farmland,[179] Castle Rock Township strives to protect the rural atmosphere of the area and ensure that all land use activities occur in harmony with natural systems,[180] and the city of Farmington strives to preserve its hometown feel through strategic preservation of natural and rural character.[181] The proposed project is immediately adjacent to several residential developments and the city of Farmington. The project's proximity to Farmington and residential developments may heighten its visibility; some residents may see the conversion of the gently rolling agricultural fields along the South Branch Vermillion River to solar arrays as an encroachment on the natural and rural atmosphere of the area. The project is designed to serve the state of Minnesota, but the potential impacts to cultural values will be experienced at the local level. This tension between infrastructure projects and rural character creates real tradeoffs.

MITIGATION

One strategy that can help mitigate the cultural impacts of large-scale renewable energy projects is the development of a benefits agreement. These agreements, formed between the project owner and host community, can be tailored to support priorities unique to the host community. Collective benefit agreements for renewable energy project host communities have been used in various European countries for over a decade,[182] the U.S. Department of Energy formalized the development of benefit agreements for projects awarded funding through the 2021 Bipartisan Infrastructure Law,[183] and renewable energy and clean energy programs issued a certificate for an energy facility by the state of Michigan are required to enter into host community agreements with each affected local unit.[184]

Community investment funds, scholarships, and training programs are all examples of collective benefits that can be included in benefits agreements as means to mitigate the impacts of renewable energy projects. Outside of a formalized community benefits agreement, the creation of partnerships between the project owner and community schools, charities and volunteer associations, religious groups, youth organizations, or other clubs or societies active in the host community provides an

[179] *Dakota County, Minnesota Comprehensive Plan DC2040.* (2021). https://www.co.dakota.mn.us/Government/Planning/CompPlan/Documents/2040ComprehensivePlanAmendment.pdf#:~:text=DC%202040%20is%20Dakota%20County%E2%80%99s%2010-year%20update%20of,to%20respond%20to%20population%20growth%20and%20change%20.

[180] *Castle Rock Township, Comprehensive Plan Executive Summary*. (2018). https://irp.cdn-website.com/f48d6b0b/files/uploaded/2040_Comprehensive_Plan_Castle_Rock_Executive_Summary.pdf

[181] *City of Farmington, Minnesota, 2040 Comprehensive Plan*. (2019). https://www.farmingtonmn.gov/DocumentCenter/View/307/2040-Comprehensive-Plan-PDF?bidId=.

[182] Glasson, J. (2017). *Large Energy Projects and Community Benefits Agreements – Some experience from the UK*. DOI: https://doi.org/10.1016/j.eiar.2017.03.009

[183] Office of Clean Energy Demonstrations. *Guidance for Creating a Community Benefits Plan for the Bipartisan Infrastructure Law Energy Improvement in Rural or Remote Areas Fixed Award Grant Program*. Retrieved from: https://www.environmentalprotectionnetwork.org/wp-content/uploads/2023/08/DE-FOA-0003045_BIL_ERA_Grant_Program_CBP_Guidance.pdf

[184] Michigan Act No. 233, Part 8, Sec. 227.

avenue to mitigate the impacts of renewable energy projects, and demonstrates the project owner's commitment to being a good neighbor in the host community.

There are no conditions in the DSP that directly address mitigation for impacts to cultural values. Section 4.3.23 addresses impacts to cultural properties. No additional mitigation is proposed.

4.3.4 Land Use and Zoning

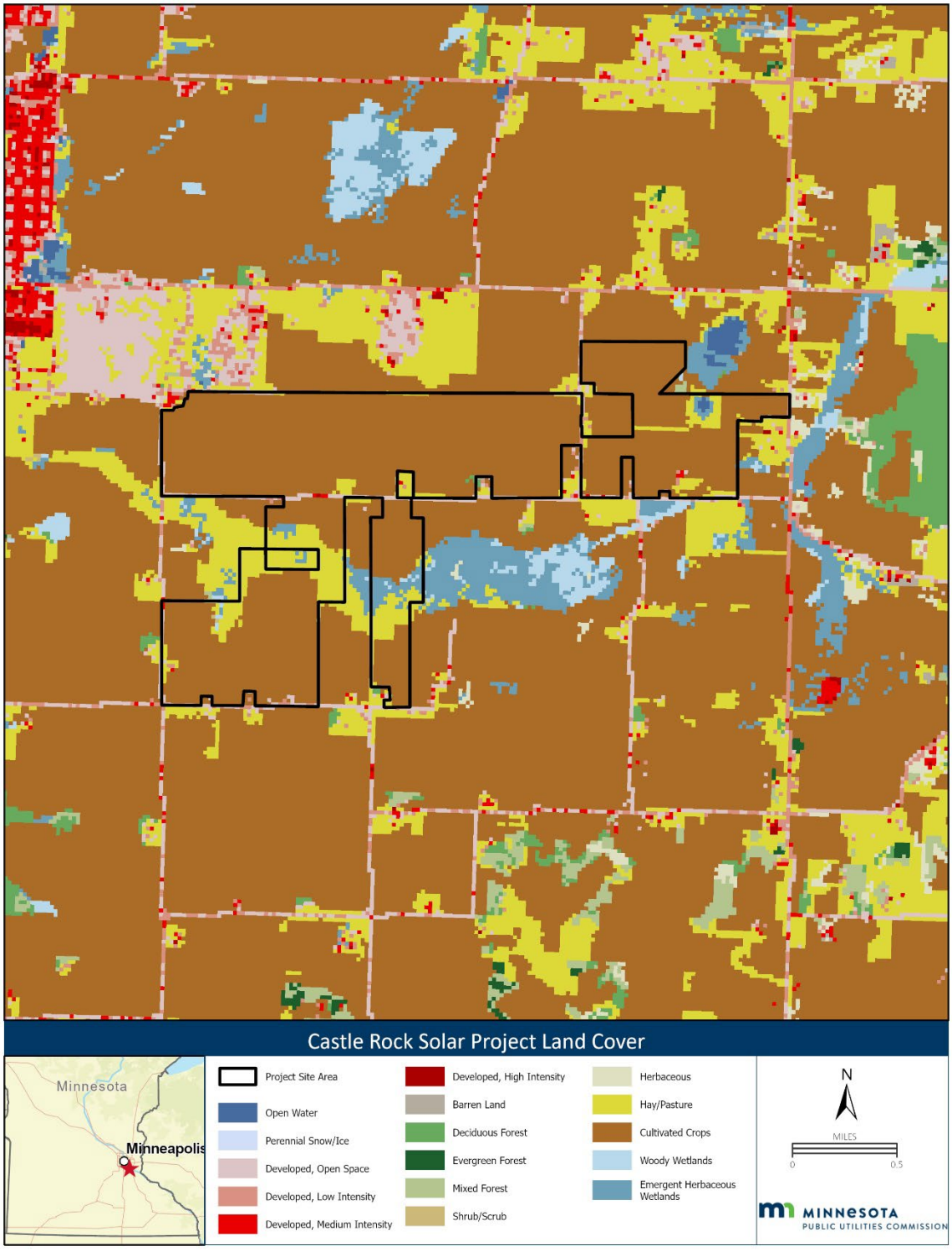
The ROI for land use and zoning is the land control area. The impact intensity level is anticipated to be **moderate** due to the conversion of agricultural land to land used for energy generation. Land use impacts are anticipated to be long-term and localized. Constructing the project will change land use from agricultural to solar energy production for a minimum of 30 years. After the project's useful life, the land control area could be restored to agricultural or other planned land uses by implementing appropriate restoration measures. Impacts can be minimized by using best practices to protect land and water quality.

Land use is the characterization of land based on what can be built on it and how the land is used. Zoning is a regulatory tool used by local governments (cities, counties, and some townships) to guide specific land uses within specific geographic areas. Land cover documents how much of a region is covered by forests, wetlands, impervious surfaces, agriculture, and other land and water types, including wetlands. Construction of solar generating facilities and transmission lines will alter current and future land use and land cover. As shown in Table 14 and Figure 30, the project land cover is dominated by cultivated agriculture, with scattered areas of wetlands and developed areas around farmsteads.

Table 14. Project Land Cover

Category	Land Control Area (Acres)	Percentage
Agricultural Lands		
Cultivated Cropland	1,229.6	85.2
Herbaceous/Hay/Pasture	32.3	2.1
Developed Areas		
Developed, Open Space	44.2	3.1
Developed, Low Intensity	9.9	0.7
Developed, Medium Intensity	1.8	0.1
Wetlands/Open Water		
Emergent Herbaceous Wetlands	123.8	8.6
Open Water	0.2	0.01
Forest		
Deciduous Forest	0.3	0.02
Evergreen Forest	0.2	0.01
Mixed Forest	<0.1	<0.01
Total	**1442.3**	100%

Figure 30. Project Area Land Cover



A site permit from the Commission supersedes local zoning, building, or land use rules.[185] Though zoning and land use rules are superseded, the Commission's site permit decision must be guided, in part, by consideration of impacts to local zoning and land use in accordance with the legislative goal to "minimize human settlement and other land use conflicts."[186] The area of land control is located within Castle Rock Township in Dakota County. The solar facility is zoned as Zone District AG-Agricultural District according to Dakota County zoning ordinance and part of the project location includes shoreland overlay and floodplain overlay district areas.[187]

Table 15 summarizes the performance standards for solar energy farms codified in Section 7.21, B of the Castle Rock Township Zoning Ordinance No. 2013-01[188] and as amended in Ordinance No. 2023-02[189], and related regulations in Dakota County.

Table 15. Castle Rock Township and Dakota County Performance Standards for Solar Farms

Standard	Castle Rock Township Solar Energy Regulations
Location	Limited to: • RR-I Rural Residential District • AG Agriculture District Prohibited within: • Floodplain Overlay District
Power & Communication Lines	Underground, to the extent practicable, otherwise must be approved by Town Board
Minimum Setbacks	• Residential Dwelling Sites: 300 feet • Neighboring Property Lines (without residential dwelling): 50 feet • Neighboring Property Lines (with residential dwelling): 100 feet • Centerlines of Public Roadways: 130 feet
Stormwater Management and Erosion Control	• Stormwater Management Plan required consistent with corresponding watershed requirements (e.g., Vermillion River Watershed "Water Resources Management Ordinance")
Other Standards/Codes	• Maximum 10% of land, to the nearest whole acre, within each section may be used for wholesale solar systems • Maximum height of solar equipment, structures, and accessory appurtenances shall not exceed 15 feet

[185] Minnesota Statutes 216E.10, subd. 1, Edition Year 2023.
[186] Minnesota Statutes 216E.03, subd. 7, Edition Year 2023.
[187] Castle Rock Township- Zoning Map (2012), retrieved from: https://irp.cdn-website.com/f48d6b0b/files/uploaded/CastleRockZoningFinalDecember2012.pdf.
[188] Castle Rock Township Zoning Ordinance No. 2013-01, Section 7.21: Solar Electric Systems, retrieved from: https://irp.cdn-website.com/f48d6b0b/files/uploaded/2021-05-31_ZoningOrdinance_with_Amendments.pdf
[189] Castle Rock Township Zoning Ordinance No. 2023-02, retrieved from: https://irp.cdn-website.com/f48d6b0b/files/uploaded/Ordinance_No._2023-02_Solar_Electric_Systems.pdf

	• Systems shall not be lighted, except for shrouded downcast security lights on major equipment or storage buildings • Systems shall not create or cause unreasonable glare on other property or public roadways • In compliance with any applicable local, state, and federal regulatory standards (e.g., State of Minnesota Uniform Building Code, National Electric Code, etc.)
Standard	**Dakota County Regulations**
Minimum Setbacks	• Follow all standard in County Ordinance No. 50, section 16.01[190]
Stormwater Management and Erosion Control	• Meets the requirements of the MPCA CSP requirements • Altered areas must be stabilized to acceptable erosion control standards as determined by the zoning administrator which are consistent with MPCA Construction Stormwater Manual • Follow all standards in County Ordinance No. 50, section 16.07[191]

The Dakota County Rural Collaborative 2040 Comprehensive Plan sets forth goals for their agricultural districts and environmental features.[192] A summary specific to Castle Rock Township is also available.[193]

Potential Impacts

Development of a solar farm in this area will temporarily change the land use from predominantly agricultural uses to energy generation for the life of the project, at least 30 years. The change of land use will have a minimal to moderate impact on the rural character of the surrounding area, and a minimal impact on the county character. Although the land is being converted from primarily agricultural to be used for energy production, the land use is consistent with other infrastructure in the area such as nearby solar farms.

The project is expected to be compatible with county planning goals, however depending on the final design of the solar array configuration, the project may not meet local zoning ordinances. If Castle Rock Solar chooses a two in-portrait configuration for the solar arrays, panel height would reach 18 feet at full tilt, thus exceeding by three feet, the height limitations in Castle Rock Township's Ordinance No. 2023-02.[194] Castle Rock Solar states that it will apply the structure setback to its

[190] Dakota County Shoreland and Floodplain Management Ordinance No. 50, retrieved from: https://www.co.dakota.mn.us/LawJustice/Ordinances/Documents/CountyOrdinance50.pdf
[191] Dakota County Shoreland and Floodplain Management Ordinance No. 50, retrieved from: https://www.co.dakota.mn.us/LawJustice/Ordinances/Documents/CountyOrdinance50.pdf.
[192] Dakota County Rural Collaborative 2024 Comprehensive Plan. (2019), retrieved from: https://clients.bolton-menk.com/ruralcommunities/wp-content/uploads/sites/16/2020/01/DCC-CompPlanComplete_Final_RED.pdf.
[193] Castle Rock Township Comprehensive Plan Executive Summary, retrieved from: https://irp.cdn-website.com/f48d6b0b/files/uploaded/2040_Comprehensive_Plan_Castle_Rock_Executive_Summary.pdf
[194] Castle Rock Township Zoning Ordinance No. 2023-02, retrieved from: https://irp.cdn-website.com/f48d6b0b/files/uploaded/Ordinance_No._2023-02_Solar_Electric_Systems.pdf

facilities in a manner consistent with Dakota County and Castle Rock Township setback requirements.[195] Castle Rock Solar filed a Preliminary Stormwater Management Plan[196] as part of their application; this plan does not include the additional acreage proposed, so a determination as to whether this part of the project is consistent with local ordinances cannot be made at this time. Castle Rock Solar states that they are updating the plan, and it will be filed once it is completed.[197]

Individual perspective largely determines whether the project aligns with Dakota County's Rural Collaborative 2040 Comprehensive Plan. Individuals might believe the project is compatible with local planning goals because it furthers the county's goals of promoting sustainable options as a method to protect and preserve certain areas. However, the project will remove agricultural land from production, which could be interpreted as being incompatible with the county's goals to preserve agricultural land.

After the project's useful life, the land control area could be restored to agricultural or other planned land uses by implementing appropriate restoration measures. The applicant has indicated that the project will be decommissioned such that agricultural activities can resume once decommissioning has been completed. Thus, any project land temporarily leased from participating landowners may return to furthering the county's goals of preserving the viability of agricultural land once decommissioned.

MITIGATION

The project would convert approximately 972 acres of cultivated cropland to solar energy production. Although the project is subject to oversight by the State of Minnesota under the Minnesota Power Plant Siting Act, Castle Rock Solar will continue to coordinate with Dakota County and Castle Rock Township on other potential permits for the project.

The DSP (**Appendix C**) has several permit conditions related to the preservation and restoration of agricultural land:

- Section 4.3.17 requires the applicant to prepare a vegetation management plan to prevent soil erosion and invest in soil health by establishing a plan to protect soil resources by ensuring perennial cover. The applicant's draft VMP is found in Appendix E of the site permit application.
- Section 4.3.18 requires the applicant to prepare an AIMP that details methods to minimize soil compaction, preserve topsoil, and establish and maintain appropriate vegetation to ensure the project is designed, constructed, operated and ultimately restored in a manner that would preserve soils to allow for the land to be returned to agricultural use. The applicant's draft AIMP is found in Appendix D of the site permit application.

[195] SPA, p. 75.
[196] SPA, Appendix G:Preliminary Stormwater Management Plan.
[197] EA, Appendix D, Question 23.

- Section 9 requires the applicant to prepare a decommissioning plan focused on returning the project site to agricultural use at the end of the project's useful life. The applicant's draft decommissioning plan is found in Appendix H of the site permit application.
- Section 9.2 requires removal of all project-related infrastructure.

Impacts to county zoning can be mitigated by ensuring the project is consistent, to the greatest extent practicable, with Castle Rock Township's zoning ordinance concerning Solar Electric Systems. The applicant states that the project will be consistent with Dakota County and Castle Rock Township zoning ordinances and comprehensive plan for development. If the two in-portrait configuration solar array design is selected, the project would not be consistent with Castle Rock Township's Ordinance No. 2023-02, as the maximum panel height would exceed the height limitations defined in the ordinance.

No additional mitigation is proposed.

4.3.5 Property Values

The ROI for property values is the local vicinity. Impacts to property values within the local vicinity could occur; however, changes to a specific property's value are difficult to determine. Because of this uncertainty, impacts to specific properties in the project vicinity could be **minimal to moderate** and decrease with distance and over time.

Impacts to property values can be measured in three ways: sale price, sales volume, and marketing time. These measures are influenced by a complex interaction of factors. Many of these factors are parcel specific, and can include condition, size, acreage, improvements, and neighborhood characteristics; the proximity to schools, parks, and other amenities; and the presence of existing infrastructure, for example, highways or transmission lines. In addition to property-specific factors, local and national market trends, as well as interest rates, can affect all three measures. The presence of a solar facility becomes one of many interacting factors that could affect a specific property's value.

Because each landowner has a unique relationship and sense of value associated with their property, a landowner's assessment of potential impacts to their property's value is often a deeply personal comparison of the property "before" and "after" a proposed project is constructed. The landowner's judgments, however, do not necessarily influence the market value of a property. Professional property appraisers assess a property's value by looking at the property "after" a project is constructed. Moreover, potential market participants are likely to see the property independent of the changes brought about by a project; therefore, they do not take the "before" and "after" into account the same way a current landowner might. Staff acknowledges this section does not and cannot consider or address the fear and anxiety felt by landowners when facing the potential for negative impacts to their property's value.[198]

[198] This paragraph is based, in part, on the following: Chalmers, James (2019) *High Voltage Transmission Lines and Residential Property Values in New England: What Has Been Learned*. The Appraisal Journal, Chicago, Vol. 87, Iss. 4: 264-277; Public Utilities Commission (May 2025) *Fact Sheet: Understanding Your Rights:*

Electrical generating facilities can impact property values. Often, negative effects result from impacts that extend beyond the project location. Examples include emissions, noise, and visual impacts. Unlike fossil-fueled electric generating facilities, this project would not generate emissions through the energy production process. Potential impacts from operational noise are not anticipated. Aesthetic impacts will occur, but because the project is relatively low in height – as compared to a wind turbine or a smokestack – impacts would be localized and limited in geographic scope.

Large solar facilities exist in Minnesota; however, limited sales information is available. A review of the literature identified one peer-reviewed journal article that addressed impacts to property values based on proximity to utility-scale, PV solar facilities. The Lawrence Berkeley National Lab studied over 1,500 large-scale PV solar facilities in six states (including Minnesota) to determine whether home sale prices were influenced within 0.5 miles (from over 1.8 million home sale transactions).[199] In summary, the study found that effects, "on home sale prices depend on many factors that are not uniform across all solar developments or across all states."

In Minnesota in particular, the study found that homes within 0.5 miles of large-scale PV solar facilities had a 4 percent reduction in home sale prices compared to homes 2-4 miles away. This finding was considered statistically significant. Additionally, only large-scale PV solar facilities developed on previously agricultural land, near homes in rural areas, and larger facilities (roughly 12 acres or more) were found to be linked to adverse home sale price impacts within 0.5 miles. The analysis did not include consideration of site features or site design, for example setbacks or landscaping features, which could play a role in nearby property valuation. Another limitation of the study was the lack of examination of the broader economic impacts or benefits to host communities from large-scale PV solar facilities, such as increased funding to local schools, which might positively impact home sale prices.

Site-specific information should be considered when comparing the project to this study. The project will be over 12 acres on agricultural land in a rural area, making it relevant to the type of development that had statistically significant findings in the study. There are 5 residences (R-008, R-031, R-033, R-036, and R-037) located within the project who are participating landowners. There are an additional 149 residences located on parcels adjacent to or near the project, e.g., in proximity to where physical structures will be constructed. Without taking other factors into consideration, these properties could experience minimal to moderate property value impacts.

Considerations such as setbacks, benefits to the community, economic impact, and vegetative features could influence property values. For instance, project facilities are expected to comply with Castle Rock Township Zoning Ordinance setbacks and applicable Dakota County setbacks. Additionally, many of the potentially affected properties have existing vegetative screening. Castle Rock Solar indicates that they will consult with adjacent landowners on the use of vegetative screening to minimize views of the project. Even with supplemental vegetative screening, the project

Transmission Lines and Your Land, retrieved from: https://puc.eip.mn.gov/sites/default/files/2025-06/Landowner%20rights_factsheet.pdf.

[199] Elmallah, S., Hoen, B., Fujita, K.S., Robson, D., & Brunner, E. (2023). Shedding light on large-scale solar impacts, Retrieved from: https://www.sciencedirect.com/science/article/pii/S0301421523000101 .

infrastructure may be visible from certain vantage points on the property and under certain conditions.

Other studies with smaller sample sizes did not find a consistent negative impact to the sales value of properties near large solar facilities. Chisago County Environmental Services and Zoning found that home sales exceeded assessed value near the 100 MW North Star solar facility at a rate comparable to the general real estate market in the area.[200] Additionally, a study prepared by CohnReznick examined compared sale prices of properties near 10 existing large solar facilities (including the North Star project) with comparable properties, and did not find a consistent negative impact to the sales value of properties near large solar facilities.[201] Similar studies outside of Minnesota found that proximity to a solar farm leads to a depreciation of 1.7 to 5.4 percent in property values.[202,203]

Potential Impacts

Impacts to the value of specific properties within the project vicinity are difficult to determine but could occur. Because of this uncertainty, and considering the information above, impacts to specific properties are anticipated to be minimal to moderate, but are expected to be within 0.5 miles of the project and to decrease with distance from the project and with time.

Based on analysis of other utility-scale solar projects, significant negative impacts to property values in the project vicinity are not anticipated. Aesthetic impacts to property values would be limited to residences and parcels in the project vicinity where the solar panels are easily visible and where adequate vegetative screening is lacking.

Neighbors in proximity to the proposed project did not voice specific concerns as to if the project would impact their property values, however one voiced concerns over the aesthetic impact and lack of screening on their property which is bordered on three sides by the project.[204] Aesthetics can impact property values; the presence of tree cover both on and off the homeowner's property[205] can result in increases to property values. The topic of Aesthetics has its own section in the EA (Section 4.3.1). As such, potential impacts and mitigation related to this topic are addressed in its own section, as opposed to here, with the understanding that mitigating effects may also reduce impacts to property values.

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[200] Kurt Schneider, Environmental Services Director, (October 20, 2017) *Email to Commerce staff*.

[201] Patricia L. McGarr, Andrew R. Lines, Sonia K. Singh. Real Estate Adjacent Property Value Impact Report: Research and Analysis of Existing Solar Facilities, Published Studies, and Market Participant and Assessor, November 2021. Retrieved from: https://www.linncountyiowa.gov/DocumentCenter/View/18016/Real-Estate-Adjacent-Property-Value-Impact-Report-PDF

[202] Gaur, V. & Land, C. Property Value Impacts of Commercial-Scale Solar Energy in Massachusetts and Rhode Island, September 2020. Retrieved from: https://www.uri.edu/news/wp-content/uploads/news/sites/16/2020/09/PropertyValueImpactsOfSolar.pdf

[203] Maddison, D., Ogier, R., & Beltrán, A. The Disamenity Impact of Solar Farms: A Hedonic Analysis, February 2023. Retrieved from: https://le.uwpress.org/content/99/1/1

[204] Oral Comments on the Scope of Environmental Assessment, eDocket ID: 20255-218652-01.

[205] Kovacs, K., West, G., Nowak, D., & Haight, R. (2022). *Tree cover and property values in the United States: A national meta-analysis*. DOI: https://doi.org/10.1016/j.ecolecon.2022.107424

MITIGATION

Impacts to property values can be mitigated by reducing aesthetic impacts and impacts to future land use. Impacts can also be mitigated through individual agreements with neighboring landowners; such as the individual vegetation screening plans developed as part of Section 5.1 of the DSP. As stated in the previous discussion on aesthetic impacts, the specific details of agreements with individual landowners are not within the scope of this EA.

4.3.6 Tourism and Recreation

The ROI for tourism is the local vicinity and the ROI for recreation is also the local vicinity. Potential impacts to recreational opportunities and tourism are anticipated to be **minimal to moderate**. During construction, unavoidable short-term impacts will occur as construction equipment and vehicle traffic will create noise, dust, and visual impacts. These impacts will be intermittent and localized. The re-route of snowmobile trail 123 is a long-term impact from this project. Users of local recreation resources may find their outdoor recreational activities less enjoyable due to aesthetic impacts of the project.

There are three Farmington city parks (Prairie View Park, Prairie Pines Park, and Prairie Waterway Greenway), as well as multi-use paved trails and sidewalks located within one mile of the project. Hampton Woods Wildlife Management Area (WMA) is located 0.75 miles east of the project. Snowmobile trail 123 runs northeast to southwest through the portion of the project located between MN 50 and 230th Street West.[206] The Fountain Valley Golf Course is located 0.1 miles northwest of the project.

In 2023, the leisure and hospitality industry in Dakota County accounted for about $1,291,416,446 in gross sales, and 18,785 private sector jobs.[207] Recreation and tourism in the area are largely related to activities including hiking, hunting, fishing, wildlife viewing, and snowmobiling. Activities in the area are associated with the Hampton Woods WMA, golf course, city trails, and the snowmobile trail that runs through the project.

Impacts to tourism and recreation can be direct or indirect. Direct impacts are impacts that directly impede the use of a recreational resource, for example, closing of a trail to facilitate project construction. Indirect impacts reduce the enjoyment of a recreational resources but do not prevent use, for example, aesthetic impacts due to the visibility of construction activity from a scenic overlook.

Snowmobile trail 123 directly intersects the project. The trail is maintained by the Dakota Trails Snowmobile Association and local snowmobile clubs,[208] and the applicant states that they will work

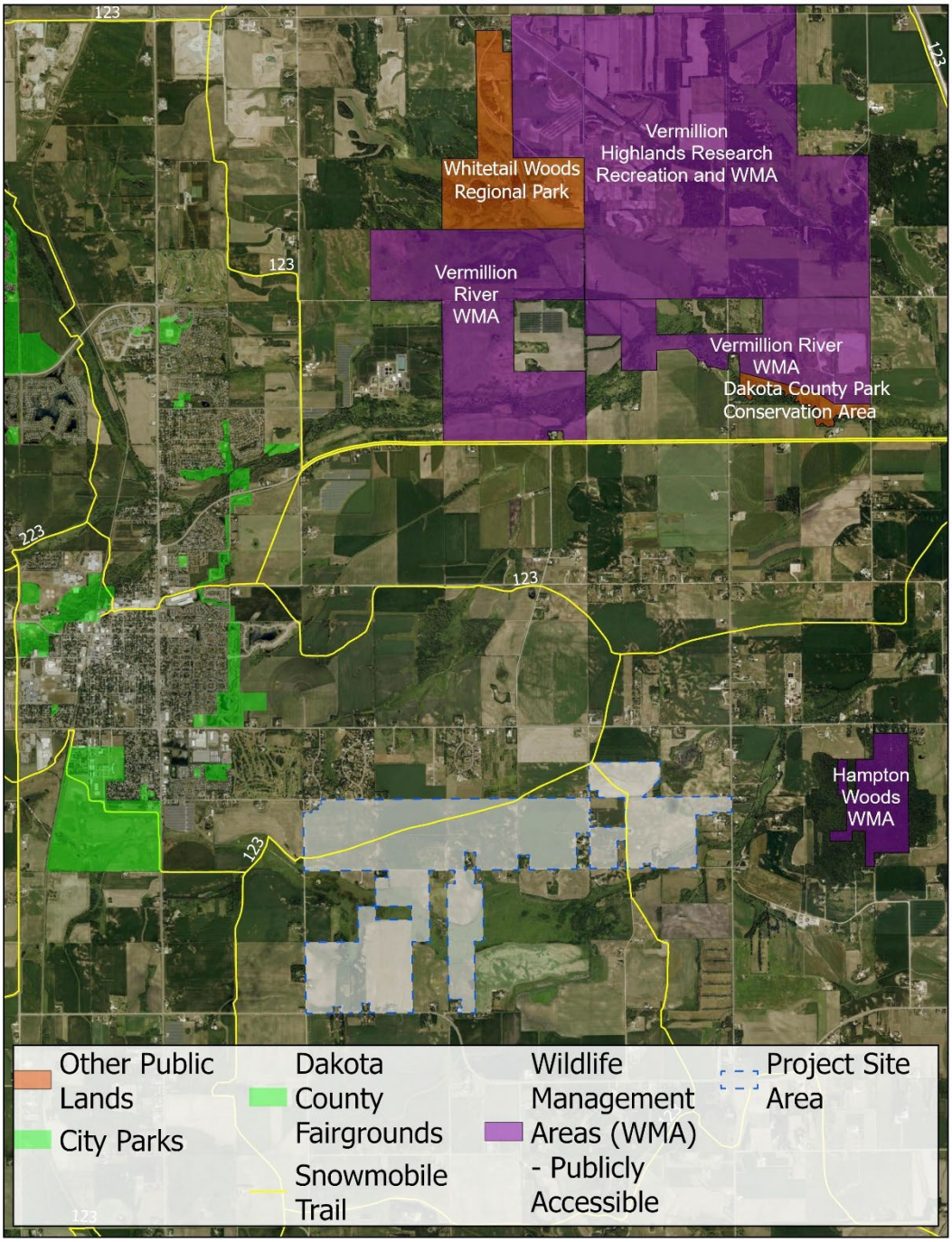
[206] Minnesota Department of Natural Resources, *Southeast Snowmobile Quad Map*, retrieved from: https://gdrs.dnr.state.mn.us/gdrs/apps/pub/us_mn_state_dnr/mndnr_geopdf_download/Snowmobile_Trails/SE%20Snowmobile%20Quad%20Map.pdf

[207] Explore Minnesota (n.d.) *2023 Leisure & Hospitality Industry Data*, retrieved from: https://mn.gov/tourism-industry/assets/2023%20MN%20L%26H%20Data_tcm1135-665060.pdf

[208] Dakota Trails Snowmobile Association webpage, retrieved from: https://www.dakotatrails.org/

with the local groups to reroute the snowmobile trail outside of the proposed fencing.[209] Figure 31 shows the location of recreational opportunities within the project area.

Figure 31. Project Area Recreation and Tourism



[209] SPA, p. 70.

Potential Impacts

Impacts to tourism and recreation are anticipated to be minimal to moderate. During the construction phase of the project, there will be short-term increases in traffic and noise that could potentially impact recreational activities near the project area. However, these impacts will be temporary.

Impacts to the tourism economy are discussed individually in Section 4.5.2 (Tourism); tourism in the local vicinity is driven by recreation resources and community events. Impacts to tourism are expected to be minimal as the project is not anticipated to cause a decline in tourism to the local area.

Long-term impacts to recreational activities include the reroute of snowmobile trail 123. This trail is managed and maintained by the Dakota Trails Snowmobile Association and nearby snowmobile clubs; it is used by the clubs and the public. No comments were received by members of these clubs, however a nearby landowner commented to inquire as to how the snowmobile trail would be impacted by the project.[210] Being that the project proposes re-routing the trail, no long-term impacts to access are expected. In the short-term, access may be restricted due to re-routing efforts.

Additional long-term impacts related to aesthetics may be felt by individuals engaging in recreational activities at the Hampton Woods WMA and golf course, and users of the snowmobile trail. The relatively flat terrain and general lack of vegetative screening makes it likely that facility components will be visible in certain areas along the snowmobile trail and certain locations in the golf course. The golf course does have mature vegetation screening to buffer views of the project, however there are still areas in the southern portion of the golf course that will be affected. The Fountain Valley Golf Club is the subject of a current rezoning effort to commercial industrial for use as a data center.[211] If this development occurs, this recreation factor would no longer exist. Due to the distance between the Hampton Woods WMA and the project (0.75 miles), no aesthetic impacts are expected as it is unlikely facility components will be visible to recreators at the WMA. Aesthetic impacts of the project are analyzed in Section 4.3.1 (Aesthetics).

While the change in viewshed will not directly impact an individual's ability to engage in a recreational activity, viewers with high sensitivity may find outdoor recreational activities less enjoyable if the natural viewshed is disrupted by solar facility components.

Mitigation

The project will not disturb or impede residents from engaging in the surrounding recreational opportunities in the long term. However, the lands surrounding the project are an important recreational resource for the community, and residents have been recreating in the area for generations. While the change in the viewshed surrounding these recreational resources will not prevent residents from utilizing them, some residents may feel that the presence of the project diminishes the recreational value of said resources.

[210] Oral Comments on the Scope of Environmental Assessment, eDocket ID: 20255-218652-01.
[211] The City of Farmington webpage for the Farmington Technology Park Project, retrieved from: https://www.farmingtonmn.gov/473/Data-Center-Farmington-Technology-Park.

Section 5.3 of the DSP is a special condition that requires the permittee to work with the local snowmobile association and associated clubs responsible for maintaining snowmobile trail 123 to identify alternative routes and interconnections to trails in the area and develop a plan for rerouting the portion of snowmobile trail 123 that falls within the project fence. The permittee will be responsible for sponsoring the reroute efforts.

4.3.7 Transportation and Public Services

The ROI for transportation and public services is the project area. Potential impacts to the electrical grid and roads are anticipated to be short-term, intermittent, and localized during construction. There is potential for moderate to significant impacts to wells and pipelines, but impacts can be mitigated with appropriate planning and site design. Overall, construction-related impacts are expected to be **minimal**, and are associated with possible traffic delays. During operation, negligible traffic increases would occur for maintenance. Impacts are unavoidable but can be minimized.

Public services are services provided by a governmental entity or by a regulated private entity to provide for public health, safety, and welfare.

Water and Wastewater

Most residents in the surrounding rural area have private septic systems and domestic wells. The Minnesota Well Index (MWI) identified four wells within the land control area.[212] Dakota County records identified four additional wells within the land control area that were not found in the MWI, which is missing many of the pre-code wells (Table 16, Figure 32).[213] It is possible there are more wells that do not have records in the MWI within the land control area. The topic of Groundwater has its own section in the EA (Section 4.7.2). As such, potential impacts and mitigation related to groundwater within wells, are addressed in its own section, while here the discussion centers on wells as a public service.

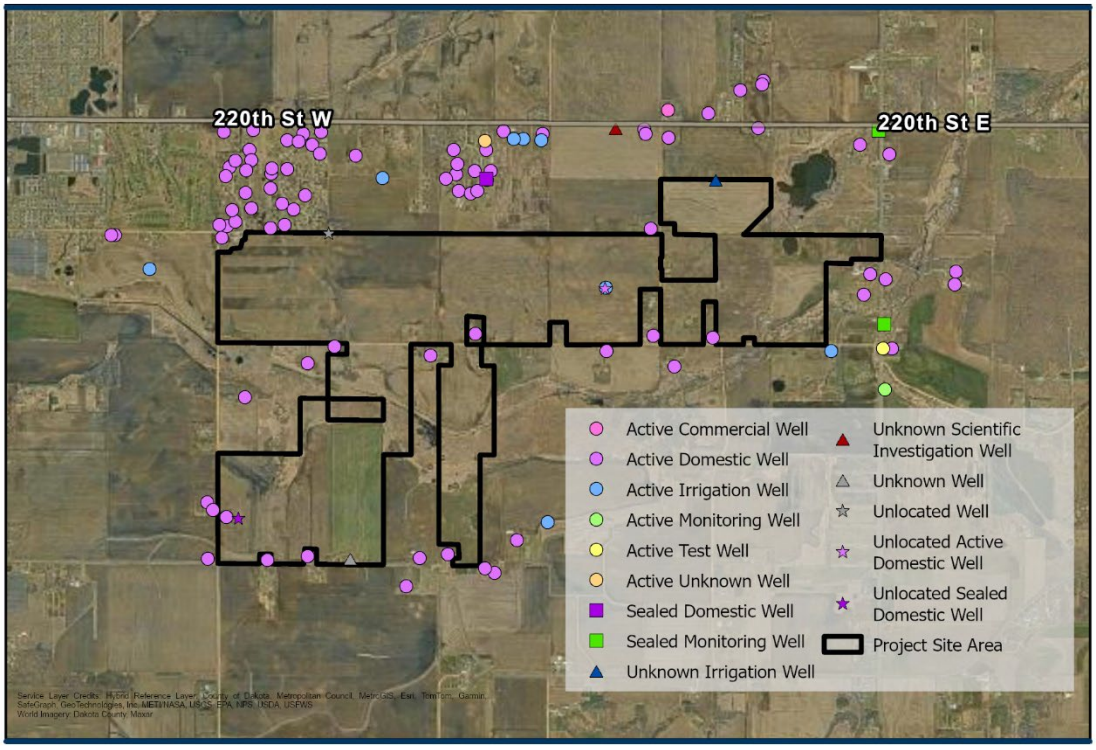
Table 16. Wells within the Land Control Area

Well ID	Use	Drill Date	Status	Depth (ft)
427134	Domestic	12/2/1996	Active	120
243775	Irrigation	6/1/1976	Unknown	190
761673	Irrigation	1/21/2010	Active	240
634974	Domestic	12/16/1999	Active	120
N/A	Domestic	Unknown	Unlocated - Sealed	57
N/A	Domestic	Unknown	Unlocated - Active	Unknown
N/A	Unknown	Unknown	Unlocated	Unknown
N/A	Unknown	Unknown	Unknown	Unknown

[212] Minnesota Department of Health. *Minnesota Well Index.* [Online] [Cited: August 25, 2025] Retrieved from: https://mnwellindex.web.health.state.mn.us/

[213] Dakota County. *Dakota County GIS*. [Online] [Cited: August 25, 2025] Retrieved from: https://gis.co.dakota.mn.us/dcgis/.

Figure 32. Wells within 0.5 Miles of the Project



Electric Utilities

The primary electric providers in the project area are Xcel Energy and Dakota Electric Association.[214] Xcel Energy owns the existing Chub Lake to Hampton Corners 345 kV transmission line running east-west through the project before turning northeast (Figure 22). In addition to the high voltage transmission line, there are lower voltage electric distribution lines throughout the project area.

Pipelines

There are two natural gas or hazardous liquid pipelines within the land control area. Flint Hills Resources' crude oil pipeline runs east-west along 230th Street before turning northeast to Annettee Avenue. Magellan Pipeline Company's low-vapor-pressure liquid pipeline runs north-south on the east side of the project (Figure 22).[215]

Roads

[214] Minnesota Public Utilities Commission. *Electric Utility Services Areas*. [Online] [Cited: August 25, 2025] Retrieved from: https://minnesota.maps.arcgis.com/apps/webappviewer/index.html?id=95ae13000e0b4d53a793423df1176514/.

[215] National Pipeline Mapping System. *Public Viewer*. [Online] [Cited: August 25, 2025] Retrieved from: https://pvnpms.phmsa.dot.gov/PublicViewer/

The major roadways adjacent to or bisecting the project are CR 78, which runs east-west along the southern edge of the project, and CR 79, which runs north-south along the eastern edge of the project. MN 50 runs east-west directly north of the project, but is not adjacent to the project boundary.

The remaining roads adjacent to or bisecting the project are all township roads, three running east-west and two running north-south. The east-west township roads adjacent to and bisecting the project are 225th Street West, in the northeastern section of the project, 230th Street East/West, in the center of the project, and 240th Street West, in the southern section of the project. The north-south township roads adjacent to or bisecting the project are Annette Avenue, in the eastern section of the project, and Biscayne Avenue West, along the western edge of the project. Table 17 summarizes the Average Annual Daily Traffic (AADT) counts for county and state roads nearby, within, or adjacent to the project.[216] Traffic counts are not available for township roads. Castle Rock Solar plans to access the project from 230th Street West, 230th Street East, Biscayne Avenue, 240th Street West, CR 78, and CR 79.[217]

Table 17. Average Annual Daily Traffic Nearby, Within, or Adjacent to the Project Area

Roadway	Year	AADT Traffic Volume Total
MN 50	2024	3777
CR 78	2018	140
CR 79	2024	647

Railroads

There are no railroads located within the land control area. A Canadian Pacific Railway owned line, operated by Union Pacific Railroad Company, runs north-south through the city of Farmington and the surrounding area, 1.75 miles west of the project's western boundary.[218]

Airports

There are no Federal Aviation Administration (FAA) registered airports located in the land control area. The nearest FAA-registered airport is the Lucht Field Airport (MN46), a privately owned airport located 0.02 miles east of the project boundary. The Lucht Field Airport has one turfgrass runway

[216] Minnesota Department of Transportation. *Traffic Mapping Application*. [Online] [Cited: August 25, 2025] Retrieved from: https://mndot.maps.arcgis.com/apps/webappviewer/index.html?id=7b3be07daed84e7fa170a91059ce63bb

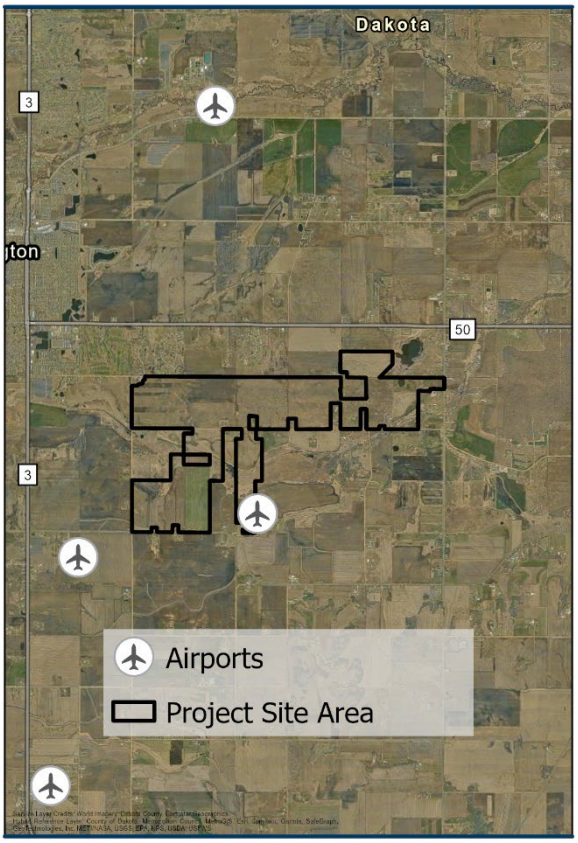
[217] EA, Appendix D, Question 12.

[218] Minnesota Department of Transportation. *Rail Viewer Application (MnRail)*. [Online] [Cited: August 26, 2025] Retrieved from: https://www.arcgis.com/apps/webappviewer/index.html?id=5640f575a86148039704660c29126f24&extent=-11690507.5359%2C5234420.4958%2C-9081864.6346%2C6507555.6389%2C102100

that is approximately 2,006 feet long. The Lucht Field Airport is owned by one of the participating landowners. Castle Rock Solar confirmed with the landowner that the private airstrip has not been used in 11 years, and the landowner has no intention of restoring the airstrip.[219] Plane activity is not expected on the Lucht Field Airport.

There is one additional FAA-registered airport located in the project area. The Nielsen's Airport (MY97) is a privately owned airport located 0.57 miles southwest of the project boundary. The Nielsen's Airport has one turfgrass runway that is approximately 2000 feet long. There are two additional FAA-registered airports within 5 miles of the project. The Jennrich Field Airport is a privately owned airport located 2.57 miles southwest of the project boundary. The Jenrich Field Airport has one turfgrass runway that is approximately 2500 feet long. The Hall Airport is a privately owned airport located 2.61 miles north of the project boundary. The Hall Airport has one turfgrass runway that is approximately 2600 feet long. The closest public airport, Airlake Airport, is located in near the city of Lakeville, approximately 5.52 miles west of the project. Figure 33 shows FAA-registered airports within 5 miles of the project.[220,221]

Figure 33. Airports within 5 Miles of Project



In order to assure safety, both the FAA and MnDOT Office of Aeronautics have established guidelines for the location of structures near airports. The FAA has height restrictions for development near public airports and guidelines for placement of buildings and other structures near high frequency omnidirectional range navigation systems. MnDOT has zoning areas around public airports that restrict the area where buildings and other structures can be placed.

Housing

There are around four thousand vacant housing units in Dakota County, but available housing in proximity to the project is more limited. The city of Farmington, which is the closest location to the

[219] Castle Rock Solar LLC, Completeness Reply Comments, January 21, 2025, eDocket No. 20252-215671-01.
[220] GlobalAir. *Airports in Minnesota.* [Online] [Cited: August 26, 2025] Retrieved from: https://www.globalair.com/airport/airports_in_minnesota.aspx
[221] Johnson, L., Bartsch, W., Hudak, G., Davenport, M., Johnson, K., Nixon, K., Reed, J., and Atlas Team. 2002. Minnesota Natural Resource Atlas: Online mapping tools and data for natural resource planning, management, and research in Minnesota. Natural Resources Research Institute, University of Minnesota Duluth.

proposed project, has 246 available housing units, and Castle Rock Township has only 27 available housing units (Table 18).

Table 18. Housing Characteristics*

Area	Total Housing Units	Total Occupied Housing Units	Total Vacant Housing Units
Minnesota	2.574,932	2,344,432	230,500
Dakota County	181,431	176,865	4,566
Castle Rock Township	529	522	27
City of Farmington	8,475	8,229	246

* U.S. Census Bureau, https://data.census.gov/

POTENTIAL IMPACTS

Large energy projects can impact public services, such as buried utilities or roads. These impacts are usually temporary, for example, road congestion associated with material deliveries. Impacts can be long-term if they change the area in a way that precludes or limits public services.

Water and Wastewater

Wells within the land control area could experience direct or indirect impacts during construction. Direct impacts to wells could occur if construction activities, such as excavation or pile driving, physically damage well structures, resulting in impaired well function. Indirect impacts to wells could occur if construction activities compact soil or fracture bedrock, redirecting water away from a well, or if dewatering lowers the water table, reducing the amount of water available in the well. In addition, increased sedimentation in stormwater runoff from vehicle movement or excavation could clog wells and reduce flow. A single domestic-sized water well may be required in the O&M building to provide potable water for drinking and sanitary services for the full time O&M manager and the solar technicians.

Roads

During construction, workers and trucks delivering construction material and equipment will use the existing state, county, and township road system to access the project. Traffic during construction is estimated to be approximately 150 employee vehicles employee vehicles on site per day during active construction (14-20 months). Approximately 10 truck trips/per day will be used during the pile, racking, and panel equipment delivery period.[222]

Construction traffic will be perceptible to area residents, particularly those residing within and around the city of Farmington and the nearby residential developments, as the traffic volume on the surrounding county and township roads is relatively low. However, because the average daily traffic within the area is well below the design capacity of a rural two-lane highway,[223] this increased traffic

[222] EA, Appendix D, Question 18.

[223] Polus, Abishai, Craus, Joseph and Livneh, Moshe. *Flow and Capacity Characteristics on Two-Lane Rural Highways*, retrieved from: onlinepubs.trb.org/Onlinepubs/trr/1991/1320/1320-016.pdf

is not expected to affect traffic function. Slow-moving construction vehicles may also cause delays on smaller roads, similar to the impact of farm equipment during planting or harvest. These delays should be minimal for the relatively short construction delivery period. Castle Rock Solar has committed to coordinating with Dakota County and Castle Rock Township to develop a road use agreement that addresses road use during construction.[224]

Once construction is complete, traffic impacts will be negligible. During the operations phase a small number of trucks and commuter vehicles will on-site daily, driven by the crew who will monitor and maintain the facilities.

Railroads

No impacts to railroads are anticipated as there are no railroads within the land control area.

Electric Utilities

No long-term impacts to electric utilities will occur because of the project. Xcel Energy's Chub Lake to Hampton Corners 345 kV line would need to be shut down so the project interconnection can be established. Local electric customers served by the Chub Lake to Hampton Corners line could experience temporary outages during this time. Five of the proposed access roads with cross the Chub Lake to Hampton Corners 345 kV line; Castle Rock Solar will coordinate the access road crossings with Xcel Energy.

Pipelines

Pipelines within the land control area could be directly damaged or struck by construction vehicles or equipment during excavation or foundation installation. Direct contact with a pipeline can affect the pipeline's integrity or the protective corrosion coating. If the contact is strong enough, damaged pipelines may rupture, resulting in a hazardous liquid spill or gas leak that threatens public safety and/or environmental health. Heavy, slow-moving construction vehicles or equipment driving over buried pipelines can damage the integrity of the pipe over time, leading to weakness and corrosion and increasing the risk of a rupture or leak.

Air Safety

Castle Rock Solar used the FAA's Notice Criteria Tool to determine if further aeronautical study or FAA filing is needed. A crane height of 180 feet, the maximum height required for a crane to set the main power transformer at the substation, was used for the entire land control area. The tool generated a "no-hazard" determination for the project, except for one topographic high point in the southwest area of the project. The tool generated a "no-hazard" determination for the southwest area of the project with a height of 125 feet. Castle Rock Solar submitted locations within the two additional parcels to the FAA's Notice Criteria Tool for review using the same 180-foot crane height; these locations are still under review. Castle Rock Solar anticipates the additional locations will have similar results as the initial filing, as the additional locations have similar topography and equipment

[224] SPA, p. 78.

height to the previously surveyed locations. Castle Rock Solar will provide the results of the FAA's Notice Criteria Tool review of the additional locations once they are received.[225]

Housing

The project will bring an influx of temporary workers to the area during the construction phase. These temporary workers will require housing for the duration of the construction phase. There is limited available housing in the project area; if vacant housing units are utilized for temporary workers, this may lead to a local housing shortage. Individuals looking to move to the area may find limited options for available housing.

MITIGATION

Castle Rock Solar indicates that permanent impacts to public utilities are not anticipated, and underground utilities will be marked prior to construction start.

Water and Wastewater

To protect wells within the solar array area, Castle Rock Solar will either mark the well with flagging and establish a fenced, five-foot protective buffer around the well or fully decommission the well. The wells within the land control area (Table 16) are deep and are likely screened within a deeper aquifer then where pile depths would reach. Pile embedment depths will be evaluated following completion of the geotechnical engineering investigation.[226] Wells found onsite that will not be used must be sealed according to Minnesota Rule 1031.301.[227]

A well construction permit from the Minnesota Department of Health (MDH) would be required if a well is installed at the O&M building. If a domestic water well is needed, Castle Rock Solar may uncap the wells within the land control areas or procure a well construction permit from the MDH.

Section 5.4 of the DSP is a special condition that requires the permittee to develop and implement a standard well protection plan for any wells within the site that will continue to be used during construction. The permittee must file the standard well protection plan at least 14 days prior to the pre-construction meeting. The permittee will be required to file notice when a well protection plan is implemented for an individual well. The individual notice should include information on how project landscaping will ensure that stormwater will not flow directly to the well.

Electric Utilities

Section 4.3.5 of the DSP (**Appendix C**) is a standard permit condition that requires the permittee to minimize disruptions to public utilities.

Prior to the temporary shutdown of the Chub Lake to Hampton Corners 345 kV line to establish the interconnection to the solar facility, Xcel Energy would coordinate with utilities and landowners and communicate the timing and duration of service interruptions with their customers.

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[225] EA, Appendix D, Question 38.
[226] EA, Appendix D, Question 36.
[227] Minnesota Rule 1031.301.

Impacts to electrical infrastructure that cross the project can be mitigated by appropriate coordination with the owners of the existing infrastructure and following industry best practices. Castle Rock Solar will coordinate the access road crossings of the Chub Lake to Hampton Corners 345 kV line with Xcel Energy.

Castle Rock Solar will coordinate with Gopher State One Call to identify the location of underground utilities during engineering surveys and marking the underground utility locations prior to construction. Additionally, Castle Rock Solar indicates they will conduct an American Land Title Association Survey to identify the locations of any underground utilities within the project.[228] If a utility is identified and structural conflicts cannot be avoided, Castle Rock Solar will coordinate with the affected utility to find a solution.

Roads

Changes or additions to driveways from county roads will require coordination with local authorities and permits from Dakota County. Castle Rock Solar will post signage on local roads during construction to notify the general public about construction vehicles entering and existing the roadway and the presence of construction workers. Appropriate approvals will be obtained prior to equipment deliveries for overweight or oversized loads, as necessary.[229] No changes to existing roadways are anticipated. No impacts to roads are anticipated during the operation; negligible traffic increases would occur for maintenance.

Section 4.3.22 of the DSP requires permittees to inform road authorities of roads that will be used during construction and acquire necessary permits and approvals for oversize and overweight loads. Permitted fencing and vegetative screening cannot interfere with road maintenance activities, and the least number of access roads shall be constructed.

In addition to permit requirements for driveway access and the conditions of the draft site permit, the following practices can mitigate potential impacts:

- Pilot vehicles can accompany movement of heavy equipment.
- Deliveries can be timed to avoid traffic congestion and dangerous situations on the roadway.
- Traffic control barriers and warning devices can be used as necessary.
- Photographs can be taken prior to construction to identify pre-existing conditions. Permittees would be required to repair any damaged roads to preconstruction conditions.

Section 5.5 of the DSP is a special condition that requires the permittee to coordinate with Dakota County and Castle Rock Township to develop a road use agreement that addresses road use during construction. The agreement should consider school bus routing, school and commuter traffic, and

[228] SPA, p. 71.
[229] SPA, pp. 5-8, Table 3: Potential Permits/Approvals.

traffic during the Dakota County Fair, along with any other relevant traffic considerations, based on the timing and duration of construction.

Pipelines

Castle Rock Solar will contact the owner/operator of each pipeline within the land control area and notify them of the project and timing of construction, should they wish to send a representative to supervise work near the pipeline. Castle Rock Solar will obtain all necessary license agreements from the owner/operator of each pipeline to cross the pipelines. BMPs required by pipeline owners/operators, such as establishing a buffer area around the pipeline where heavy equipment is not permitted, using manual excavation techniques, use of a crane, or use of equipment mats to distribute vehicle weight will be followed. Heavy equipment will cross pipelines at a slow speed in a perpendicular direction. An experienced spotter may be used to observe work and guide the equipment operator when heavy equipment is used near buried lines.

No above ground facilities will be located within the easement of either pipeline. Castle Rock Solar will coordinate with each pipeline owner/operator to establish minimum cover requirements for access roads and minimum separation requirements for collection line cable where they cross the pipelines.

In the event that a pipeline is damaged or struck, Castle Rock Solar will cease all work immediately, secure the area, call 911 from a safe location, and notify the pipeline operator.[230]

Section 5.6 of the DSP is a special condition requiring the permittee to coordinate with Flint Hills Resources and Magellan Pipeline Company to determine the location of each existing pipeline within the land control area. The permittee will coordinate with Flint Hills Resources and Magellan Pipeline Company to develop a pipeline protection plan for each pipeline within the site that details how impacts to each pipeline will be avoided. The pipeline protection plans should include crossing plans, minimum cover requirements for access roads, minimum separation requirements for collection line cable crossings, and the BMPs that will be implemented during construction. The permittee must file each pipeline protection plan at least 14 days prior to the pre-construction meeting.

Section 8.12 requires permittees file an *Emergency Response Plan* with the Commission and local first responders prior to operation. The plan requirements have been amended to include specific training and response plans for impacts related to pipeline strike or damage events.

Railroads

No active railroads are within the project area; therefore, no mitigation is required.

Air Safety

[230] EA, Appendix D, Question 37.

Identification of height-restricted areas using FAA's Notice Criteria Tool for review is still in progress. Castle Rock Solar will comply with FAA requirements regarding the maximum height of construction equipment within the site. No additional mitigation is proposed.

Housing

Castle Rock Solar is aware of the limited housing availability in the project area. They have indicated that temporary construction workers will likely be housed in nearby hotels and vacant housing in the Dakota County and/or Scott County, rather than local vacant housing units. This will maintain housing availability for other individuals who may relocate to the area. No impacts to local housing availability are anticipated, therefore no mitigation is required.[231]

4.3.8 Socioeconomics

The ROI for socioeconomics is the region. The impact intensity level is anticipated to be **minimal to significant** and positive. Effects associated with construction will, overall, be short-term and minimal. Significant positive effects may occur for individuals. Impacts from operation will be long-term and significant. Adverse impacts are not anticipated.

Dakota County and the city of Farmington are growing faster than Minnesota as a whole; between 2010 and 2020, the population in Dakota County increased by 13.1 percent and the population in the city of Farmington increased by 12.1 percent, compared to a growth of 7.6 percent for Minnesota overall. From 2010 to 2020 the population of Castle Rock Township decreased by 0.6 percent. Dakota County has a higher minority population compared to the State, while Castle Rock Township and the city of Farmington have lower minority populations compared to the State. Additionally, Dakota County, Castle Rock Township, and the city of Farmington have notably higher median household incomes compared to the State (Table 19).

Dakota County is part of the Minnesota Department of Economic Development Region 11, which is located in the Twin Cities Planning Region. In 2023, the industries with the largest employment in Dakota County were educational services, healthcare, and social assistance (22.5 percent), professional, scientific, management, administrative, and waste management services (12.7 percent) and retail trade (11.1 percent).[232] In 2024, Dakota County had a marginally lower unemployment rate (2.5 percent) than the state average (2.8 percent). The county had a higher labor force participation rate (71.7 percent) than Minnesota as a whole (68.5 percent) and is projected to see a labor force increase from 2025 to 2035.[233]

[231] SPA, p. 67.
[232] American Community Survey, 2023.
[233] Minnesota Department of Economic Employment and Development. *Economic Development Region Profile, Dakota County 2024 Regional Profile*. (2024), https://mn.gov/deed/assets/052725_dakota_tcm1045-407440.pdf

Table 19. Population Characteristics

Area	Total Population				Population Characteristics		
	2010 Census*	2020 Census*	% Change 2010 - 2020	2024 Estimate **	% Minority‡	Median Household Income ($)º	% Below Poverty Levelº
Minnesota	5,303,925	5,706,494	+7.6	5,842,388	23.3º	87,556	9.2
Dakota County	389,078	439,882	+13.1	454,301	26.2º	105,212	5.6
Castle Rock Township	1,342	1,350	+0.6	1,365	5.2º	107,708	20
City of Farmington	21,086	23,632	+12.1	24,361	17.6º	118,556	3.8

* U.S. Census Bureau, https://data.census.gov/

** 2024, Minnesota State Demographic Center, Population Data, Our Estimates, https://mn.gov/admin/demography/data-by-topic/population-data/our-estimates/

º 2023 American Community Survey 5-year estimates

‡ Minority population includes all persons who do not self-identify as white alone.

Potential Impacts

The impact intensity level is anticipated to be positive. Potential impacts associated with construction will be positive, but minimal and short-term. Significant positive effects might occur for individuals. Impacts from operation will be long-term, positive, and moderate. The project will not disrupt local communities or businesses and does not disproportionately impact low-income or minority populations (see discussion of environmental justice in Section 4.3.9). Adverse impacts are not anticipated.

Construction of the project is likely to result in increased expenditures for lodging, food and fuel, transportation, and general supplies at local businesses during construction. Construction of the project will create local job opportunities for various trade professionals and will also generate and circulate income throughout the community by investing in local business expenditures as well as state and local taxes.

Employment and Wages

The applicant anticipates supporting 200-375 temporary construction and installation jobs for this project.[234] Castle Rock Solar will follow the prevailing wage and apprenticeship rules in place under the United States Inflation Reduction Act, a federal public law signed in 2022.[235] The Inflation Reduction Act offers enhanced tax benefits for a range of clean energy projects. Taxpayers that wish to take advantage of an enhanced clean energy tax benefits must ensure that all laborers and mechanics are paid the applicable prevailing wage, including fringe benefits, for all hours performing

[234] EA, Appendix D, Question 19.
[235] SPA, p. 67.

construction or repair, and must employ apprentices from registered programs for a certain number of hours.[236]

The applicant anticipates the project will require 200-375 laborers during the construction and installation phases. Long-term personnel during the operations phase include one fulltime O&M manager and two to six solar technicians. Castle Rock Solar indicates that the request for proposal process will include a preference for construction contractor and supplier bids that utilize local, union construction employees.

To the greatest extent feasible, Castle Rock Solar will select a contractor that will consider local craft workers, local subcontractors, and local vendors during the construction phase, as this will maximize local economic benefits. Castle Rock Solar notes that it may be necessary to import specialized labor from non-local areas in Minnesota or other states, as the short duration of the construction phase precludes special training of local labor. Job opportunities created during the construction phase include general skilled and specialized labor positions, equipment operators, and licensed electricians. Long-term positions during the operations and maintenance phase include skilled labor to operate and maintain the project, snow plowing, and access road and landscape maintenance.[237]

Figure 34. Project "Local Worker" Radius

Minnesota's Renewable Energy Objectives[238] and Renewable Energy Initiatives[239] establish several Commission priorities relating to renewable energy project construction including:

- Creation of jobs that support Minnesota families
- Employing local workers for project construction
- Recognition of the rights of workers to organize and unionize

The location of the proposed project gives Castle Rock Solar the potential to meet Commission priorities by providing significant socioeconomic benefits to local, union construction workers. "Local workers" are defined as Minnesota residents and/or permanent residents who live within 150 miles of a proposed energy facility.[240] Figure 34 presents a 150 mile "local worker" radius from the proposed

[236] U.S. Department of Labor, *Prevailing Wage and the Inflation Reduction Act*. https://www.dol.gov/agencies/whd/IRA
[237] SPA, p. 67.
[238] Minnesota Statute 216B.1691, Subd. 9.
[239] Minnesota Statute 216B.2422.
[240] Minnesota Statute 216B.2422, Subd. 1.

project location, which would be accessible to workers living in Western, Central, and Southern Minnesota. Project construction will result in indirect, local economic benefits from additional spending on lodging, goods and services and local sales tax.[241] These benefits are anticipated to be greater if the construction workforce is largely composed of local labor versus non-local labor. Local workers are found to generate approximately three times more local economic activity through spending than a non-local worker at the individual level,[242,243] and a largely local workforce generates double the economic impact of a largely non-local workforce.[244]

The use of local workers who reside in Dakota County could have significant positive impacts, not just through providing employment on this project, but by providing workers the opportunity to develop the required technical skills to work in the green economy,[245] which can increase opportunities for future employment. Minnesota is anticipated to continue to expand renewable energy development in the coming years,[246] and the state's investments in the development and incentivization of clean energy[247] will enable future renewable projects. Castle Rock Solar's use of local labor would provide Minnesota workers with the relevant skills for the growing renewable industry, preparing them for future employment opportunities.

Taxes

Once the project is operational, Castle Rock Solar will pay property taxes and production taxes on the land and energy production to local governments. Property taxes are calculated on the land underlying the facility. Because the land for the solar generating facility is used primarily for solar generation, the land is classified as Class 3a (commercial/industrial/public utility) which is taxed at a rate ranging from 1.5-2.0 percent. This is a higher tax rate than land used primarily for homestead or agriculture, which is taxed at a rate ranging from 1.0-1.25 percent. The value of the generation equipment is exempted from the property tax.[248] The conversion of agricultural land to a solar facility will change the project site's land classification from agricultural land to Class 3a land, resulting in increased tax revenue for Dakota County and Castle Rock Township.

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[241] SPA, p. 66.

[242] Franco, L. 2020 *A Transformative Investment: Maximizing the Socioeconomic Benefits of the Fargo-Moorhead Diversion Project.* Retrieved from: https://d3ciwvs59ifrt8.cloudfront.net/272d7204-1f87-45d8-a9dc-744c9333acc6/e6f95bb7-5559-4dd9-a0bd-21c636c5b778.pdf

[243] Franco, L. 2019. *Catching the Wind 3.0: The impact of local versus non-local hiring practices on wind farms in North Dakota.* Retrieved from: https://ndlegis.gov/assembly/67-2021/testimony/SNATRES-2301-20210204-5243-F-FRANCO_LUCAS_A.pdf

[244] Franco, L. 2020. *Maximizing The Benefits of Wind Energy Development Through Local Construction Hiring: The Northern Divide Wind Energy Project Case Study.*

[245] Grima, S., Sood, K., Özen, E., & Dalli Gonzí, R.E. (Eds.). (2025). *Greening our economy for a sustainable future*, retrieved from: https://www.sciencedirect.com/book/9780443236037/greening-our-economy-for-a-sustainable-future

[246] 2024 Minnesota Energy Factsheet, retrieved from: https://www.cleanenergyeconomymn.org/wp-content/uploads/2024/04/2024-Minnesota-Energy-Factsheet.pdf

[247] H.F. 5247

[248] Minnesota Statutes 272.02, subdivision 24; Minnesota House Research, *Property Tax 101: Property Tax Variation by Property Type*, July 2022, https://www.house.leg.state.mn.us/hrd/pubs/ss/ssptvart.pdf .

Minnesota has adopted a production tax of $1.20/MWh paid 80 percent to counties and 20 percent to the cities and townships.[249] Castle Rock Solar estimates average annual solar energy production and property tax revenue of approximately $185,000 to $310,000 for Dakota County and approximately $46,000 to $76,000 for Castle Rock Township.[250]

Financial Assurances

Section 9.1 of the DSP makes the project owner financially responsible for decommissioning the project and its facilities. Castle Rock Solar anticipates providing financial assurance for decommissioning in the form of a surety bond or other agreed upon method of financial assurance that equals the costs to ensure the project is properly decommissioned. The financial assurance will be posted no earlier than the 10th anniversary from the project's commercial operation date. From that point, a revised decommissioning estimate and update of financial assurance will be submitted every five years. The revised plans will reflect any new advancements in the techniques, reclamation equipment, and standards related to decommissioning. The revised plans will also include a reassessed and revised decommissioning cost estimate that will reflect any changes in the costs, include the salvage values of materials and equipment. The amount of financial surety will be determined in accordance of the decommissioning plan, as the decommissioning plan is revised in accordance with the site permit, throughout the life of the project.[251,252]

MITIGATION

Socioeconomic impacts are anticipated to be positive. Section 8.5 of the DSP requires quarterly reports concerning efforts to hire Minnesota workers. The reporting requirements have been amended to require the permittee to provide detailed information on efforts to hire Minnesota workers and notify the Commission if the permittee intends to deviate from its commitment to select a contractor that will maximum use of local, union labor to the greatest extent feasible. Consistent with Minn. Stat. 216E.03, subd. 10 (c). (Edition Year 2023), Section 8.6 requires the permittee, as well as its construction contractors and subcontractors, to pay no less than the prevailing wage rate.

No additional mitigation is proposed.

4.3.9 Environmental Justice

The ROI for economic justice analysis is the region. The project is not within environmental justice (EJ) communities as defined by Minnesota Statute. The project **will not have** disproportionately high and adverse human health or environmental effects on low-income, minority, or tribal populations.

Environmental justice ensures that all people, regardless of race, color, national origin, or income, experience equal benefits from environmental protections, and receive equal opportunities to

[249] *Minnesota Department of Revenue. 2021.* https://www.revenue.state.mn.us/solar-energy-production-tax#:~:text=The%20Solar%20Energy%20Production%20Tax%20rate%20is%20%241.20%20per%20megawatt,nameplate%20capacity%20exceeding%201%20megawatt

[250] SPA, p. 67.

[251] SPA, Appendix H: Decommissioning Plan.

[252] SPA, pp. 40-41.

participate in the decisions related to the development, implementation, and enforcement of environmental regulations and policies that may impact their environment or health. The goal of environmental justice is not to shift risks among populations, but to identify populations that have experienced disproportionately high exposure to, and adverse effects from, environmental hazards, and determine how these impacts can be mitigated.[253]

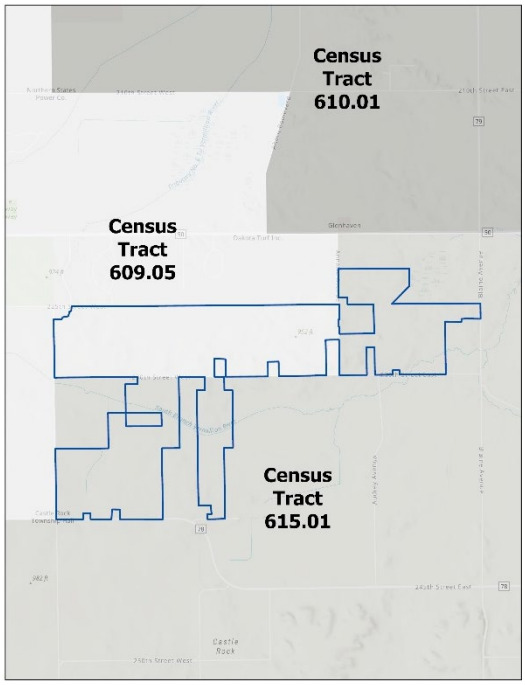
As defined by Minnesota Statute 216B.1691, subd. 1(e), "Environmental justice area" means an area in Minnesota that, based on the most recent data published by the United States Census Bureau, meets one or more of the following criteria:

(a) 40 percent or more of the area's total population is nonwhite;
(b) 35 percent or more of households in the area have an income that is at or below 200 percent of the federal poverty level;
(c) 40 percent or more of residents over the age of five have limited English proficiency; or
(d) the area is located within Indian country, as defined in United States Code, title 18, section 1151.

The MPCA defines "Environmental justice" as the right of communities of color, Indigenous communities, and low-income communities, to the enjoyment of a healthy environment and to fair treatment with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. "Environmental justice community" or "EJ community" means a people group or geographic location that experiences environmental justice related harms and risks.

Figure 35 shows the census tract used to compare the project site with Dakota County and Minnesota as a whole. MPCA's "Understanding Environmental Justice in Minnesota" web-based mapping tool was used to determine whether the project intersects any census tracts with environmental justice populations based on the definitions above.[254] Table 20 provides data from the U.S. Census Bureau's 2023 American Community Survey, 5-year estimate.

Figure 35. Census Tracts in Project Area



[253] Minnesota Department of Health. (2021). *Environmental Justice*, retrieved from: https://data.web.health.state.mn.us/environmental_justice

[254] MPCA, Understanding environmental justice in Minnesota Mapping Tool, 2023. https://experience.arcgis.com/experience/bff19459422443d0816b632be0c25228/page/Page/?views=EJ-areas.

Staff conducted a demographic assessment of the affected communities to identify low-income and minority populations using 2023 American Community Survey, 5-year estimates. These communities include Dakota County, the city of Farmington, Castle Rock Township, and Census Tracts 609.05 and 615.01. Dakota County has a higher minority population than Minnesota by 2.4 percent. Castle Rock Township reported a higher percentage of the population below the poverty level than the state, the county and the census tracts. Both the city and township have a smaller limited English-speaking population percentage than Minnesota.

The proposed project is not within the exterior boundaries of a federally recognized tribal reservation or community; the Prairie Island Indian Community is approximately 16 miles east of the project. The project is also approximately 7.2 miles southeast of the nearest EJ area for people of color near Apple Valley, MN.

Table 20. Low-Income and Minority Population Characteristics

Area	% Income ≤ 200% of Poverty Level	% limited English proficiency	% Minority Population‡
Area			
Minnesota	22.0	2.2	21.6
Dakota County	15.9	2.2	24.0
City of Farmington	11.0	0.8	14.4
Castle Rock Township	26.8	0.0	5.0
Project Census Tracts			
Census Tract 609.05	16.7	1.4	21.6
Census Tract 615.01	21.6	0.0	7.0

Source: U.S. Census Bureau, 2023 American Community Survey 5-year Estimate

‡ Minority population includes all persons who do not self-identify as white alone.

Potential Impacts

Utility infrastructure can adversely impact low-income, minority or tribal populations. Based on the MPCA's mapping tool, as well as the project area population and demographics data (Table 20), there are no EJ communities identified in the project area or region. The MPCA's mapping tool lists census tract 615.01 as historically within an EJ area for income, with 19.19 percent reporting income less than the 200 percent federal poverty level (+/- 16 percent margin of error).[255]

Since there are no EJ communities identified in the region, there are no impacts to EJ communities anticipated as a result of the project. Castle Rock Solar notes that the project is expected have positive

[255] MPCA, Understanding environmental justice in Minnesota Mapping Tool, 2023. https://experience.arcgis.com/experience/bff19459422443d0816b632be0c25228/page/Page/?views=EJ-areas.

socioeconomic impacts due to the financial benefits to local landowners participating in the project, and surrounding community benefits due to increased demand for commodities and lodging.[256]

MITIGATION

This project is not sited within an EJ community. Therefore, the project is not anticipated to create disproportionate or adverse impacts to low-income or minority populations. Additional mitigation is not proposed.

4.4 Human Health and Safety

Construction and operation of a solar facility has the potential to impact human health and safety.

4.4.1 Electric and Magnetic Fields

The ROI for EMF is the land control area. Impacts to human health from possible exposure to EMFs are **not anticipated**.

Electric and magnetic fields (EMFs) are invisible forces that result from the presence of electricity. They occur naturally and are caused by weather or the geomagnetic field. They are also caused by all electrical devices and found wherever people use electricity. EMFs are characterized and distinguished by their frequency, that is, the rate at which the field changes direction each second. Electrical lines in the United States have a frequency of 60 cycles per second or 60 hertz, which is extremely low frequency EMF ("ELF-EMF"). The strength of an electric field decreases rapidly as it travels from the conductor and is easily shielded or weakened by most objects and materials.

Voltage on a conductor creates an electric field that surrounds and extends from the wire. Using water moving through a pipe as an analogy, voltage is equivalent to the pressure of the water moving through the pipe. The strength of the electric field is measured in kilovolts per meter (kV/m). Electric fields decrease rapidly as they travel from the conductor and are easily shielded or weakened by most objects and materials.

Current moving through a conductor creates a magnetic field that surrounds and extends from the wire. Using the same analogy, current is equivalent to the amount of water moving through the pipe. The strength of a magnetic field is measured in milliGauss (mG). Like electric fields, the strength of a magnetic field decreases rapidly as the distance from the source increases; however, unlike electric fields, magnetic fields are not easily shielded or weakened.

Table 21 provides examples of electric and magnetic fields associated with common household items. "The strongest electric fields that are ordinarily encountered in the environment exist beneath high voltage transmission lines. In contrast, the strongest magnetic fields are normally found very close to

[256] SPA p. 66.

motors and other electrical appliances, as well as in specialized equipment such as magnetic resonance scanners used for medical imaging."[257]

Table 21. Electric and Magnetic Field Strength of Common Household Objects[258]

Electric Field*		Magnetic Field**			
Appliance	kV/m	Appliance	mG		
	1 foot		1 inch	1 foot	3 feet
Stereo	0.18	Circular saw	2,100 to 10,000	9 to 210	0.2 to 10
Iron	0.12	Drill	4,000 to 8,000	22 to 31	0.8 to 2
Refrigerator	0.12	Microwave	750 to 2,000	40 to 80	3 to 8
Mixer	0.10	Blender	200 to 1,200	5.2 to 17	0.3 to 1.1
Toaster	0.08	Toaster	70 to 150	0.6 to 7	< 0.1 to 0.11
Hair Dryer	0.08	Hair dryer	60 to 200	< 0.1 to 1.5	< 0.1
Television	0.06	Television	25 to 500	0.4 to 20	< 0.1 to 1.5
Vacuum	0.05	Coffee maker	15 to 250	0.9 to 1.2	< 0.1

* German Federal Office for Radiation Safety
** Long Island Power Institute

Health Studies

In the late-1970s, epidemiological studies indicated a weak association between childhood leukemia and ELF-EMF levels. "Epidemiologists observe and compare groups of people who have had or have not had certain diseases and exposures to see if the risk of disease is different between the exposed and unexposed groups but does not control the exposure and cannot experimentally control all the factors that might affect the risk of disease."[259]

Ever since, researchers have examined possible links between ELF-EMF exposure and health effects through epidemiological, animal, clinical, and cellular studies. To date, "no mechanism by which ELF-EMFs or radiofrequency radiation could cause cancer has been identified. Unlike high-energy (ionizing) radiation, EMFs in the non-ionizing part of the electromagnetic spectrum cannot damage DNA or cells directly," that is, the ELF-EMF that is emitted from HVTLs does not have the energy to

[257] World Health Organization. *Radiation: Electromagnetic Fields, What are typical exposure levels at home and in the environment?* (2016). https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields

[258] World Health Organization. *Radiation: Electromagnetic Fields, What are typical exposure levels at home and in the environment?* (2016). https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields

[259] National Institute of Environmental Health Sciences. *EMF: Electric and Magnetic Fields Associated with the Use of Electric Power.* (2002). https://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf

ionize molecules or to heat them.[260] Nevertheless, they are fields of energy and thus have the potential to produce effects.

> "The few studies that have been conducted on adults show no evidence of a link between EMF exposure and adult cancers, such as leukemia, brain cancer, and breast cancer."[261]

> "Overall there is no evidence that exposure to ELF magnetic fields alone causes tumors. The evidence that ELF magnetic field exposure can enhance tumor development in combination with carcinogens is inadequate."[262]

> "A number of scientific panels convened by national and international health agencies and the U.S. Congress have reviewed the research carried out to date. Most concluded that there is insufficient evidence to prove an association between EMF and health effects; however, many of them also concluded that there is insufficient evidence to prove that EMF exposure is safe."[263]

The Minnesota State Interagency Working Group on EMF Issues, comprised of staff from state agencies, boards, and Commission, was tasked to study issues related to EMF. In 2002, the group published *A White Paper on Electric and Magnetic Field Policy and Mitigation Options*, and concluded the following:

> "Some epidemiological results do show a weak but consistent association between childhood leukemia and increasing exposure to EMF…. However, epidemiological studies alone are considered insufficient for concluding that a cause-and-effect relationship exists, and the association must be supported by data from laboratory studies. Existing laboratory studies have not substantiated this relationship…, nor have scientists been able to understand the biological mechanism of how EMF could cause adverse effects. In addition, epidemiological studies of various other diseases, in both children and adults, have failed to show any consistent pattern of harm from EMF.
>
> The Department of Health concludes that the current body of evidence is insufficient to establish a cause and effect relationship between EMF and adverse

[260] National Cancer Institute. *Electromagnetic Fields and Cancer*. (2016). http://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/magnetic-fields-fact-sheet.

[261] National Institute of Environmental Health Sciences. *Electric and Magnetic Fields*, (2018). http://www.niehs.nih.gov/health/topics/agents/emf/index.cfm.

[262] World Health Organization. *Extremely Low Frequency Fields*. (2007). https://iris.who.int/bitstream/handle/10665/43646/9789241572385_eng.pdf?sequence=1, page 10.

[263] State of Minnesota, State Interagency Working Group on EMF Issues (2002) *A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options*, https://apps.commerce.state.mn.us/eera/web/project-file?legacyPath=/opt/documents/EMF%20White%20Paper%20-%20MN%20Workgroup%20Sep%202002.pdf: page 1.

> health effects. However, as with many other environmental health issues, the possibility of a health risk cannot be dismissed.[264]"

Regulations and Guidelines

Currently, there are no federal regulations regarding allowable ELF-EMF produced by power lines in the United States; however, state governments have developed state-specific regulations. For example, Florida limits electric fields to 2.0 kV/m and magnetic fields to 150 mG at the edge of the ROW for 161 kV transmission lines.[265] Additionally, international organizations have adopted standards for exposure to electric and magnetic fields (Table 22).

Table 22. International Electric and Magnetic Field Guidelines

Organization	Electric Field (kV/m)		Magnetic Field (mG)	
	Public	Occupational	Public	Occupational
Institute of Electrical and Electronics Engineers	5.0	20.0	9,040	27,100
International Commission on Non-Ionizing Radiation Protection	4.2	8.3	2,000	4,200
American Conference of Industrial Hygienists	—	25.0	—	10,000/ 1,000[a]
National Radiological Protection Board	4.2	—	830	4,200

[a] For persons with cardiac pacemakers or other medical electronic devices

The Commission limits the maximum electric field under high voltage transmission lines in Minnesota to 8.0 kV/m.[266] It has not adopted a standard for magnetic fields.

POTENTIAL IMPACTS

Potential impacts are anticipated to be negligible and are not expected to negatively affect human health. The primary sources of EMF from the proposed project will be from the solar arrays, electrical collection lines, the transformers installed at each inverter, and the overhead gen-tie line connecting the project substation to Xcel Energy's Chub Lake to Hampton Corners 345 kV transmission line.

[264] State of Minnesota, State Interagency Working Group on EMF Issues (2002) *A White Paper on Electric and Magnetic Field (EMF) Policy and Mitigation Options*, https://apps.commerce.state.mn.us/eera/web/project-file?legacyPath=/opt/documents/EMF%20White%20Paper%20-%20MN%20Workgroup%20Sep%202002.pdf: page 36.

[265] Florida Department of State. *Rule 62-814.450 Electric and Magnetic Field Standards*. (2008). https://www.flrules.org/gateway/ruleNo.asp?id=62-814.450.

[266] *E.g.*, Department of Commerce (2018). *Potential Human and Environmental Impacts of the Freeborn Wind Transmission Line Project,* retrieved from: https://mn.gov/eera/web/project-file?legacyPath=/opt/documents/34748/1%20Text%20Figures%20Tables.pdf.

The EMF generated by solar arrays is at the level generally experienced near common household appliances. Measured magnetic fields at utility-scale PV projects drop to very low levels of 0.5 mG or less at distances of 150 feet from inverters.[267] For electrical collection lines, a study found that at 27.5 kV magnetic fields are within background levels at 1 meter above ground.[268] Castle Rock Solar estimated projected magnetic fields for all collection line scenarios in Appendix L of their application. A 5 parallel collection line scenario, the maximum number of parallel cables considered for the project design, is estimated to have a maximum magnetic field of 19.21 mG.[269]

Castle Rock Solar states that the collection line system is either to be buried at a depth of at least 36 inches to the top of the cables or it will be enclosed within a conduit and buried at a depth of at least 24 inches with shielding around the cables. Shielded cables have the energizing conductor located in the center of the power cable and surrounded by a grounded metallic shield.[270] The shielding design confines the electric field to the interior of the power cable and neither the cables nor any other collection system components produce a detectable electric field.

Project transformers and inverters will be located within the substation area. Measured magnetic fields at utility-scale PV projects drop to very low levels of 0.5 mG or less at distances of 150 feet from inverters.[271] The proposed substation location is over 1,000 feet from any nearby residence.[272]

The project proposes a 345 kV 200-foot gen-tie line. Based on the results of the EMF study provided in Appendix L of the SPA, the overhead collection line is estimated to have a maximum electric field of 0.54 kV/m and decrease to 0 kV/m 200 feet from the centerline.[273]

MITIGATION

No health impacts from EMF are anticipated. EMF diminishes with distance from a source. The nearest solar array is located approximately 341 feet from the nearest residence and the nearest inverter is located approximately 602 feet from the nearest residence. The proposed 200-foot gen-tie line is approximately 700 feet from the nearest residence, the nearest residence to the proposed substation location is approximately 1,026 feet, and the nearest residence to the project switchyard is 823 feet.

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[267] Flowers, George and Cleveland, Tommy. North Carolina Clean Energy Technology Center. (2017). Health and Safety Impacts of Solar Photovoltaics. Retrieved from: https://content.ces.ncsu.edu/static/publication/js/pdf_js/web/viewer.e56617a9a878.html?slug=health-and-safety-impacts-of-solar-photovoltaics

[268] McCallum L.C., Whitefield Aslund M.L., Knopper L.D., Ferguson G.M., & Ollson C.A. (2014). *Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern?* DOI: https://doi.org/10.1186/1476-069x-13-9

[269] SPA, Appendix L: Electro-Magnetic Field Calculations.

[270] Kelly, L. J. & Landinger, C. C. (1999). *Electrical Power Cable Engineering, Chapter 9: Standards and Specifications*. Retrieved from: https://studylib.net/doc/8676369/electrical-power-cable-engineering

[271] Flowers, George and Cleveland, Tommy. North Carolina Clean Energy Technology Center. (2017). Health and Safety Impacts of Solar Photovoltaics. Retrieved from: https://content.ces.ncsu.edu/static/publication/js/pdf_js/web/viewer.e56617a9a878.html?slug=health-and-safety-impacts-of-solar-photovoltaics

[272] EA, Appendix D, Question 31.

[273] SPA, Appendix L: Electro-Magnetic Field Calculations.

At these distances both electric and magnetic fields will dissipate to background levels in all cases. No additional mitigation is proposed.

4.4.2 Public Safety and Emergency Services

The ROI for public and work safety is the land control area. Like any construction project, there are risks. These include potential injury from falls, equipment and vehicle use, electrical accidents, etc. Public risks involve electrocution. Electrocution risks could also result from unauthorized entry into the fenced area. Potential impacts during construction are anticipated to be **minimal**. Potential impacts during operation are anticipated to be **minimal**. Impacts would be short- and long-term and can be minimized.

Like any construction project, there are risks. These include potential injury from falls, equipment and vehicle use, electrical accidents, etc. During operation there are occupational risks similar to those associated with construction. Public risks would result from unauthorized entry into the facility.

Construction crews must comply with local, state, and federal regulations when installing the project. This includes standard construction-related health and safety practices. This generally includes safety orientation and training, as well as daily/weekly safety meetings. The project will be designed and constructed in compliance with applicable electric codes. Electrical inspections will ensure proper installation of all components, and the project will undergo routine inspection. Electrical work will be completed by trained technicians. Standard industry practices around public safety will be followed during after project construction, including the installation of a perimeter fence, access gates, and proper signage, and restricting site access to authorized personnel. Fencing will deter public access, and signage will provide appropriate public warnings.

Emergency services in the project area are provided by county and local law enforcement and emergency response agencies located in nearby communities. Table 23 lists the emergency services within approximately 22 miles of the project that could be expected to respond to an emergency situation. The nearest hospitals to the project are Northfield City Hospital (9.6 Miles), Allina United Hospital-Hastings Regina (12.4 Miles), and Fairview Ridges Hospital (11.7 Miles). The Lakeville Clinic (7.5 miles), Apple Valley Medical Center (9.1 Miles), and Allina Savage Health Center (14.7 Miles) are smaller medical centers within the area.

Table 23. Emergency Service Providers Near the Project

Entity	Approximate Distance from Project
Police Services	
Dakota County Sheriff Department	11.7 miles
Farmington Police Department	4.2 miles
Lakeville Police Department	7.8 miles
Rosemount Police Department	8.0 miles
Apple Valley Police Department	9.0 miles
Northfield Police Department	11.6 miles
Dundas Police Department	13.1 miles
Cannon Falls Police Department	10.2 miles

Fire Services	
Farmington Fire Department	2.3 miles
Northfield Area Fire and Rescue	10.4 miles
Cannon Falls Fire Department	10.6 miles
Randolph-Hampton Fire	3.0 miles
Lakeville Fire Department	6.6 miles
Rosemount Fire Department	7.9 miles
Apple Valley Fire Department	8.8 miles
Ambulance Services	
North Memorial AirCare	22.7 miles
Lakeville, ALF Ambulance	9.5 miles
Cannon Falls Ambulance	10.2 miles
EMS-Northfield	11.6 miles

Potential Impacts

Worker safety issues are primarily associated with construction. Public safety concerns would be most associated with unauthorized entry to the project.

The inflow of temporary construction personnel could increase demand for emergency and public health services. On the job injuries of construction workers requiring assistance due to slips, trips or falls, equipment use, or electrocution can create a demand for emergency, public health, or safety services that would not exist if the project were not to be built.

The closest ARMER tower is located approximately 4.8 miles east of the project site. The project design does not include features will be greater than 150 ft tall. Thus, no impacts to the ARMER system are anticipated.

Several specific public safety concerns are individually addressed below.

Fire Risk and Emergency Services

Like any electrical system, solar panels do represent a potential fire risk. Research on fire risk in PV systems indicates that electrical arcing is a main cause of fires, arising due to the use of faulty products, installation errors, or irregular maintenance failing to identify issues with system components.[274] Thus far, research investigating the causes of fire in PV systems has mainly focused on rooftop installations; considering that ground-mounted PV systems contain similar electrical components as rooftop systems, they likely experience similar fire causes as well.

[274] Ong, N., Sadiq, M., Said, M., Jomaas, G., Tohir, M., & Kristensen, J. (2022). *Fault tree analysis of fires on rooftops with photovoltaic systems.* DOI: https://doi.org/10.1016/j.jobe.2021.103752

The preliminary development area will contain native vegetation, which could increase the fire hazard if improperly managed. Due to the proximity of the project to several residential developments, an uncontrolled fire within the site could become a threat to public safety. The Farmington Fire Department would likely be the initial responder to fires on site, as a small-town fire department they may lack experience or equipment necessary for managing fires in large-scale electrical utilities.

Law enforcement, fire services, and ambulances may need to enter the site in an emergency. If site access or maneuverability is hindered, this may delay their response time.

MITIGATION

Construction is bound by federal and state Occupational Safety and Health Administration (OSHA) requirements for worker safety, and must comply with local, state, and federal regulations regarding installation of the facilities and qualifications of workers. Established industry safety procedures will be followed during and after construction of the project. Castle Rock Solar indicates that the project will be fenced and locked to prevent unauthorized access, and signs will be posted to warn unauthorized persons not to enter fenced area due to the presence of electrical equipment.

Public safety is addressed in several sections of the DSP (**Appendix C**):

- Section 4.3.30 requires the permittee to take several public safety measures, including landowner educational materials, appropriate signs and gates, etc.
- Section 8.12 requires permittees file an Emergency Response Plan with the Commission and local first responders prior to operation.
- Section 8.13 requires disclosure of extraordinary events, such as fires, etc.
- Section 9.1 requires a decommissioning plan prior to construction and updated every five years. Periodic updates of the plan will address the developing information on end-of-life issues related to PV panels.

Additional mitigation in relation to the specific public safety concerns raised are discussed below.

Fire Risk and Emergency Services

Appropriate PV system installation can reduce fire risk resulting from inaccurate construction methods, and proactive maintenance and monitoring of electrical equipment can identify risky system components before a fire occurs. The project will be designed and constructed in compliance with applicable electric codes. Electrical inspections will ensure proper installation of all components, and the project will undergo routine inspection. Electrical work will be completed by trained technicians. Data streams from the SCADA equipment will be remotely monitored 24/7, allowing for constant monitoring of, and communication with, the project and relaying of alarms and communication errors.[275] Compliant system installation along with continual monitoring and a proactive approach to maintenance tasks will reduce fire risk within the site.

[275] SPA, p. 30.

Castle Rock Solar's VMP provides additional fire risk mitigation.[276] Vegetation will be controlled via mowing, preventing the accumulation of biomass and reducing fire hazard. The use of rotating PV arrays alongside vegetation removal techniques can reduce fire hazards.[277]

Section 8.12 of the DSP requires the permittee to prepare an Emergency Response Plan in coordination with local emergency responders. In addition, Castle Rock Solar will share a Fire Safety Protocol with local fire departments and organize cooperation and training meetings with local emergency responders.[278] The DSP (**Appendix C**) proposes the following special conditions related to emergency responders:

- Section 5.7 requires the permittee to develop a Fire Safety Protocol and make it available to local fire departments.
- Section 5.8 requires the permittee to organize and hold cooperation and training meetings with local emergency response providers to maintain familiarity with site facilities and clear channels of communication.

No additional mitigation is proposed.

4.5 Land-based Economies

Solar facilities impact land-based economies by precluding or limiting land use for other purposes.

4.5.1 Agriculture

The ROI for agriculture is the land control area. Potential impacts to agricultural producers are anticipated to be **minimal to significant** — lost farming revenues will be offset by lease or easement agreements. Herbicide drift into an adjacent certified-organic operation could restrict organic market access and significantly impact farming revenues; these impacts can be mitigated with appropriate planning, design, and, in the event of drift, financial compensation. A loss of farmland in Dakota County would occur for the life of the project. Potential impacts are localized and unavoidable but can be minimized.

Agricultural use dominates approximately 87 percent of the land control area, with corn and soybeans as the dominant crops. Agricultural characteristics for Dakota County are summarized in Table 24.

[276] SPA, Appendix E: Vegetation Management Plan.
[277] Vaverková, M., Winkler, J., Uldrijan, D., Ogrodnik, P., Vespalcová, T., Aleksiejuk-Gawron, J., Adamcová, D., & Koda, E. July 2022. *Fire hazard associated with different types of photovoltaic power plants; Effect of vegetation management.* DOI: https://doi.org/10.1016/j.rser.2022.112491
[278] SPA, p. 44.

Table 24. Agricultural Characteristics – Dakota County[279]

Category	2022	Percent change from 2017
Acres of farmland	208,517	-8
Number of Individual farms	841	+3
Average farm size (acres)	248	-10
Average value of agricultural production	$433,796	+51
Top crops (in acres)	Corn and soybeans	NA
Largest livestock inventory	Cattle and calves	NA

Crops comprise roughly three-quarters of the market value of agricultural production in Dakota County (approximately 78 percent), with the remainder from livestock, poultry, and products. In terms of acreage, corn and soybeans dominate the landscape, though Dakota County also has thousands of acres of vegetables, sweet corn, and forage (hay and haylage). Cattle and calves, along with milk from cows, comprise the largest portion of livestock revenues, followed by hogs and pigs, and poultry and eggs.

Prime farmland is defined by Federal regulation at 7 C.F.R.657.5(a)(1) as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses." Nearly all the preliminary development area is classified as prime farmland (Table 25). With respect to prime farmland, the applicant indicates that no feasible or prudent alternatives to the project exist.

Table 25. Prime Farmland within Land Control Area[280]

Farmland Classification	Acres	% of Site
Prime Farmland	780.9	54.1
Prime Farmland if Drained	146.6	10.2
Prime Farmland if Protected from Flooding	17.4	1.2
Farmland of Statewide Importance	245.3	17
Not Prime Farmland	252.2	17.5
Total	**1442.4**	**100**

[279] USDA, 2022 Census of Agriculture, County Profile: Dakota County, Minnesota. Retrieved from: https://www.nass.usda.gov/Publications/AgCensus/2022/Online_Resources/County_Profiles/Minnesota/cp27037.pdf.

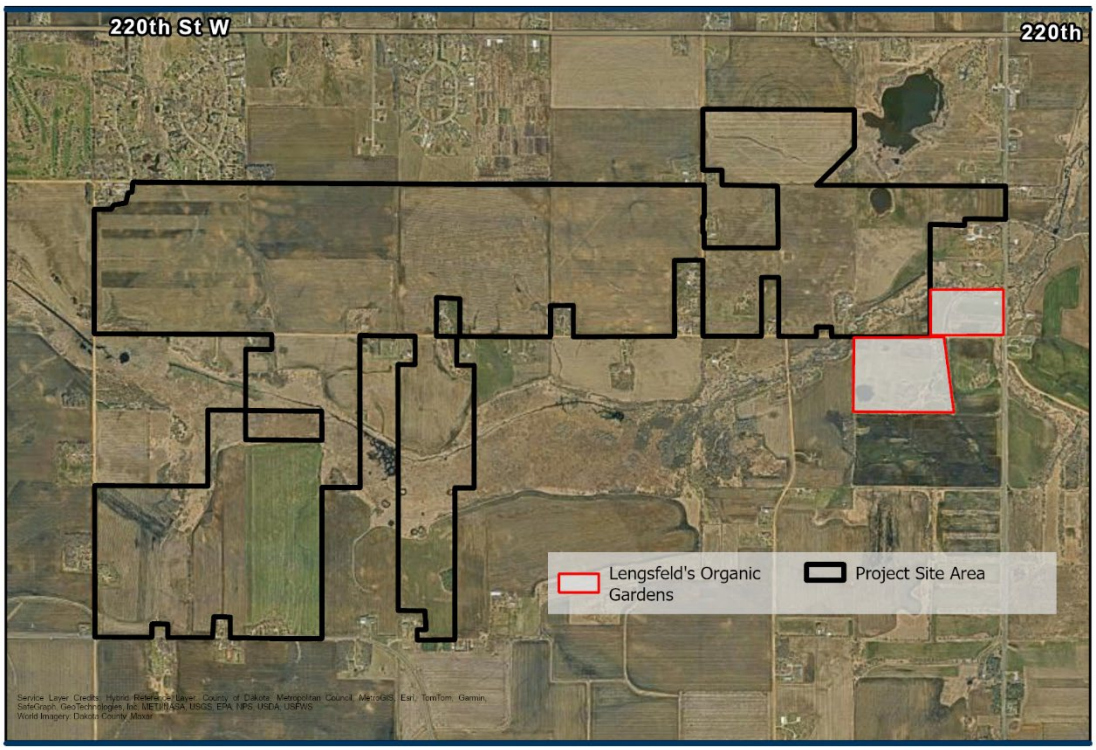
[280] EA, Appendix D, Question 27

Over the past century, many farmers in the area have installed subsurface drainage systems to enhance crop yield. These systems use perforated pipe placed at a slope to move excess water from the crop root zone to a ditch or other outlet. Most drainage pipe used today is plastic, but because concrete or clay pipes were used historically, terms such as tile or tiling or drain tile are still used. Tiling can enhance crop productivity by lowering the water table, improving soil aeration, and allowing the soil to warm and dry more quickly in the spring.[281]

Organic Operations

Lengsfeld's Organic Gardens is a certified organic crop operation that produces crops on two parcels along 230th Street East, adjacent to the project (Figure 36). [282,283]

Figure 36. Lengsfeld's Organic Gardens Parcels



[281] University of Minnesota Extension. *Impact of Agricultural Drainage in Minnesota.* (2018). Retrieved from: https://extension.umn.edu/agricultural-drainage/impact-agricultural-drainage-minnesota#sources-1360510.

[282] SPA, Appendix F: Landowner List & Map.

[283] Dakota County, Minnesota. *Dakota County GIS (GCIS), Parcel ID*. [Online] [Cited: August 28, 2025] Retrieved from: https://gis.co.dakota.mn.us/DCGIS/

Lengsfeld's Organic Gardens was certified organic by the Midwest Organic Services Association (MOSA), a U.S. Department of Agriculture (USDA) accredited agency, on July 25, 2002. The operation is certified under the USDA's National Organic Program (USDA-NOP). Lengsfeld's Organic Gardens produces a variety of organic vegetables, fruits, and herbs on the two parcels adjacent to the project.[284]

MOSA-certified organic operations must comply with all applicable organic production and handling regulations in the National Organic Standards,[285] including the National List of Allowed and Prohibited Substances (National List).[286] The operator must adhere to the MOSA certification requirements, which include establishing and implementing an annually updated Organic System Plan, permitting annual on-site inspections, and allowing access to all applicable organic records for review and copying to determine compliance.[287]

Green Acres and Rural Preserve Program Operations

The Green Acres and Rural Preserve Programs provide property tax relief for qualifying farmland. The programs aim to limit increases in the market value of farmland that faces development pressure. The assessor determines two values on the farmland property, the estimated market value and the agricultural value. Taxes are calculated on both values, but only the lower agricultural value taxes are paid. The difference between the estimated market value tax and the agricultural value tax is deferred until the farmland property is sold or no longer qualifies for enrollment in the program.[288] The reduction in tax burden allows these farmland properties to remain rural in character and ensures their continued use for agricultural purposes.[289] There are parcels within the land control area that are enrolled in the Green Acres Program.[290]

POTENTIAL IMPACTS

The potential impact intensity level ranges from minimal to significant. The intensity of the impact is likely to be subjective. For example, conversion of farmland to solar energy production can be viewed as a conversion from one type of industrial use to another. Conversely, the conversion of farmland to solar energy production can be viewed as a negative impact to agricultural production. Restoring the site with native grasses and forbs will reduce soil erosion, provide pollinator and wildlife benefits, and improve soil health. This EA acknowledges that the perceived impacts to prime farmland are

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[284] USDA. *Organic Integrity Database, Operation Profile (9950000610).* [Online] [Cited: August 28, 2025] Retrieved from: https://organic.ams.usda.gov/integrity/CP/OPP?cid=45&nopid=9950000610&ret=Home&retName=Home

[285] 7 CFR § 205 - National Organic Program.

[286] 7 CFR Part 205 Subpart G – National Organic Program: The National List of Allowed and Prohibited Substances.

[287] MOSA. (2024). *Program Manual*, retrieved from: https://mosaorganic.org/assets/forms/Master-Cert-Forms/Program-Manual_2024-07-05-174949_kjaq.pdf.

[288] Minnesota Department of Revenue. *Green Acres and Rural Preserve,* retrieved from: https://www.revenue.state.mn.us/green-acres-and-rural-preserve.

[289] MN House Research. *Minnesota's Property Tax Programs for Agricultural and Rural Lands*, retrieved from: https://www.house.mn.gov/hrd/pubs/ss/ssgrnacres.pdf.

[290] SPA, p. 81.

subjective and may be difficult to assess given the trade-offs associated with utility scale solar projects.

Rural areas, with large parcels of relatively flat, open land, are ideal for solar development, which require six to eight acres of land to generate one MW of electricity. The project will result in up to 1,190.2 acres of farmland being removed from agricultural production for the life of the project (Table 25).[291] This change in land use would take productive farmland out of production for the life of the project, representing approximately 0.6 (out of 208,517 acres) percent of existing agricultural land in Dakota County. The applicant indicates that the land could be returned to agricultural uses after the project is decommissioned and the site is restored.

Soil Compaction and Erosion

Construction of the project has the potential to damage agricultural soils through compaction or erosion if BMPs are not implemented to minimize damage. Soil compaction could occur during the construction phase due to the heavy axle loads and tire contact pressure from equipment used to install project components. Compaction reduces soil pore size, resulting in reduced water infiltration, internal drainage, and holding capacity. The increased water retainment in compacted soils delays warming in the spring, which can result in late and uneven emergence of crops. Crops grown in compacted soils, which are difficult to penetrate, develop restricted root systems, limiting their nutrient uptake ability. The consequences of these compaction-induced effects on crop development can result in nutrient-deficient crops with poor growth, leading to overall reductions in yield.[292]

Soil erosion could result from the ground-disturbing and grading activities necessary during the construction phase. Erosion could be heightened during wet or windy conditions. Topsoil, considered the most productive soil layer, is rich in nutrients and organic matter. Declines in topsoil nutrients and thickness resulting from erosion can cause significant reductions in crop yield[293] and require supplementation with fertilizers and agricultural treatments, increasing production costs. Subsoil, while less productive than topsoil, contains important stores of water and nutrients that are essential for high yields, particularly in areas with nutrient-depleted topsoil.[294]

Solar Facility Siting on Prime Farmland

In Minnesota, no large electric power generating site may be permitted where the developed portion of the plant site includes more than 0.5 acres of prime farmland per megawatt of net generating

[291] This is based on the land control area, not the preliminary development area, thus contains more land than will be constructed on. However, Castle Rock Solar will have site control over all land within the land control area.

[292] DeJong-Hughes, J. & Daigh, A. (2022). *Upper Midwest Soil Compaction Guide*, retrieved from: https://conservancy.umn.edu/items/c1345055-559e-4c51-95a4-c8f869f5a49e.

[293] Zhang, L., Huang, Y., Rong, L., Duan, X., Zhang, R., Li, Y., & Guan, J. (2021). *Effect of soil erosion depth on crop yield based on topsoil removal method: A meta-analysis*. DOI: https://doi.org/10.1007/s13593-021-00718-8

[294] Ning, T., Liu, Z., Hu, H., Li, G. & Kuzyakov, Y. (2022). *Physical, chemical, and biological subsoiling for sustainable agriculture.* DOI: https://doi.org/10.1016/j.still.2022.105490.

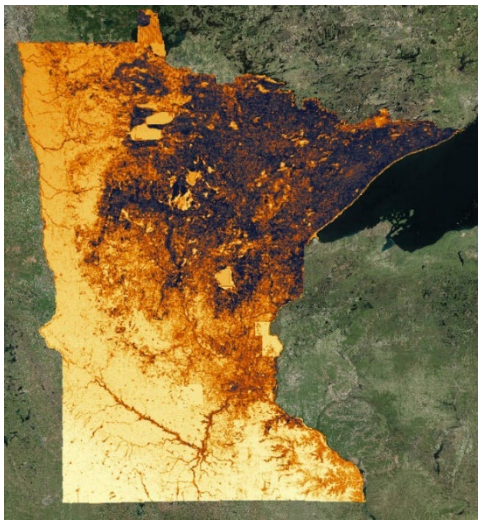
capacity, unless there is no feasible and prudent alternative (Prime Farmland Rule).[295] The provisions of the Prime Farmland Rule do not apply to the following areas:

- Areas located 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.
- Areas designated for orderly annexation under Minnesota Statute.[296]

Minnesota Statute divides cities into four classes based on population. Second class cities are cities that have more than 20,000 and less than 100,000 inhabitants.[297] According to the 2020 Census, the city of Farmington has a population of 23,632 people (Table 25). Thus, Farmington is classified as a second-class city, and the Prime Farmland Rule does not apply in areas within two miles of the city of Farmington. This two-mile Farmington buffer zone encompasses approximately 740.6 acres of the preliminary development area. Approximately 193.3 acres of the preliminary development area is located outside of the two-mile Farmington buffer zone; this portion of the project is subject to the Prime Farmland Rule.

Within the 193.3 acre portion of the preliminary development area subject to the Prime Farmland Rule, solar arrays with approximately 33.6 MW_{ac} would be sited on approximately 103.1 acres of Prime Farmland.[298] By Prime Farmland Rule, this portion of the project should impact no more than 16.8 acres of prime farmland. This is less than the actual acreage of prime farmland affected, which is conservatively estimated to be 103.1 acres of prime farmland.

Figure 37. Minnesota Solar Irradiance



Castle Rock Solar conducted a site selection analysis to inform their project location choice.[299] The first siting factor considered was the level of horizontal solar irradiance in a region; Castle Rock Solar identified the areas of Minnesota which have adequate solar resource to host a project (Figure 37[300]). Castle Rock Solar analyzed the areas of the state with adequate solar resource to identify existing transmission lines with available capacity to interconnect to the project, 150 MW. Castle Rock Solar targeted existing transmission lines located within two

[295] Minnesota Rule 7850.4440.
[296] Minnesota Statute 414.0235.
[297] Minnesota Statute 410.01.
[298] SPA, p. 17.
[299] SPA, pp. 12-16.
[300] Brink, C., Gosack, B., Kne, L., Luo, Y., Martin, C., McDonald, M., Moore, M., Munsch, A., Palka, St., Piernot, D., Thiede, D., Xie, Y., & Walz, A. (2015). Solar Insolation, Minnesota (2006-2012). Retrieved from the Data Repository for the University of Minnesota (DRUM), http://dx.doi.org/10.13020/D6X59X

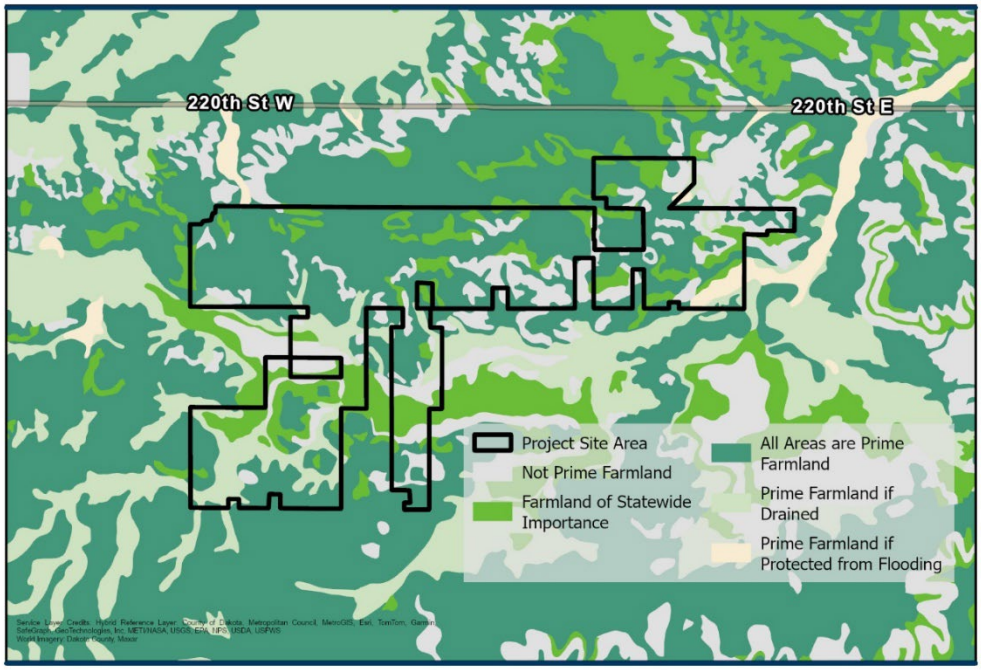
miles of first-, second-, or third-class cities to identify an area that would be compliant with the Prime Farmland Rule. The existing Chub Lake to Hampton Corners 345 kV transmission line was determined to have available capacity to interconnect to the project and is located within two miles of the city of Farmington. Castle Rock Solar then screened an approximately 2,500 acre area to find available land in proximity to the existing Chub Lake to Hampton Corners 345 kV transmission line and within two miles of the city of Farmington.

Castle Rock Solar determined land within 2,500 acre area to be potentially suitable if it was cleared and undeveloped, had few environmental factors of potential concerns, would not impact known archeological, cultural, or historic resources, had topography suitable for construction, had road infrastructure compatible with large construction vehicles and deliver trucks, and was in a community that welcomes solar projects and responsible economic development opportunities. Once potential areas passed the screening tests, Castle Rock Solar approached landowners to negotiate landowner commitments. The proposed location was ultimately chosen as it is in close proximity to the POI, passes the land suitability screening constraints, and has supportive landowners.

Ditches and Drain Tile

Drain tile is an important agricultural practice in the Midwest. Drain tile can be particularly useful to improve crop productivity of poorly drained soils.[301] Soil classified as "Prime farmland if drained" makes up approximately one-tenth of the land control area (Table 25) and a notable amount of the neighboring properties (Figure 38).

Figure 38. Prime Farmland in Project Area



[301] Rui, Y., Goller, B., & Kladivko, E. (2024). Long-term crop yield benefits of subsurface drainage on poorly drained soils. DOI: https://doi.org/10.1002/agj2.21621

While drain tile appears to be minimal in the area,[302] there are two private agricultural drainage ditches present within the land control area.[303] Damaged or blocked tile lines or ditches can impede soil drainage and impact productivity. The interconnected nature of the drainage system demonstrates that even if damage to a tile line happened within the project boundaries, non-participating landowners could experience impacts to crop yield. Additionally, the decommissioning plan indicates that the site will be restored to its prior use[304] (87 percent cultivated farmland). Damage to drainage systems within the project boundaries could prevent participating landowners from returning their land to agricultural practice.

Organic Operations

The National List identifies the synthetic and non-synthetic (natural) substances (e.g., herbicides, insecticides, etc.) that are allowed or prohibited for use in organic crop production.[305] As a USDA-NOP certified-organic operation, Lengsfeld's Organic Gardens may only use allowed substances from the National List for crop production. The parcels that Lengsfeld's Organic Gardens uses to harvest crops that will be sold, labeled, or represented as "organic" must have had no prohibited substances, as provided in the National List, applied to it for a 3-year period immediately preceding the organic crop harvest.[306]

Castle Rock Solar's VMP discusses the use of selective and non-selective herbicides to control weeds and woody plants throughout the project's lifespan. Castle Rock Solar notes that both low-volume/spot herbicide spray applications and broadcast herbicide spray applications may be used. Spot spray is appropriate for managing small patches of weedy and invasive species following construction. Broadcast spray, or spray over large areas, is appropriate for large-scale site preparation, and may occur if weeds and invasive species are present in large or dense patches following construction.[307] Table 26 lists the proposed herbicides that Castle Rock Solar is considering for use in the project. None of the proposed herbicides in Castle Rock's Solar VMP are allowed for use in organic crop production in accordance with the National List.

Table 26. Castle Rock Solar - Proposed Herbicides[308]

Active Ingredient
Glyphosate
2,4-D
Triclopyr

[302] SPA, p. 26.
[303] EA, Appendix D, Question 35.
[304] SPA, Appendix H: Decommissioning Plan.
[305] 7 CFR Part 205 Subpart G – National Organic Program: The National List of Allowed and Prohibited Substances.
[306] 7 CFR § 205 - National Organic Program.
[307] SPA, Appendix E: VMP, pp. 41-46.
[308] SPA, Appendix E: VMP, Table 13: Environmental Information for Proposed Herbicides.

Aminopyralid
Clopyralid
Clethodim

Particles or vapor from herbicide spray applications can move through the air, drifting away from the intended application site into unintended areas. A variety of factors, including droplet size, spray pressure, boom height, and wind speed, influence the drift distance of spray applications.[309] Lengfeld's Organic Gardens is located within < 0.1 miles of the project. Herbicides sprayed in project parcels adjacent to Lengsfeld's Organic Gardens, particularly herbicides sprayed using the broadcast method, which uses a taller boom height, could drift into Lengfeld's Organic Gardens property. Herbicide drift into the Lengsfeld's Organic Gardens parcels from the Castle Rock Solar project could harm the growing produce, negatively affecting the operation's annual yield and revenues. Additionally, as Lengsfeld's Organic Gardens must not apply any prohibited substances to its parcels for a 3-year period preceding the organic crop harvest, herbicide drift could impact the operation's USDA-NOP certification, restricting the operation's organic market access for 3 years and significantly impacting the Lengsfeld's Organic Gardens organic farming revenues.

Green Acres and Rural Preserve Program Operations

Land is removed from the Green Acres or Rural Preserve Programs when it no longer qualifies due to a change in use or a change in ownership. Land removed from the programs must pay back the deferred tax for the current year and two previous years as well as any deferred special assessments plus interest once the entire parcel is removed.[310] The parcels within the land control area currently enrolled in the Green Acres Program will be removed from the program prior to construction.[311]

MITIGATION

Several sections of the DSP (**Appendix C**) address agricultural mitigation and soil-related impacts:

- Section 4.3.9 requires protection and segregation of topsoil.
- Section 4.3.10 requires measures to minimize soil compaction.
- Section 4.3.11 requires the permittee to "implement erosion prevention and sediment control practices recommended by the [MPCA]" and to "obtain a [CSW Permit]." A CSW Permit requires both temporary and permanent stormwater controls to ensure that stormwater does not become a problem on or off-site.
- Section 4.3.16 requires that "site restoration and management" practices enhance "soil water retention and reduces storm water runoff and erosion".

[309] Kruger, G., Klein, R., Ogg, C., & Vieira, B. (2019). Nebraska Extension. *Spray Drift of Pesticides*, retrieved from: https://extensionpubs.unl.edu/publication/g1773/2019/pdf/view/g1773-2019.pdf
[310] Minnesota Department of Revenue. *Green Acres and Rural Preserve,* retrieved from: https://www.revenue.state.mn.us/green-acres-and-rural-preserve.
[311] SPA, p. 81.

- Section 4.3.17 requires the permittee to develop a VMP that defines how the land control area will be revegetated and monitored over the life of the project. Appropriate seeding rates and timing of revegetation will stabilize soils and improve overall soil health. Castle Rock Solar has included a draft VMP as Appendix E of its site permit application.
- Section 4.3.18 requires the permittee to develop an AIMP with MDA. Castle Rock Solar's draft AIMP (Appendix D of its site permit application) details methods to minimize soil compaction, preserve topsoil, control noxious weeds and invasive species, maintain the existing drainage conditions through appropriate maintenance and repair of existing drain tile, and establish and maintain appropriate vegetation to ensure the project is designed, constructed, operated and ultimately restored in a manner that would preserve soils to allow for the land to be returned to agricultural use.
- Section 4.3.20 requires the permittee to develop an Invasive Species Management Plan to prevent introduction and spread of invasive species during construction of the project.
- Section 4.3.21 requires the permittee to take reasonable precautions against the spread of noxious weeds.
- Section 4.3.25 requires the permittee to avoid, repair, or replace all drainage tiles broken or damaged during all phases of the project's life.
- Section 4.3.29 requires the permittee to fairly restore or compensate landowners for damages to crops, fences, drain tile, etc. during construction.

Castle Rock Solar indicates that best management practices (BMPs) would be implemented during construction in order to minimize and mitigate long-term impacts to agricultural lands, including performing regular inspections during any earthmoving phases, preventing soil profile mixing, monitoring compaction, halting construction during wet weather conditions, ensuring proper site drainage and erosion control, and limiting the spread of noxious weeds and invasive species by cleaning construction equipment. Following construction, Castle Rock Solar indicates that disturbed areas would be repaired and restored to pre-construction contours and characteristics to the extent possible.[312,313]

Reduced or lost farming revenues to participating landowners may be offset by leasing agreements, which are outside the scope of this document.

Green Acres and Rural Preserve Program Operations

Landowner(s) who entered a leasing agreement with Castle Rock Solar for parcels currently enrolled in the Green Acres Program have agreed to a change in use of the farmland parcel, which will be converted to a solar facility. This change in use will remove the farmland parcels from the Green Acres Program, as the parcels will no longer qualify for enrollment. The required pay back of deferred tax

[312] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[313] SPA, Appendix E: Vegetation Management Plan.

payments for parcels removed from the Green Acres Program may be offset by leasing agreements, which are outside the scope of this document.

Organic Operations

USDA-NOP land requirements for organic farms include having distinct, defined boundaries and buffer zones that prevent contact with a prohibited substance applied to adjoining land that is not under organic management,[314] such as the herbicides applied within the project. Required and recommended buffer distances can be found on individual herbicide labels, and requirements differ between herbicides. To protect non-target vegetation from ground spraying herbicide applications, the recommended minimum buffer width is 20 feet, and the upper end of the recommended buffer width is 130 feet.[315] However, some individual herbicide labels recommend a buffer of at least 250-300 feet. Additional BMPs for chemical spraying should be used in conjunction with buffers.

The DSP (**Appendix C**) proposes special conditions to address organic operation-related impacts:

- Section 5.9 requires the permittee to develop an appendix for the AIMP titled Mitigative Actions for Organic Agricultural Land that that describes herbicide application planning and considerations to minimize drift potential.
- Section 5.10 requires the permittee to establish an herbicide buffer zone within the project that is consistent with the maximum recommended distance based on the herbicides that will be used on site. The buffer zone must be marked with signage and all employees and/or contractors who will be responsible for applying herbicides to the site must be aware of the location and purpose of the buffer.
- Section 5.11 requires the permittee to be responsible for compensating Lengsfeld's Organic Gardens for any damages to crops or decertification resulting from herbicide drift.

4.5.2 Tourism

The ROI for tourism is the project area. There may be potential for impacts to local recreational and community activities during construction, however impacts will be temporary and short-term in duration. Long-term impacts are expected due to the re-routing of snowmobile trail 123 that is located within the project area.

Tourism in the local area is primarily limited to outdoor recreational activities, including snowmobile trails and public lands, along with local community events and amenities. The nearby city of Farmington, whose city limits is approximately 500 feet to the northwest of the project, had a population of 23,675 as of the 2023 census. Farmington is home to many local attractions such as the Farmington Water Park, Fountain Valley Golf Course, the Glenhaven Events wedding venue, and the Dakota City Heritage Village.

[314] 7 CFR § 205 - National Organic Program.

[315] Bentrup, G. (2008). *Conservation buffers: design guidelines for buffers, corridors, and greenways*. Gen. Tech. Rep. SRS-109. Ashville, NC: Department of Agriculture, Forest Service, Southern Research Station. 110 p. Retrieved from: https://www.fs.usda.gov/nac/buffers/docs/conservation_buffers.pdf

Farmington also boasts many public parks including Dakota County Park Conservation Area, Middle Creek Park, and Whitetail Woods Regional Park which offers unique cabin rentals. Farmington has other local attractions including a hockey arena, bowling alley, frisbee golf course, and other sports complexes for baseball. Also near the project is the Watt Munisotaram, a working Cambodian Buddhist Society and Temple. Farmington also hosts the Dakota County Fair annually in August. Events at the Dakota County Fair include a carnival, car show, live music, stunt dog show, lumberjack shows, livestock shows, exhibits, and contests.

POTENTIAL IMPACTS

All project facilities will be located on privately-owned land, therefore impacts to tourism and recreation are anticipated to be minimal. Minimal impacts to outdoor recreational activities could occur during construction due to noise and traffic increase, however these impacts will be temporary and short-term in duration. Attendees traveling to and from the Dakota County Fair may experience minor travel impacts if the event coincides with construction phases characterized by increased traffic.

Long-term impacts are possible and expected for tourism related to snowmobile trail 123; recreationalists traveling to use this trail may be expecting a rural landscape or may be accustomed to the current route. As part of the proposed project, the trail will be re-routed outside of the project fence line. The change from an agricultural to solar setting may deter tourists from traveling to use this trail, or this portion of the trail, in the future.

MITIGATION

Similar to mitigation screening for aesthetics at nearby residences, screening may decrease aesthetic impacts of the snowmobile trail 123 thereby decreasing impacts to tourism. Castle Rock Solar also states that they will utilize muffled equipment, and standard dust suppression techniques during construction to mitigate impacts to nearby tourism.[316] As stated in Section 4.3.6 (Tourism and Recreation), Section 5.2 of the DSP is a special condition that requires the permittee to work with the local snowmobile association responsible for maintaining snowmobile trail 123 to identify alternative routes and interconnections to trails in the area. Because significant impacts are not anticipated, no additional mitigation measures are proposed.

4.6 Archeological, Cultural, and Historic Resources

The ROI for archeological and historic resources is the project area. The impact intensity level is anticipated to be **negligible to minimal**. Impacts would be localized. Impacts can be mitigated through prudent siting.

Archeological resources are locations where objects or other evidence of archaeological interest exist, and can include aboriginal mounds and earthworks, ancient burial grounds, prehistoric ruins, or

[316] SPA, p. 83.

historical remains.[317] Historic resources are sites, buildings, structures, or other antiquities of state or national significance.[318]

Construction and operation of project has the potential to impact resources that have importance to American Indian Tribes with ties to the region. Siting of large energy facilities in a manner that respects historic and cultural ties to the land requires coordination with tribes.

Potential Impacts

Castle Rock Solar reports contacting the eleven federally recognized Tribal Nations in Minnesota, including Minnesota Tribal Nations' Tribal Historic Preservation Officers (THPOs) and the Minnesota Indian Affairs Council (MIAC) for additional information or comment on the project.[319] The Shakopee Mdewakanton Sioux Community THPO noted that while they have no recorded or known burials in the area, the area known as Castle Rock today holds historical significance to both Ojibwa and Dakota peoples, as a battle took place near the area along the Cannon River.[320] The Leech Lake Band of Ojibwe THPO commented that while they have no recorded historic properties within the area, that does not mean there are no cultural resources present. In addition, the Leech Lake Band of Ojibwe THPO requested that the tribe be notified if human remains or suspected human remains are encountered.[321]

Historic Architecture Resources

Castle Rock Solar hired a contractor to conduct a historic architecture review for the land control area and a quarter-mile buffer around the land control area. The survey examined records from the Minnesota State Historic Preservation Office (SHPO) and Minnesota Statewide Historic Inventory Portal (MnSHIP). In addition, the National Register of Historic Places (NRHP) database, was consulted, along with a review of available historic maps.

The historic architecture literature review, conducted in November 2023, identified 12 previously recorded historic architectural resources (Table 27), one of which, a timber slab span bridge (DK-CRK-00052), is within the land control area. The 11 remaining previously recorded historic architectural resources, primarily roadways and bridges, are located within 0.25-miles of the land control area. 11 of these historic properties have been determined not eligible for listing on the NRHP. One property, the Castle Rock Townhill (DK-CRK-00003), is unevaluated for listing in the NRHP as it has been demolished. Structure DK-CRK-000529, the timber slab span bridge within the land control area, was previously evaluated and determined not eligible for inclusion in the NRHP in 1995. The bridge was reevaluated in 2023 and again determined not eligible for inclusion in the NRHP.[322] During the

[317] Minnesota Statutes, Section. 138.31, subd. 14.
[318] Minnesota. Statutes, Section 138.51.
[319] SPA, Appendix C: Agency Correspondence.
[320] SPA, Appendix C: Agency Correspondence, p. 36.
[321] Written Comments on the Scope of Environmental Assessment, eDocket No. 20255-218653-01, p. 2.
[322] SHPO. *Minnesota Statewide Historic Inventory Portal (MnSHIP).* (2023). Mead & Hunt, Inc. (2023). *Minnesota Historic Bridge Inventory Form* (DK-CRK-00052.pdf), retrieved from: https://mnship.gisdata.mn.gov/public-view/27554.

literature review, an additional 38 locations were identified as having structures old enough to be evaluated for the NRHP (Table 27).

The historic architecture literature review was followed by a historic architecture survey of previously recorded and literature review-identified architectural resources in the area. All 11 of the previously recorded historic architectural resources were recommended not eligible for listing based on the survey, and the project will not impact any of these sites. All additional 38 locations identified in the literature review were recommended not eligible for listing based on the survey, and the project will not impact any of these sites.[323]

Castle Rock Solar provided the historic architectural survey report to the SHPO for concurrence on October 31, 2024,[324] and received determination from the SHPO on December 12, 2024, that "there are no properties listed in the National or State Registers of historic Places, or within the Historic Sites Network, that will be affected by this project.[325]

Table 27. Historic Architectural Resources Within 0.25 Miles of the Site

Site Number	Description	NRHP Eligibility	Within Site
Previously Recorded Historic Architectural Resources			
DK-CRK-00003	Castle Rock Town Hall	Unevaluated	No
DK-CRK-00009	Bridge 19505	Not Eligible	No
DK-EMP-00011	Culvert 96686	Not Eligible	No
DK-EMP-00013	Bridge 91168	Not Eligible	No
DK-EMP-00014	Bridge 91169	Not Eligible	No
DK-CRK-00049	Bridge 8458	Not Eligible	No
DK-CRK-00051	Bridge L3253	Not Eligible	No
DK-CRK-00052	Bridge L3254	Not Eligible	Yes
DK-FMC-00076	Pfenning Farm/Farmstead	Not Eligible	No
XX-ROD-00050	Trunk Highway 3	Not Eligible	No
XX-ROD-00070	Trunk Highway 50	Not Eligible	No
XX-ROD-00178	Trunk Highway 65	Not Eligible	No
Historic Architectural Resources Identified in Literature Review			
DK-CRK-00057	House	Not Eligible	No
DK-CRK-00058	Farmstead	Not Eligible	No

[323] SPA, Appendix J: Cultural Resource Reports – Historic Architectural Survey Report, pp. 85-248.
[324] SPA, Appendix C: Agency Correspondence, p. 91.
[325] SPA, Appendix C: Agency Correspondence, p. 92.

DK-CRK-00059	House	Not Eligible	No
DK-CRK-00060	House	Not Eligible	No
DK-CRK-00061	House	Not Eligible	No
DK-CRK-00062	House	Not Eligible	No
DK-CRK-00063	House	Not Eligible	No
DK-CRK-00064	House	Not Eligible	No
DK-CRK-00065	House	Not Eligible	No
DK-CRK-00066	Farmstead	Not Eligible	No
DK-CRK-00067	House	Not Eligible	No
DK-CRK-00068	House	Not Eligible	No
DK-CRK-00069	Farmstead	Not Eligible	No
DK-CRK-00070	House	Not Eligible	No
DK-CRK-00071	House	Not Eligible	No
DK-CRK-00072	House	Not Eligible	No
DK-CRK-00074	House	Not Eligible	No
DK-CRK-00075	Farmstead	Not Eligible	No
DK-CRK-00076	Emmanuel Cemetery	Not Eligible	No
DK-CRK-00077	House	Not Eligible	No
DK-CRK-00078	House	Not Eligible	No
DK-CRK-00079	Farmstead	Not Eligible	Yes
DK-CRK-00080	House	Not Eligible	No
DK-CRK-00081	House	Not Eligible	No
DK-CRK-00082	House	Not Eligible	No
DK-CRK-00083	House	Not Eligible	No
DK-CRK-00084	House	Not Eligible	No
DK-CRK-00085	House	Not Eligible	No
DK-CRK-00086	House	Not Eligible	No
DK-CRK-00087	Farmstead	Not Eligible	No
DK-CRK-00088	House	Not Eligible	No
DK-CRK-00089	House	Not Eligible	Yes
DK-CRK-00090	Farmstead	Not Eligible	No
DK-CRK-00091	House	Not Eligible	No
DK-CRK-00092	House	Not Eligible	No
DK-CRK-00093	Farmstead	Not Eligible	Yes
DK-CRK-00094	House	Not Eligible	No
DK-CRK-00095	House	Not Eligible	No

DK-CRK-00096	House	Not Eligible	No

Archeological and Cultural Resources

Castle Rock Solar hired a contractor to conduct a Phase Ia literature review for the land control area and 1-mile project area radius. The survey examined records from the Minnesota State Historic Preservation Office (SHPO) and Minnesota Office of the State Archeologist (OSA). In addition, the National Register of Historic Places (NRHP) database, was consulted, along with a review of available historic maps.

The literature review identified three previously recorded archaeologic sites within the 1-mile study area (Table 28). Two of the previously recorded archeological sites, a structural ruin consisting of concrete pilings that formed the foundation for a historic corncrib (21DK0075) and an artifact scatter and structural ruin representing foundational remains of a historic farmstead (21DK0094), are within the land control area. The third previously recorded archeological site, located within 1 mile of the land control area, is an alpha site (21DKk), a site that is likely to have archeological resources. This alpha site has not been formally investigated by professional archaeologists.

The contractor evaluated the potential for the presence of cultural resources within the land control area by developing a model of precontact archeological site probability. The model utilized general tendencies of precontact site locations. Tendencies were divided into high, medium, and low probability areas. Proximity to water sources, such as streams, rivers, and marshes, and suitability of specific landforms for habitation were also factored into the site probability model. The evaluation led the contractor to determine the portions of the land control area that had a moderate to high potential for the presence of cultural resources, the Survey Area, for a Phase I archaeological reconnaissance survey. The Phase I archaeological reconnaissance surveys were conducted in November 2023 and May 2024. The surveys consisted of surface collection and shovel test unit excavation along with visual inspection within areas of topographically distinct landforms and former and existing wetlands and waterbodies.

During the surveys, none of the previously recorded archeological resources within the land control area were identified. Resource 21DK0075, a structural ruin consisting of concrete pilings that formed the foundation for a historic corncrib, was unable to be relocated, suggesting that the site has been destroyed. A 2013 phase I survey in the area, conducted as part of a separate project, was unable to relocate 21DK0075 and similarly concluded that the site had been destroyed.[326] As such, resource 21KD0075 is recommended to remain not eligible for listing on the NRHP. Evidence for resource 21DK0094, an artifact scatter and structural ruin representing foundational remains of a historic farmstead, was not identified. As such, resource 21KD0094, the bulk of which is mapped outside the

[326] Great River Energy and Xcel Energy, Brookings Project Chub Lake to Hampton Filing, Exhibits B, C, D, and E, Part 4 of 4, p. 25, June 3, 2013, eDocket No. 20136-87757-04.

land control area, is recommended to remain unevaluated for listing on the NRHP. No new archeological sites were identified in the survey.[327]

Castle Rock Solar provided the Phase I Archaeological Investigation report to the SHPO for concurrence on October 31, 2024,[328] and received concurrence from the SHPO on December 12, 2024, that "there are no known or suspected archaeological resources that will be affected by this project."[329]

Table 28. Archaeologic Sites Within 1 Mile of the Site

Site Number	Description	NRHP Eligibility	Within Site
Archeologic Sites			
21DK0075	Post-contact Structural Ruin	Not Eligible	Yes
21DK0094	Post-contact Artifact Scatter and Structural Ruin	Unevaluated	Yes
21DKk	Pre-contact/Alpha Site	Unevaluated	No

Castle Rock Solar hired a contractor to conduct a literature review and Phase I archeological survey on the two additional parcels. The literature review identified no previously recorded archaeological sites or historic resources located within the survey area. The Phase I archeological survey of the two additional parcels occurred on April 15, 2025. The survey identified one concentration of twentieth century historic material that consisted of two Bristol stoneware shards, two whiteware sherds, two flat glass fragments, one glass bottle base, one machine-made bead bottle finish, and one solarized manganese pressed glass rim. The concentration was dated to the twentieth century based on the machine-made bottle finish and manganese glass. No historic structures related to the artifact concentration were identified in historical documents. The lack of associated historic structures and scarce amount of historic material suggests that this artifact concentration represents trash dumping within the field and does not warrant further investigation. Based on the results of the surveys, the contractor recommended a finding of No Historic Properties Affected for the Project and, should the project proceed as planned, no further archeological work is recommended. Castle Rock Solar submitted the supplemental survey results to SHPO for review in July 2025.[330] The preliminary survey results can be found in **Appendix G**. Castle Rock Solar will provide the results of SHPO's review upon receipt.

[327] SPA, Appendix J: Cultural Resource Reports – An Archaeological Reconnaissance Survey of the Castle Rock Solar Project, pp. 20-70.
[328] SPA, Appendix C: Agency Correspondence, p. 91.
[329] SPA, Appendix C: Agency Correspondence, p. 92.
[330] EA, Appendix D, Question 26.

MITIGATION

Prudent siting to avoid impacts to archaeological and historic resources is the preferred mitigation. Section 4.3.23 of the DSP (**Appendix C**) address archeological resources and requires the permittee to avoid impacts to archaeological and historic resources where possible and to mitigate impacts where avoidance is not possible. If previously unidentified archaeological sites are found during construction, the permit requires the permittee to stop construction and contact SHPO to determine how best to proceed. Ground disturbing activity will stop, and local law enforcement will be notified should human remains be discovered.

No impacts to architectural resources are anticipated as a result of the project. Out of the 12 previously recorded and 38 newly recorded architectural resources, none of the resources were recommended eligible for the NRHP.

No impacts to the archaeological resources are anticipated as a result of the project. The archaeological resources identified during the literature review remain not eligible (21DK0075) and unevaluated (21DK0094; 21DKk), and no new resources were identified during the survey.

Castle Rock Solar has prepared an Unanticipated Discovery Plan (UDP) that details the steps to be taken if unrecorded cultural resources or human remains are encountered during construction.[331] As part of the UDP, construction and contractor personnel will be required to participate in a training program prior to commencement of work on the project that covers the historical context of the project area, identification information for archaeological materials and skeletal remains, and procedures to follow if unanticipated discoveries of cultural properties, including gravesites, are made during construction.

In the event that an unanticipated discovery of archeological materials or suspected human remains is made, the Castle Rock Solar project manager will be notified immediately. All construction activity at the discovery location will immediately cease and the on-site construction manager will be notified. A 100-foot no-work zone buffer will be established around the edge of the discovery and a qualified professional archaeologist will be contacted to assess the discovery.

If the unanticipated discovery does not include archeological material or cultural resources greater than 45 years of age, or deemed otherwise significant, human skeletal remains, or possible burial sites, the professional archaeologist will document the discovery for the record and construction activities will resume at the discovery location.

If the unanticipated discovery includes archeological material or cultural resources greater than 45 years of age, or deemed otherwise significant, work suspension at the discovery location will continue. Castle Rock Solar will consult with MIAC, SHPO, OSA, and other consulting parties as appropriate, such as tribes and landowners, to assess the discovery. If consulting parties agree that the discovery does not represent a significant resource, construction activities my resume at the discovery location. For

[331] SPA, Appendix J: Cultural Resources Reports.

discoveries eligible for listing on the NRHP, construction may not resume until SHPO, OSA, and/or MIAC develop avoidance or mitigation strategies. After Castle Rock Solar carries out the approved treatment measures, construction activities may proceed.

If the unanticipated discovery includes human skeletal remains or possible burial sites, Castle Rock Solar will notify local law enforcement. In the event that the discovery is considered to be an unplatted human burial and is not associated with a crime scene, Castle Rock Solar will notify MIAC and OSA. MIAC has the sole authority to determine if American Indian burials can be removed and relocated, disturbed, or have protective measures, such as fences and trees, removed. Involved parties will devise a plan of action, and Castle Rock Solar will coordinate efforts to resolve the issues of the discovery, as possible. OSA or MIAC have the sole authority to authorize continuation of construction activity following the discovery of human remains or burial sites. Castle Rock Solar will not share any information regarding human remains in public or press disclosures at any time during or after the project.[332]

Section 5.12 of the DSP is a special condition requiring the permittee to update the UDP contact list to include accurate contact information for the permittee and the Leech Lake Band of Ojibwe. In the event that human remains or suspected human remains are encountered, the Leech Lake Band of Ojibwe must be contacted immediately. The permittee shall keep records of compliance with the UDP and provide them upon the request of Commission staff. The permittee is required to file the updated UDP with the Commission at least 14 days prior to the preconstruction meeting.

No additional mitigation is proposed.

4.7 Natural Resources

Solar facilities impact the natural environment. Impacts are dependent upon many factors, such as how the project is designed, constructed, maintained, and decommissioned. Other factors, for example, the environmental setting, influence potential impacts. Impacts can and do vary significantly both within, and across, projects.

4.7.1 Air Quality

The ROI for air quality is the region. Potential impacts to air quality during construction would be intermittent, localized, short-term, and **minimal**. Impacts are associated with fugitive dust and exhaust. Impacts can be mitigated. Once operational, the solar array will not generate criteria pollutants or carbon dioxide. Negligible fugitive dust and exhaust emissions would occur as part of routine maintenance activities. Impacts are unavoidable and do not affect a unique resource. Impacts can be minimized.

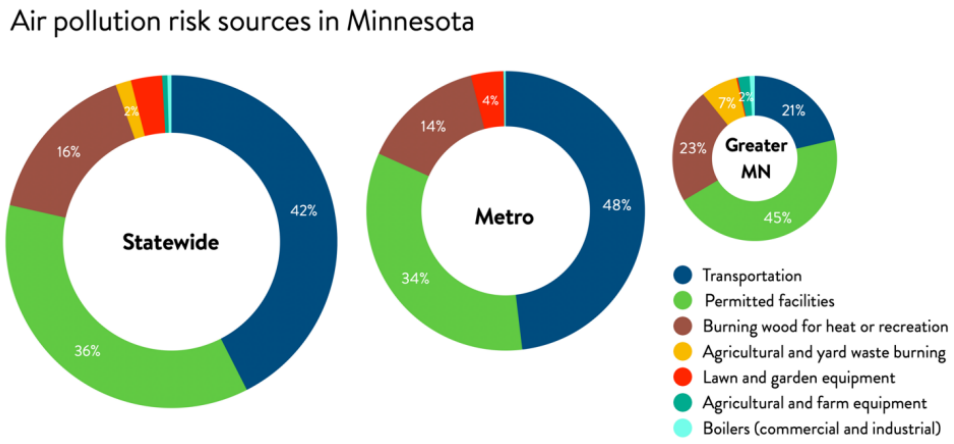
Air quality is a measure of how pollution-free the ambient air is and how healthy it is for humans, other animals, and plants. Emissions of air pollutants will occur during construction and operation of new infrastructure for the project. Regulation and voluntary action throughout Minnesota has led to

[332] SPA, Appendix J: Cultural Resource Reports – Cultural Resources Unanticipated Discovery Plan, pp. 2-19.

a reduction in air pollution over time. As a result, overall air quality in Minnesota has improved over the last 20 years, and the state has generally remained in compliance with tighter national ambient air quality standards (NAAQS). However, current levels of air pollution still contribute to health impacts, and environmental justice communities are still disproportionately affected by air pollution.

As illustrated in Figure 39, today, most of our air pollution comes from smaller, widespread sources that we all contribute to on our own such as vehicles and lawn equipment. Additionally, increasing trends of fine particle concentrations from Western wildfire smoke infiltrating Minnesota skies are expected to continue due to climate change.[333]

Figure 39. Air Pollution Sources by Type



In Minnesota, air quality is tracked using air quality monitoring stations at 59 sites across the State. The MPCA uses data from these monitors to calculate the Air Quality Index (AQI) on an hourly basis, for ozone (O_3), particulate matter (PM10/PM2.5), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO). The AQI is used to categorize the air quality of a region as one of five levels: good, moderate, unhealthy for sensitive groups, unhealthy, or very unhealthy.[334]

The project area is within the South Metro region, one of the more populated areas of the state. Air quality in the South Metro region is marginally better than the Minneapolis-St. Paul region, the most populated area of the state. According to MPCA models, air pollution in the project area's census tract is in the lowest 30 to 40 percent of all air scores in Minnesota. The top four air pollutants are NO2,

[333] The State of Minnesota's Air Quality, January 2025 Report to the Legislature, https://www.pca.state.mn.us/sites/default/files/lraq-1sy25.pdf

[334] 2025 Air Monitoring Network Plan for Minnesota. https://www.pca.state.mn.us/sites/default/files/aq10-24a.pdf

PAHs, glycol ethers, and benzene, released from permitted facilities, traffic emissions, and wood burning, but no air pollutants are above the health benchmarks.[335]

There are several air quality monitors throughout the South Metro region. The nearest South Metro region air quality monitor to the project is near Lakeville, Minnesota, approximately 10 miles northwest of the land control area. The station monitors CO, nitrogen oxides (NO_x), and PM2.5. Table 29 lists the daily air quality index category for the project area for the past 7 years.[336] Overall, air quality is categorized as good approximately seventy percent of the year, with moderate days occurring the remaining thirty percent of the year. There were several unhealthy for sensitive groups and unhealthy days over the last seven years, but no very unhealthy days. Compared to the other years, 2023 had a notable increase in the number of unhealthy for sensitive group days, and a marginal increase in the number of unhealth days. This increase is likely due to the Canadian wildfire smoke that plagued Minnesota throughout the summer of 2023, when Minnesotans experienced worse air quality and higher pollution exposure than much of the country.[337] The impacts of wildfire smoke may be exaggerated in the more populated areas of the state, such as the South Metro region, as populated areas tend to have worse air quality. The project area may experience increasingly more unhealthy days in the next years, as wildfire smoke continues to drift into Minnesota.

Table 29. Daily Air Quality Index Categories in South Metro, Minnesota

Year	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy
2017	254	111	0	0	0
2018	237	126	2	0	0
2019	247	118	0	0	0
2020	252	113	1	0	0
2021	231	131	1	2	0
2022	257	108	0	0	0
2023	167	178	15	5	0

[335] Pollution Control Agency (n.d.). *MNrisks: Pollutant Priorities*, retrieved from: https://experience.arcgis.com/experience/bff19459422443d0816b632be0c25228/page/Page/?views=Air-pollution-score

[336] MPCA. *Annual AQI Days by Reporting Region.* Retrieved from: https://data.pca.state.mn.us/views/Minnesotaairqualityindex/AQIExternal?%3Aembed=y&%3AisGuestRedirectFromVizportal=y

[337] Chase, W., Davis, E., Beheraj, K., & Whalen, J. (2023). *Haze*. Retrieved from: https://www.axios.com/us-climate-change-air-quality-canada-wildfire-season.

Potential Impacts

Construction

Minimal intermittent air emissions are expected during construction of the solar project. Air emissions associated with construction are highly dependent upon weather conditions and the specific activity occurring. For example, traveling to a construction site on a dry gravel road will result in more fugitive dust than traveling the same road when wet. Once operational, neither the generating facility nor the overhead gen-tie line will generate criteria pollutants or carbon dioxide.

Air emissions from project construction activities would likely primarily include carbon dioxide (CO_2), NO_x, and other particulate matter. Motorized equipment will emit exhaust. This includes construction equipment and vehicles travelling to and from the project. Exhaust emissions, primarily from diesel equipment, would vary according to the phase of construction.

All projects that involve movement of soil, or exposure of erodible surfaces, generate some type of fugitive dust emissions. The majority of the soils in the land control area are designated as non-wind erodible, with only a small amount designated as highly wind erodible.[338] Dry conditions may enhance soil erodibility. The project will generate fugitive dust from travel on unpaved roads, grading, and excavation. Dust emissions would be greater during dry periods and in areas where fine-textured sols are subject to surface activity. The land control area is bordered and intersected by several unpaved roads and increased vehicular traffic anticipated during the construction phase could intensify dust emissions for area residents.

Operation

Emissions associated with maintenance are dependent upon weather conditions and the specific activity occurring. Vehicle exhaust will be emitted during maintenance visits to the generating facility. The applicant indicates that, over the life of the project, fugitive dust emissions will be reduced by the elimination of farming and establishment of permanent vegetative cover. The applicant also indicates that the project will have a positive effect on air quality by replacing electrical generation produced by burning fossil fuels, reducing associated greenhouse gas emissions.

Mitigation

Castle Rock Solar indicates that dust control measures, such as the application of water or other commercially available dust control agents on unpaved areas, can be implemented during construction to reduce the potential for slow moving dust clouds to increase particulate matter and degrade air quality. Castle Rock Solar is committed to using non-chloride dust control measures to prevent harm to wetland and river systems.[339]

Castle Rock Solar can implement best management practices during construction and operation of the project to minimize dust and emissions. Exhaust emissions can be minimized by using modern equipment with lower emissions ratings and properly functioning exhaust systems, not running the

[338] EA, Appendix D, Question 28 (soils designated as highly wind erodible are in wind erodibility groups 1 and 2).
[339] SPA, p. 86.

equipment unless necessary, and minimizing the number of driving trips. Standard construction practices to minimize dust and emissions include watering exposed surfaces, covering open-bodied haul trucks, reducing speed limits on unpaved roads, containing excavated materials and treating stockpiles, and protecting and stabilizing soils.

As a component of the construction stormwater permit that will be obtained for the project, a National Pollutant Discharge Elimination System/State Disposal System construction stormwater permit and an associated SWPPP will be developed and implemented prior to construction in order to minimize the potential for fugitive dust emissions.

The AIMP identifies construction best management practices related to soils and vegetation that will help to mitigate against fugitive dust emissions. Several sections of the draft plan indirectly mitigate impacts to air quality, including sections related to construction and vegetation removal, soils, erosion and sediment control, and restoration of the site to pre-construction conditions.[340]

4.7.2 Geology and Groundwater

The ROI for geology and groundwater is the land control area. Because of the presence of potential karst in the project, there is potential for both direct and indirect impacts to groundwater because of construction and operation of the project. Direct and indirect impacts are anticipated to be **minimal to significant**, as domestic water wells and the high-vulnerability Hastings DWSMA occur within the site. Impacts to geology could occur from bedrock excavation and are anticipated to be **minimal to moderate**. Indirect impacts from surface waters might occur during construction. Impacts can be mitigated through adherence to BMPs for construction and stormwater management in karst areas.

The geology of a project area can influence the anticipated impacts of construction and operation. Bedrock geology features within the project area are primarily composed of two Paleozoic bedrock formations. The Lower Ordovician Prairie du Chien Group – Shakopee Formation, the oldest formation, is composed of dolostone, sandy to silty dolostone, sandstone, and shale. The Middle to Lower Ordovician St. Peter Sandstone formation consists of white to tan-colored fine- to medium-grained, friable, quartzose sandstone in its upper half to upper two-thirds, with the lower portion consisting of white to gray feldspathic shale and siltstone interbedded with coarser-grained sandstone.[341]

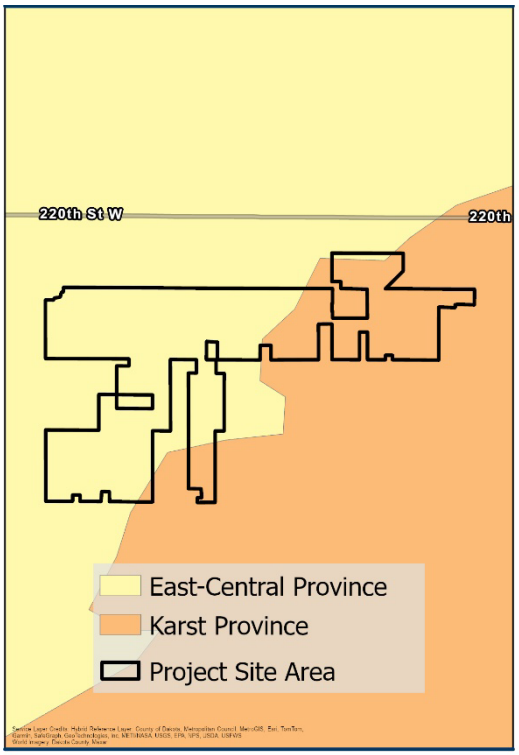
Depth to bedrock within the land control area ranges from less than 25 feet to more than 150 feet beneath ground surface.[342] Surficial sediments within the land control area are primarily composed of outwash sand and gravel sediment, containing coarse- to fine-grained sand that is poorly- to well-sorted, cobbly and bouldery in places; deposited by subaerial meltwater prior to and during the Wisconsinian glaciation period. There are also portions of loam diamicton, unsorted till sediment with

[340] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[341] Minnesota Geological Survey (2011), S-21 Geologic Map of Minnesota-Bedrock Geology, retrieved from: https://conservancy.umn.edu/items/96de8d96-46ba-441c-94ca-41080b4335be.
[342] Minnesota Geological Survey (2023), D-03, Depth to Bedrock – Minnesota, retrieved from: https://mngs-umn.opendata.arcgis.com/content/7d6744ce505d45e781fd4a063baeba14/about.

a loamy matrix containing uncommon to common pebbles and rare cobbles and boulders, deposited by ice; alluvium, coarse-grained sand and gravel deposited in fluvial channels along with finer-grained loam, silt, and sand on floodplains; and organic debris sediment, containing decomposed organic matter largely consisting of peat with smaller amounts of fine-grained sediment mixed in, deposited in marshes, ponded water, alluvial floodplains, and other landscape depressions.[343]

Groundwater in Minnesota is largely a function of local geologic conditions that determine the type and properties of aquifers. Minnesota is divided into six groundwater provinces based on bedrock and glacial geology. The majority of the project is within Province 1 (Figure 40), the East-Central Province, and is characterized by buried sand aquifers and relatively extensive surficial sand plains. Province 1 is underlain by sedimentary bedrock with good aquifer properties. The eastern and southeastern sections of the project are within Province 3 (Figure 40), the Karst Province. Sediment in Province 3 is thin or absent, as such, it is not used or relatively unimportant as aquifers, except for major river valleys, areas where sediment thickness is greater. Province 3 is underlain by productive bedrock aquifers; the aquifers closest to the land surface are often impacted by human activities.[344]

Figure 40. Project Groundwater Provinces



Depth to bedrock beneath the project ranges from less than 25 ft to more than 150 ft below ground surface. Bedrock depth increases from east to west; near surface bedrock is possible and should be evaluated further.

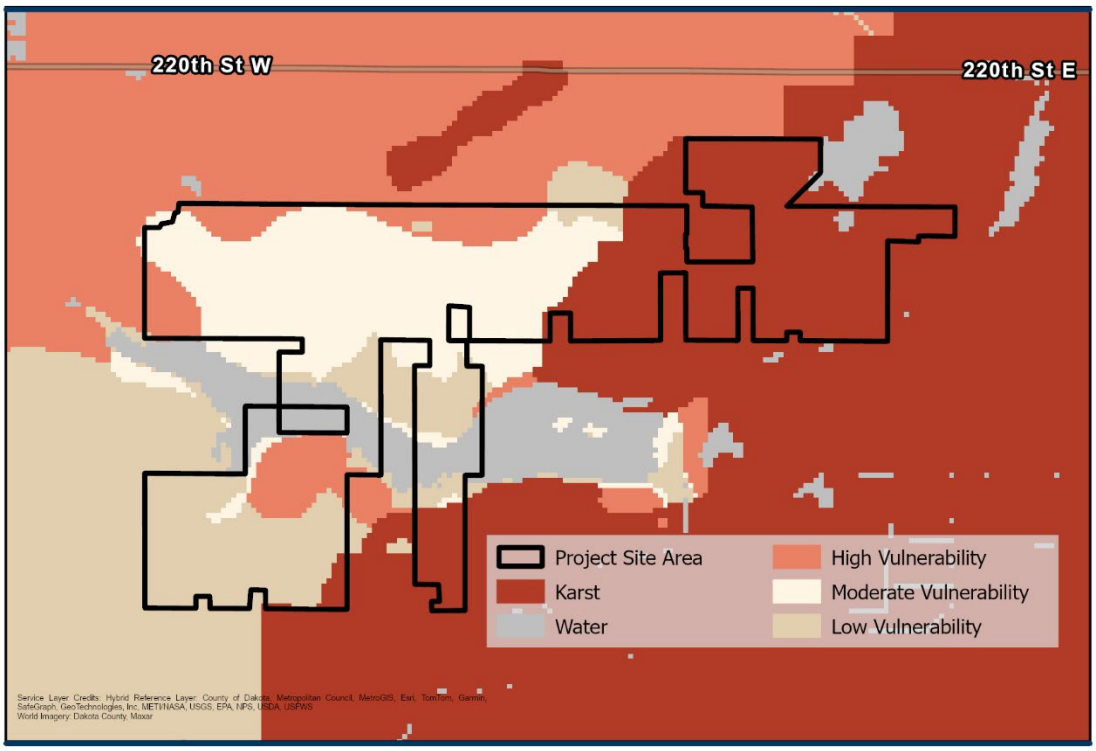
Depth to water table in the project is relatively shallow, ranging from surface level to less than 10 feet below the surface throughout the majority of the project.[345,346] Depth to water table is shallower in hydric soils and areas near water features such as wetlands, streams, and rivers, and deeper in the non-hydric soil units. The groundwater flow direction in the project is expected to follow surface topography and surface water flow, flowing towards the wetlands or the South Branch Vermillion River. However, the groundwater flow direction may vary throughout the project depending on factors such as the presence of underground utilities and/or other surficial features. In areas with

[343] Minnesota Geological Survey (2023), S-23 Geologic Map of Minnesota – Quaternary Geology, retrieved from: https://conservancy.umn.edu/items/49a5c319-0b36-4502-9d5f-e64f283d5003.
[344] DNR, Minnesota Groundwater Provinces (2021) https://www.dnr.state.mn.us/waters/groundwater_section/mapping/provinces.html
[345] USDA, Web Soil Survey, retrieved from: https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx.
[346] DNR, Water Table Depth, retrieved from: https://mnatlas.org/gis-tool/.

drain tile, the depth to groundwater is altered and likely deeper than what has been reported on the USDA Web Soil Survey.

Pollution sensitivity of near surface materials in the land control area range from the "high" to "low" category (Figure 41).[347] The sensitivity to pollution of near-surface materials is an estimate of the time it takes for water to travel through the unsaturated zone to reach the water table, which for the purposes of the model was assumed to be 10 feet below the land surface.[348] The land control area is generally expected to have varying groundwater pollution sensitivity. In low sensitivity areas, contaminants from the land surface would not reach groundwater for months to a year, while in high sensitivity areas, contaminants from the land surface could reach groundwater within hours to a week.[349] Low sensitivity does not guarantee protection. Leakage from an unsealed well for example, may bypass the natural protection, allowing contamination to directly enter an aquifer.

Figure 41. Pollution Sensitivity within Project

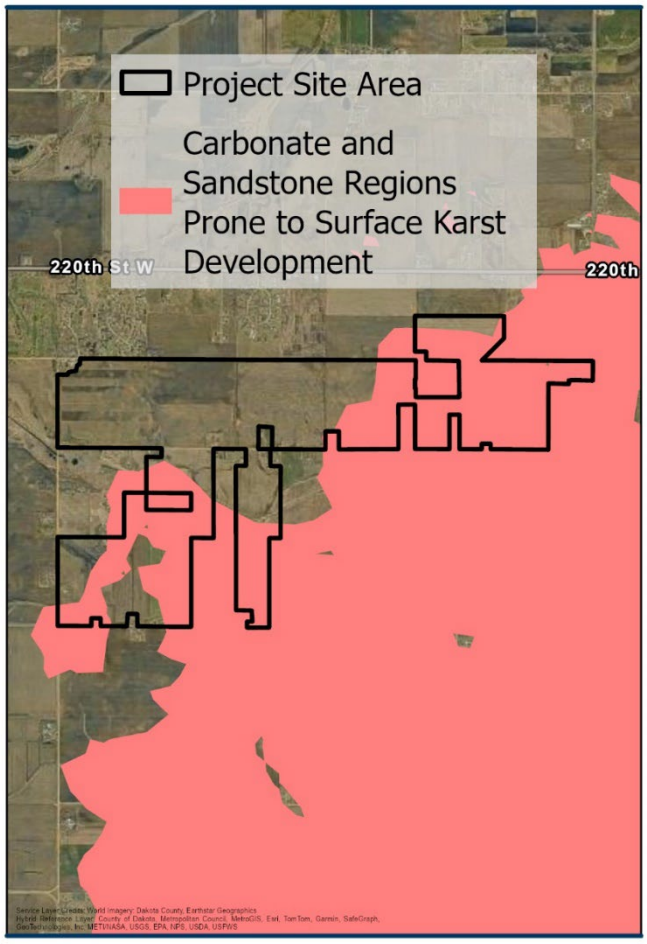


[347] Minnesota Natural Resource Atlas, retrieved from https://mnatlas.org/gis-tool/.
[348] Adams, R. (June 2016) Pollution Sensitivity of Near-Surface Materials, retrieved from: https://www.leg.state.mn.us/docs/2017/other/170839.pdf , page 3.
[349] DNR, Methods to Estimate Near-Surface Pollution Sensitivity, retrieved from: https://files.dnr.state.mn.us/waters/groundwater_section/mapping/gw/gw03_ps-ns.pdf.

Karst

Portions of the project are in areas prone to surface karst development (Figure 42).[350] Areas prone to surface karst development are identified by less than 50 feet of glacial deposits and/or sediments above bedrock. These areas contain bedrock containing carbonate and sandstone, which can dissolve in slightly acidic water. Karst features such as sinkholes, springs, and stream sinks have not been identified within the land control area. The nearest karst feature to the project location is a sinkhole, located approximately 1.85 miles from the project boundary.[351] However, Castle Rock Solar notes that several isolated tree clusters appear in agricultural fields within the land control area; the tree clusters may be indicative of potential karst features that have not been evaluated.

Figure 42. Areas of Project Prone to Karst Surface Development



[350] DNR, Regions Prone to Surface Karst Feature Development, retrieved from: https://mnatlas.org/gis-tool/.
[351] DNR, Karst Feature Inventory Points, retrieved from: https://mnatlas.org/gis-tool/.

The DNR describes karst as "terrain with distinctive landforms and hydrology created primarily from the dissolution of soluble rocks. It is characterized by sinkholes, caves, springs, and underground drainage dominated by rapid conduit flow. Karst allows a direct, very rapid exchange between surface water and groundwater and significantly increases groundwater contamination risk from surface pollutants."[352] It is mainly, but not exclusively, formed on limestone. In Minnesota, karst topography is generally found in the southeastern portion of the state.

Minnesota Well Index

The land control area was reviewed for EPA designated sole source aquifers, wells listed on the MWI and MDH Wellhead Protection Areas (WHPAs).[353] The MDH maintains the MWI, which provides basic information (e.g., location, depth, geology, construction, and static water level) for wells and borings drilled in Minnesota. The MWI identifies four documented wells within the land control area, and Dakota County records identify four unknown and/or unlocated wells within the land control area (Table 16, Figure 32). The documented wells in the land control area are used for both domestic and irrigation purposes and range from 120 feet to 240 feet in depth. Three of the four documented wells in the land control area are currently active, the fourth well's status is unknown. In addition, there are 98 wells outside of the land control area within approximately one-half mile of the project, ranging from 16 to 420 feet in depth: 94 active wells (one commercial well, one test well, one monitoring well, one unknown well, seven irrigation wells, and 83 domestic wells), three sealed wells (one domestic well and two monitor wells), and one unknown scientific investigation well.[354]

Wellhead Protection Areas

Under the Safe Drinking Water Act, each state is required to develop and implement a Wellhead Protection Program to identify the land and recharge areas contributing to public supply wells and prevent the contamination of drinking water supplies. WHPAs are determined by MDH as "areas surrounding public water supply wells that contribute groundwater to the well. In these areas, contamination on the land surface or in water can affect the drinking water supply."[355] WHPA encompasses the area around a drinking water well where contaminants could enter and pollute the well.

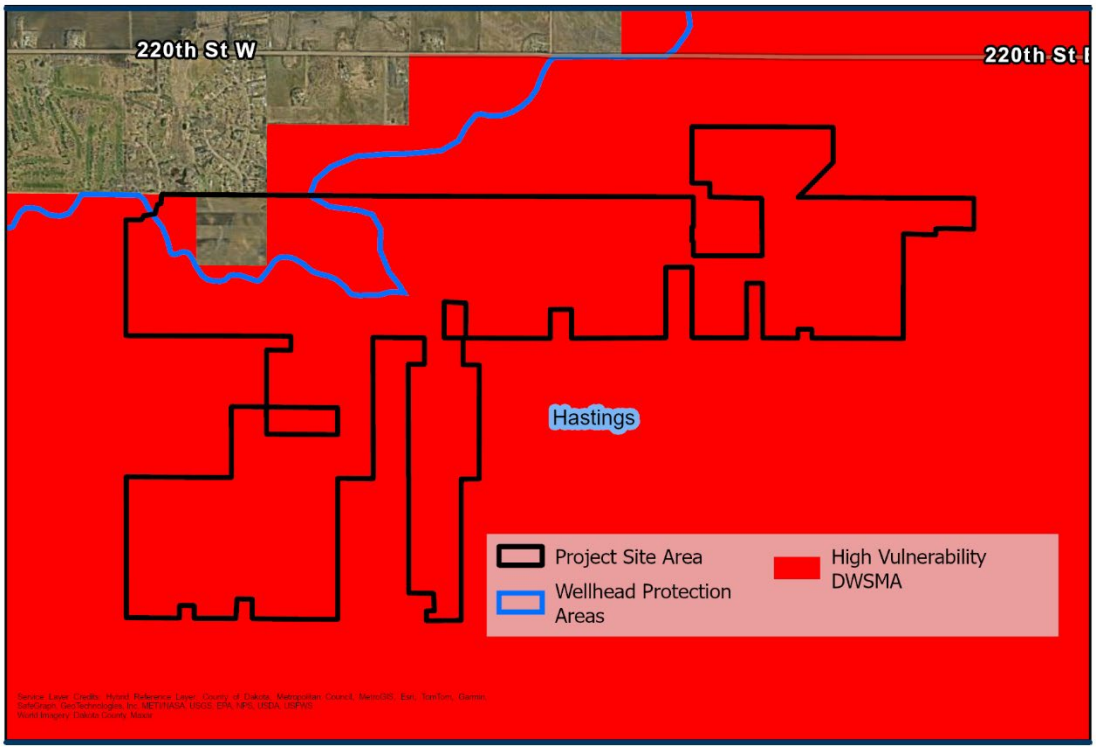
Public and non-public community water supply source-water protection in Minnesota is administered by the MDH through the Wellhead Protection program. WHPAs for public and community water-supply wells are delineated based on a zone of capture for 10-year groundwater time-of-travel to the well and are available through a database and mapping layer maintained by MDH (2023b). The MDH

[352] DNR. Minnesota Regions Prone to Surface Karst Feature Development. (2016). http://files.dnr.state.mn.us/waters/groundwater_section/mapping/gw/gw01_report.pdf
[353] SPA, p. 89.
[354] MDH (n.d.) *Minnesota Well Index* https://www.health.state.mn.us/communities/environment/water/mwi/index.html.
[355] MDH. (n.d.). *Source Water Protection Web Map Viewer*. Retrieved from: https://mdh.maps.arcgis.com/apps/View/index.html?appid=8b0db73d3c95452fb45231900e977be4

mapping layer also includes the Drinking Water Supply Management Areas (DWSMA) and SWSMA Vulnerability rankings.

A search in the MDH database indicated that majority of the land control area is within the Hastings WHPA and Hastings DWSMA. The Hastings DWSMA provides drinking water to the city of Hastings and has a vulnerability ranking of high (Figure 43).[356] DWSMA vulnerability is impacted by several factors, including hydrogeology, water use, and groundwater-surface water interactions.[357] The Hastings DWSMA has a vulnerability ranking of high due to several factors relating to the area's hydrogeology, namely a predominance of coarse textured soils, shallow bedrock, and karst geology, all of which create an environment conducive to groundwater leaching. This means that water and contaminants within the Hastings DWSMA may travel from the land surface to the city of Hasting's aquifer within a time span of months to a few years.[358]

Figure 43. Hastings WHPA/DWSMA within Project



[356] Id.
[357] MDH. *Protecting Vulnerable Drinking Water Sources*. Retrieved from: https://www.health.state.mn.us/communities/environment/water/docs/cwf/vulnacres.pdf.
[358] MDA. *Hastings DWSMA Groundwater Protection Rule Summary*. Retrieved from: https://www.mda.state.mn.us/sites/default/files/docs/2025-06/hastingsdwsmasum_add.pdf.

POTENTIAL IMPACTS

Potential impacts to geology and groundwater can occur directly or indirectly. Direct impacts to groundwater are generally associated with construction, for example, structure foundations that could penetrate shallow water tables or groundwater usage. The tracking racks, switchyard, inverters, substation, and O&M building may require some concrete foundations, geochemical testing will determine the final foundation installation process. If concrete foundations are used, some portion of the soluble components of the cement paste might leach into groundwater prior to the setting and hardening of the concrete. This will change the pH of groundwater around the surface of the concrete but should not extend far from the foundation.[359]

Indirect impacts could occur through spills or leaks of petroleum fluids or other contaminants that contaminate surface waters which could ultimately contaminate groundwater. The shallow depth to groundwater within the site means that any spills on the surface will rapidly move into the aquifer. In the event of a spill or contamination event, impacts could be significant, as the majority of the land control area is within the Hastings WHPA and Hastings DWSMA, which has a high vulnerability ranking and serves the city of Hastings along with several other small cities and rural townships in the surrounding area.

Due to the project's location within areas prone to karst surface development, and the potential for karst features to occur within the site, the project could have an increased potential for groundwater contamination. The concern with groundwater contamination in karst areas is that, due to permeability, any contamination on the surface or in the shallow groundwater can quickly migrate from the surface to the aquifer even if construction activities are confined to areas above the aquifer. Stormwater runoff can dissolve the carbonate and sandstone rock, eroding the bedrock below and creating cracks and fissures that allow for rapid spread of contaminants into the groundwater. Runoff could spread through newly developed channels within the bedrock, contaminating nearby domestic water supply wells, public wells within the Hastings DWSMA, or the South Branch Vermillion River, resulting in impacts to drinking water and aquatic habitat. In addition, the use of stormwater retention ponds can create sinkholes due to the additional weight of water on the bedrock,[360] which can result in impacts to the landscape on site.

If the project facilities include oil storage of more than 1,320 gallons, a Spill Prevention, Control, and Countermeasure (SPCC) Plan would be required. Castle Rock Solar states that they will prepare an SPCC Plan prior to construction for construction-related fuel storage and prior to operation for operation-related fuel storage, should said storage exceed applicability thresholds.[361] Castle Rock Solar will install secondary containment areas for the substation transformer as necessary.[362]

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[359] See Department of Commerce (May 14, 2018) *Potential Human and Environmental Impacts of the Freeborn Wind Transmission Line Project*. Retrieved from: https://mn.gov/eera/web/project-file?legacyPath=/opt/documents/34748/1%20Text%20Figures%20Tables.pdf

[360] MPCA. *Minnesota Stormwater Manual: Karst*. Retrieved from: https://stormwater.pca.state.mn.us/index.php?title=Karst.

[361] SPA, pp. 5-8, Table 3: Potential Permits/Approvals.

[362] SPA, p. 27.

The water supply needs of the project will be limited, and Castle Rock Solar does not anticipate drawdown impacts to resources such as aquifers and water wells. However, because of the shallow depth to groundwater in some areas of the project, dewatering may be required during construction. Dewatering will be discharged to the surface to allow it to infiltrate back into the ground, minimizing impacts. If dewatering exceeds 10,000 gallons of water per day, a DNR water appropriation permit will be required.[363] Castle Rock Solar has committed to developing a dewatering plan that will be implemented on site.[364]

The disturbance of soil and vegetative cover could affect water quality in groundwater resources. The construction of a solar project will create an increase in impervious and semi-impervious surfaces within the area of land control. This could lead to an increase of stormwater runoff, and in turn reduce groundwater recharge.

Castle Rock Solar notes that due to the presence of shallow bedrock, excavation of bedrock may be necessary in portions of the project.[365] If excavation creates new fractures in the bedrock, it could cause disturbances to groundwater flow or a loss of bedrock stability, which could result in bedrock collapse and sinkhole formation.

Mitigation

Stormwater management is important to ensure that structure foundations maintain their integrity and that rainwater and surface runoff drain away from the project structures and roads in a way that does not adversely affect existing drainage systems, roads, or nearby properties. Castle Rock Solar has designed a stormwater management system that largely consists of vegetated swales and ditch checks, save for one retention pond located near the substation, switchyard, and potential BESS location (Figure X). The MPCA prefers the use of swale stormwater management systems in sites with shallow bedrock,[366] such as the project site. This management system uses site-appropriate permanent stormwater management measures that will address drainage from the newly established impervious areas. Unlike basins, which centralize runoff, swales disperse stormwater flow over a broad area, preventing the runoff from becoming channelized and limiting the potential for runoff to dissolve the carbonate and sandstone bedrock or create new sinkholes. Furthermore, Castle Rock Solar indicates that solar panels will be mounted above the ground with a perennial seed mix underneath, allowing water to filter into vegetation and soil prior to discharging.[367]

Any new wells require notification to MDH and would be constructed by a well borer licensed by MDH. If any previously unmapped wells are discovered, Castle Rock Solar should cap and abandon the well in place in accordance with MDH requirements.

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[363] DNR, Water Use Permits: retrieved from: https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/permits.html
[364] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[365] SPA, p. 88.
[366] MPCA. *Minnesota Stormwater Manual: Karst*. Retrieved from: https://stormwater.pca.state.mn.us/index.php?title=Karst.
[367] SPA, p. 90.

Because the project will disturb more than one acre, Castle Rock Solar must obtain a CSW Permit from the MPCA. The CSW Permit will identify BMPs for erosion prevention and sediment control. As part of the CSW Permit, Castle Rock Solar will also develop a SWPPP that describes construction activity, temporary and permanent erosion and sediment controls, BMPs, and permanent stormwater management that will be implemented during construction and through the life of the project. Implementation of the protocols outlined in the SWPPP will minimize the potential for soil erosion and detail stormwater management methods during construction and operation of the facility. Section 4.3.11 of DSP (**Appendix C**) requires the permittee to obtain a MPCA CSW Permit and implement the BMPs within for erosion prevention and sediment control. Impacts to groundwater can also be minimized by mitigating impacts to soils and surface waters as discussed in Section 4.7.3 and Section 4.7.4.

A National Pollutant Discharge Elimination System (NPDES) permit application to discharge stormwater from construction facilities will also be acquired by Castle Rock Solar from the MPCA. BMPs will be used during construction and operation of the project to protect topsoil and adjacent resources and to minimize soil erosion.

Any dewatering required during construction will be discharged to the surrounding upland vegetation, thereby allowing it to infiltrate back into the ground to minimize potential impacts.

Prior to construction, Castle Rock Solar will conduct a geotechnical investigation to confirm the depth to bedrock, potential karst features, and subsurface properties. Generally, a minimum 150-foot radius buffer can be used from the edges around any potential karst features to reduce the risk of karst potential for the solar arrays.

The DSP (**Appendix C**) proposes special conditions to address geology and groundwater-related impacts:

- Section 5.13 requires the permittee to notify the city of Hastings and nearby domestic well users in the event of a spill or leak of potential contaminants. Notifying the city of Hastings and nearby domestic well users must be included in the SPCC Plan.
- Section 5.14 requires the permittee to file a geotechnical investigation report prepared by a third-party geotechnical engineer or authorized representative. The report should include methodology, results, and conclusions drawn from the geotechnical investigation with recommendations on project design and construction. The special conditions also preclude construction activity or placement of project infrastructure within 150 feet of active karst features.
- Section 5.15 requires the permittee to develop a bedrock excavation plan in the event that bedrock excavation is necessary. The plan will detail the excavation protocols, necessary equipment, BMPs, and monitoring techniques to ensure the structural integrity of the bedrock is maintained. The plan should identify appropriate response procedures in the event that bedrock is fractured or otherwise unintentionally damaged during excavation. The plan should be filed at least 14 days prior to the pre-construction meeting. Details on bedrock excavation should be included in the monthly Construction Status Reports required by Section 8.4.

- Section 5.16 requires the permittee to develop a dewatering plan and provide training to personnel directly involved with discharge activities. The plan should be filed at least 14 days prior to the pre-construction meeting. All on-site personnel directly involved with discharge activities are required to have access to the dewatering plan at all times while at the discharge locations.

4.7.3 Soils

The ROI for the soils is the land control area. Impacts to soils will occur during construction and decommissioning of the project. The impact intensity level is expected to be **minimal to moderate**. Potential impacts will both positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur. Because the soil at the solar facility will be covered with native perennial vegetation for the life of the project, soil health is likely to improve; however, success of the native vegetation will depend on final design of the project's solar panels.

The soils deposited in the land control area (Table 30) are predominantly made up of 1-6 percent slopes, and well drained, fine-loamy soils. Predominantly non-hydric and non-hydric soils cover the majority of the land control area (82 percent or 1182 acres), while predominantly hydric and hydric soils cover approximately 18 percent (258.5 acres). Topsoil in the land control area, including the preliminary development area, has a thickness ranging from 0-19+ inches, with the majority in the >12-18 inch range. The site contains soils with low and moderate water erodibility. The site contains 95.8 percent non-wind erodible soils and 4.2 percent wind erodible soils.

The soils within the land control area are susceptible to compaction (approximately 26 percent "low" compaction-prone and 74 percent "medium" compaction-prone). Soils within the site are moderately and severely susceptible to rutting (21 percent and 79 percent, respectively). Compaction and rutting will worsen when heavy equipment is used on fine- or medium-textured soils with wet conditions. Most of the soils within the land control area are designated prime farmland (54 percent), and the rest is designated farmland of state importance (17 percent), prime farmland if drained (10 percent), prime farmland if protected from flooding (1 percent), and not prime farmland (17 percent).[368]

Table 30. Soil Types in Solar Facility Land Control Area[369,370]

Soil Type	Slopes (Percent)	Drainage Class	Acres	Percent of Project
Aquolls and Histosols, ponded	-----	Very Poorly Drained	29.15	2.02
Anthroportic Udorthents	2-9	Moderately Well Drained	1.69	0.12
Cylinder loam	0-2	Somewhat Poorly Drained	28.31	1.96
Burkhardt sandy loam	6-12	Somewhat Excessively Drained	6.54	0.45

[368] SPA, p. 96, Table 26: Prime Farmland Classifications within Project Area.
[369] SPA, pp. 91-94, Table 25: Soil Units Within the Solar Facility.
[370] SPA, Appendix D: Agricultural Impact Mitigation Plan.

Burkhardt sandy loam	12-18	Somewhat Excessively Drained	7.06	0.49
Garwin silty clay loam	-----	Poorly Drained	0.55	0.04
Winnebago loam	2-6	Well Drained	26.45	1.83
Carmi loam	2-8	Well Drained	7.10	0.49
Ostrander- Carmi loams	2-6	Well Drained	67.78	4.70
Kato silty clay loam	-----	Poorly Drained	5.54	0.38
Klinger silt loam	1-5	Somewhat Poorly Drained	97.42	6.75
Kennebec silt loam	-----	Moderately Well Drained	5.94	0.41
Marshan silty clay loam	-----	Poorly Drained	6.23	0.43
Dickinson sandy loam	2-6	Well Drained	15.71	1.09
Plainfield loamy sand	0-2	Excessively Drained	2.67	0.19
Plainfield loamy sand	2-6	Excessively Drained	4.86	0.34
Rockton loam	2-6	Well Drained	5.55	0.38
Ostrander loam	1-6	Well Drained	109.18	7.57
Ostrander	6-12	Well Drained	32.99	2.29
Lindstrom silt loam, till plain	2-6	Well Drained	46.09	3.20
Spillville loam, occasionally flooded	0-2	Somewhat Poorly Drained	4.63	0.32
Maxfield silty clay loam	-----	Poorly Drained	134.27	9.31
Wadena loam	2-6	Well Drained	253.74	17.59
Wadena loam	6-12	Well Drained	4.79	0.33
Etter fine sandy loam	2-6	Well Drained	22.14	1.54
Etter fine sandy loam	6-12	Well Drained	6.02	0.42
Waukegan silt loam	1-6	Well Drained	90.82	6.30
Waukegan silt loam	6-12	Well Drained	2.40	0.17
Kanaranzi loam	2-6	Well Drained	98.11	6.80
Kanaranzi loam	6-12	Well Drained	3.22	0.22
Estherville sandy loam	2-6	Somewhat Excessively Drained	41.66	2.89
Zumbro fine sandy loam	-----	Well Drained	14.65	1.02
Klossner muck	0-1	Very Poorly Drained	65.34	4.53
Hawick gravelly sandy loam	6-12	Excessively Drained	124.32	8.62
Hawick gravelly sandy loam	12-20	Excessively Drained	13.60	0.94
Boone loamy fine sand	2-6	Excessively Drained	7.99	0.55
Boone loamy fine sand	6-12	Excessively Drained	28.48	1.97
Colo silt loam, occasionally flooded	-----	Poorly Drained	17.42	1.21
Water	-----	Poorly Drained	1.91	0.13
Solar Facility Subtotal			1442.32	

Potential Impacts

Primary impacts to soils include compaction from construction equipment, soil profile mixing during grading and pole auguring, rutting from tire traffic, drainage interruptions, and soil erosion. Impacts to soils are likely to be greatest with the below-ground electrical collection system. Potential impacts

will be positive and negative, and short- and long-term. Isolated moderate to significant negative impacts associated with high rainfall events could occur.

Construction of the solar facility will disturb approximately 972 acres within the land control area. Several of the activities proposed will require varying levels of grading; grading consists of cutting and filling earth in targeted areas, to provide a level and stable base for the project substation and access roads, and spot grading at select solar array and inverter skid locations when the arrays cannot follow existing grades. The location is relatively level, with the majority of soils in the 1-6 percent slope range, and Castle Rock Solar will minimize grading to the extent practicable.

Topsoil depth varies throughout the land control area, but most of the land is characterized by topsoil depths between 12 and 18 inches. Grading and excavating will separate the first 12 inches of topsoil, which will be stored on-site and replaced when construction is completed. Approximately 12.3 miles of underground collector and communication lines will be installed in 18-inch-wide trenches at least three feet below the surface, or conduits at least two feet below the surface.[371]

As with any ground disturbance, there is potential for soil compaction and erosion. Heavy rainfall events during construction or prior to establishment of permanent vegetation, increase the risk that significant sedimentation and erosion could occur. Inadvertent disturbance of drain tile from construction activities could disrupt existing drainage. Castle Rock Solar will maintain, repair, relocate, or replace existing drain tile (if damaged by project construction or operation) as needed.

The soils within the land control area are generally fine-loamy in texture and well drained. As a result, the soils are susceptible to compaction or rutting during wet conditions due to the fine texture of the soil. Castle Rock Solar states that construction will be designed to avoid deep compaction and rutting by limiting equipment passes, utilizing low-ground-pressure tracked vehicles, and with the use of erosion control devices such as silt fences and temporary construction matting.[372]

Soil cover and management at the solar facility will change from cultivated cropland to a mixture of impervious areas with native groundcover plantings and semi-impervious surfaces. Once permanent vegetation is properly established, stormwater management, as well as general soil health, will likely improve with the use of native plants. Soil cover and soil health are maximized by the use of native seed mixes, particularly deep-rooted native species. These high-diversity native seed mixes increase soil carbon storage and biomass of soil microbes,[373] and the penetrating root systems allow for greater water infiltration,[374] reducing soil erosion. These soil characteristics are important for growing crops, making the use of diverse, native seed mixes beneficial to participating landowners who return their parcels to agricultural production following project decommissioning.

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[371] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[372] EA, Appendix D, Question 20.
[373] Lange, Markus, et al. “Plant diversity increases soil microbial activity and soil carbon storage” 2015. Nature Communications. 6, 6707 (2015).
[374] Wang, H., Zhu, X., Zakari, S., Chen, C., Liu, W., & Jiang, X. (2022). *Assessing the Effects of Plant Roots on Soil Water Infiltration Using Dyes and Hydrus-1D*. https://doi.org/10.3390/f13071095

This project proposes installing solar panels at a minimum of 18 inches above grade at maximum tilt. This height would necessitate vegetation be kept below 18 inches high to prevent panel shading. If installed as proposed, this short distance may limit success of plantings and establishment. Castle Rock Solar states that they will use low-growing seed mixes as part of their vegetation management for the array areas.[375]

The location and amount of stored topsoil will be documented to facilitate re-spreading of topsoil after decommissioning. The segregated topsoil will have temporary and permanent stabilization measures established to prevent erosion. These benefits could extend beyond the life of the project if they are preserved through decommissioning practices, and if the site is returned to agricultural use.

Once project construction is complete, Castle Rock Solar will restore any disturbed areas to pre-construction conditions to the extent possible. BMPs to prevent soil erosion will be implemented, including temporary and permanent seeding, mulching, filter strips, erosion blankets, and sod stabilization.

MITIGATION

Several sections of the DSP (**Appendix C**) address soil-related impacts:

- Section 4.3.9 requires protection and segregation of topsoil;
- Because the project will disturb more than one acre, Castle Rock Solar must obtain a CSW Permit from the MPCA. The CSW Permit will identify BMPs for erosion prevention and sediment control. As part of the CSW Permit, Castle Rock Solar will also develop a SWPPP that describes construction activity, temporary and permanent erosion and sediment controls, BMPs, permanent stormwater management that will be implemented during construction and through the life of the project. Section 4.3.11 requires the permittee to obtain a MPCA CSW Permit and implement the BMPs within for erosion prevention and sediment control.
- Section 4.3.16 requires that “site restoration and management” practices enhance “soil water retention and reduces storm water runoff and erosion”.
- Section 4.3.17 requires the permittee to develop a VMP that defines how the land control area will be revegetated and monitored over the life of the project. Appropriate seeding rates and timing of revegetation will stabilize soils and improve overall soil health. Castle Rock Solar has included a draft VMP as Appendix E of its site permit application.
- Section 4.3.18 requires the permittee to develop an AIMP which details methods to minimize soil compaction, preserve topsoil, and establish and maintain appropriate vegetation to ensure the project is designed, constructed, operated and ultimately restored in a manner that would preserve soils to allow for the land to be returned to agricultural use. Castle Rock Solar has included a draft AIMP as Appendix D of its site permit application.

[375] SPA, Appendix E: Vegetation Management Plan

4.7.4 Surface Water and Floodplains

The ROI for surface water resources is the land control area. The impact intensity level is anticipated to be **minimal to moderate**. Direct impacts to surface waters are not expected. Indirect impacts to surface waters might occur, such as during increased rain events. These impacts will be short- and long-term. Drainage systems within the land control area could extend impacts to the South Branch Vermillion River and the main stem of the Vermillion River. Impacts can be mitigated. Significant impacts to floodplains are not anticipated. However, the project site has increased risk for flooding events due to the presence of water features.

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

The project is in the Mississippi River & Lake Pepin Major Watershed, where it lies within both the South Branch of the Vermillion River Minor Watershed and the Vermillion River Minor Watershed.[376] The DNR uses the Watershed Health Assessment Framework (WHAF) to rate the health of watersheds; WHAF uses a scale of 1 to 100 using the mean of five biological, geological, and water quality components to generate a score from low health (0) to high health (100). The Mississippi River & Lake Pepin Major Watershed has an average ecological health condition ranking of 50. The DNR indicates that lower health scores trend closely with removal of permanent vegetation, landscape changes, increased impervious surface, or altered waterbodies.[377]

The National Hydrography Dataset maps the water drainage network of the United States, representing features such as rivers, streams, canals, lakes, ponds, coastlines, dams, and streamgages. A search of the National Hydrography Dataset identified two flowlines within the land control area, one perennial stream/river, the South Branch Vermillion River, and one intermittent stream/river tributary to the South Branch Vermillion River, Tributary No. 5.[378]

The DNR's Public Waters Inventory identified one watercourse within the land control area, the South Branch Vermillion River. Public waters include wetlands, water basins, and watercourses of significant recreational or natural resource value in Minnesota. A public waters designation means that DNR has regulatory jurisdiction over the water.[379] The South Branch Vermillion River is the only Public Waters

[376] DNR, Watershed Suite, retrieved from: https://gisdata.mn.gov/dataset/geos-dnr-watersheds.
[377] DNR, Watershed Health Score. [Online] Retrieved from: https://whaf-explorer.dnr.state.mn.us/?z=7+lat=46.5338+lng=-94.4163+base=streets+eco=93+opac=0.7+topo=80+lyr=aux67,aux5,dnrTopo+lyrZ=7,6,5+lyrV=y,y,n+id=select.
[378] United States Geological Survey. (2023). *National Hydrography Dataset*, retrieved from: https://data.usgs.gov/datacatalog/data/USGS:ecd2ad5e-faa2-4291-bcdb-441b7113ea41.
[379] Public waters are defined in Minnesota Statute 103G.005, subdivision 15.

Inventory (PWI) waterbody within the area of land control. Outside of the land control area, the nearest PWI waterbody is an unnamed wetland, approximately 1.5 miles west of the project.[380]

Minnesota designates some water resources as outstanding resource value waters because of their exceptional qualities. Outstanding resource value designated waters have additional protections that conserve their unique values, which can include high water quality, exceptional recreation, cultural, aesthetic, or scientific value. There are no outstanding resource value waters in the land control area. The nearest outstanding resource value water is the Cannon River, located over 6 miles south of the project.[381]

The surface waters within the land control area include wetlands, an open water feature, agricultural ditches, and the South Branch Vermillion River and its tributary (Figure 44).[382] Surface water within the northernmost portion of the land control area, approximately 10 percent of the site, drains north towards the Vermillion River, while surface water in the central and southern portions of the land control area, approximately 90 percent of the site, drains south and east towards the South Branch Vermillion River.[383] The South Branch Vermillion River flows east through the project and then turns north to meet the main stem of the Vermillion River. The stretch of the South Branch Vermillion River approximately 0.25 miles east of the project is a designated trout stream, as is the Vermillion River's main stem. This waterway is the only trout stream within an urban metro area in the United States.[384]

Under Section 303(d) of the Clean Water Act, states are required to assess all waters of the state to determine if they meet water quality standards, list waters that do not meet standards and update the list biannually and conduct total maximum daily load studies to set pollutant-reduction goals needed to restore waters to the extent that they meet water quality standards for designated uses. The list, known as the 303(d) list, is based on violations of water quality standards. The MPCA has jurisdiction over determining 303(d) waters in the State of Minnesota.

There is one waterbody listed by the MPCA as impaired waters within the land control area, the South Branch Vermillion River, which is listed as impaired for aquatic recreation due to fecal coliform. The stretch of the South Branch Vermillion River east of Blaine Avenue, approximately 0.25 miles east of the project, is listed as impaired for aquatic recreation, due to fecal coliform, and aquatic life, due to fish and benthic macroinvertebrate bioassessments and total suspended solids.[385]

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[380] DNR. *Public Waters (PW) Basin and Watercourse Delineations*. Minnesota Geospatial Commons: https://gisdata.mn.gov/dataset/water-mn-public-waters

[381] MPCA. *Outstanding Resource Value Waters*. Minnesota Geospatial Commons: https://gisdata.mn.gov/dataset/env-orv-waters.

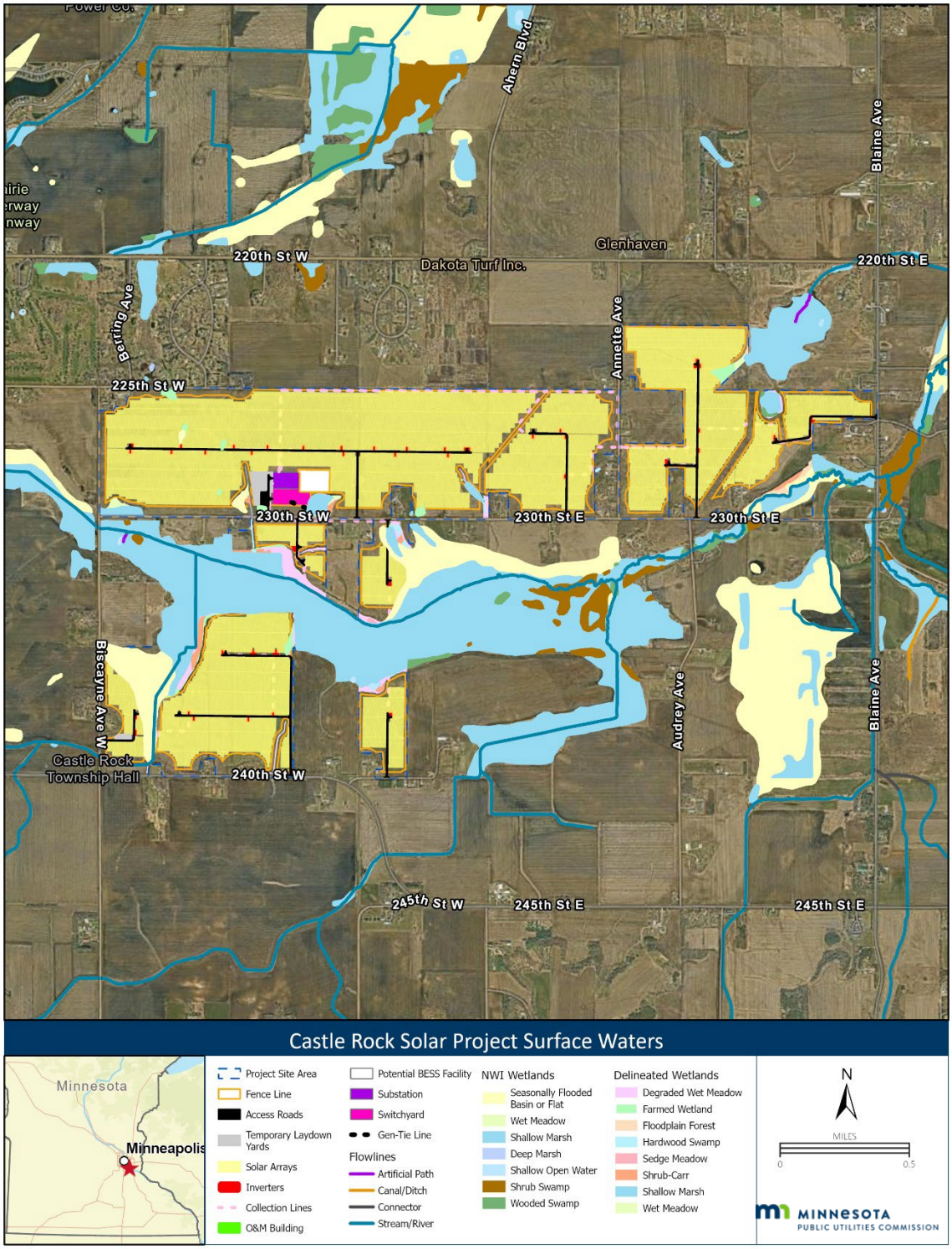
[382] SPA, pp. 97-100.

[383] SPA, Appendix G: Preliminary Stormwater Management Plan.

[384] Friends of the Mississippi River, *South Branch Vermillion River Aquatic Management Area*, retrieved from: https://fmr.org/south-branch-vermillion-river-aquatic-management-area.

[385] MPCA, MPCA Impaired Waters Viewer https://gisdata.mn.gov/dataset/impaired-waters-viewer.

Figure 44. Project Area Surface Waters



Floodplains are flat, or nearly flat, land adjacent to a river or stream that experiences occasional or periodic flooding. It includes the floodway, which consists of the stream channel and adjacent areas that carry flood flows, and the flood fringe, which includes areas covered by the flood, but which do not experience a strong current. Floodplains prevent flood damage by detaining debris, sediment, water, and ice. The Federal Emergency Management Agency (FEMA) delineates floodplains and determines flood risks in areas susceptible to flooding. Within floodplains, FEMA also classifies areas as flood zones, designating areas at risk for minimal or moderate flood hazard, and Special Flood Hazard Areas (SFHA). Flood zones defined as Zone A or AE are identified as a SFHA. SFHA's include areas at risk for a 1-percent annual chance flood, also referred to as the base flood or 100-year flood. The base flood that FEMA uses, known as the 100-year flood, has a one percent chance of occurring during each year. Other flood zones at a moderate or minimal risk of flooding would be classified as Zone X, or Zone C.[386]

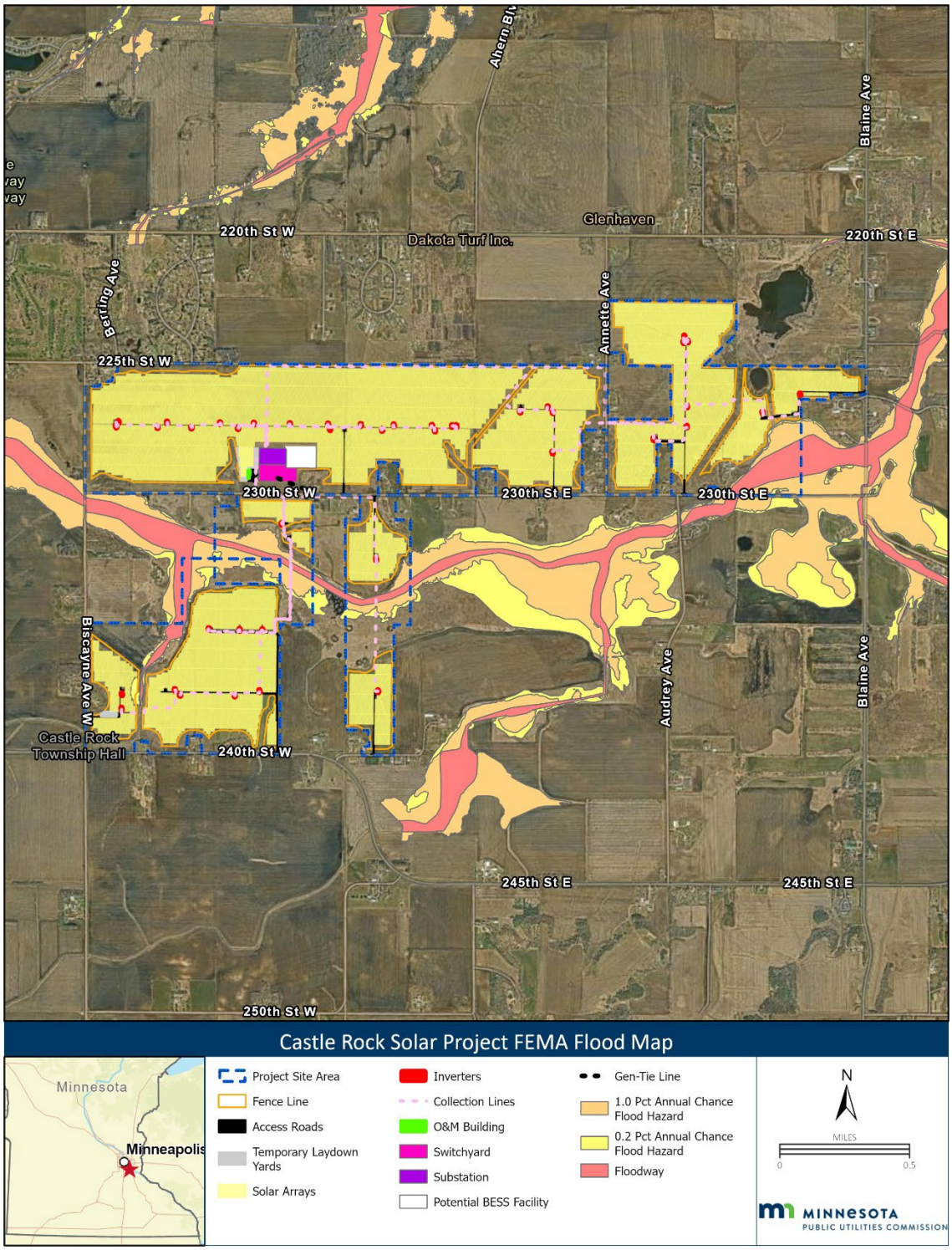
At the state level, the DNR oversees the administration of the state floodplain management program by promoting and ensuring sound land use development in floodplain areas in order to promote the health and safety of the public, minimize loss of life, and reduce economic losses caused by flood damages.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

According to the FEMA floodplain maps, there are designated floodway and flood hazard zones in the center of the land control area along the South Branch Vermillion River. Approximately three percent of the land control area (36.43 acres) is designated as a floodway. This zone represents the area that will carry the flood flow and experience a strong current in the event of a flood. Approximately four percent of the land control area (48.72 acres) is designated as Flood Hazard Zone AE. This zone represent areas at risk for 100-year storms and floods. This means there is a 1.0 percent chance of flooding annually in these areas.

Approximately one percent of the land control area (13.46 acres) is designated as Flood Hazard Zone X: Moderate Flood Hazard Area. This zone represent areas at risk for 500-year storms and floods. This means there is a 0.2 percent chance of flooding annually in these areas.[387] The remaining 92 percent of the land control area is designated as Flood Hazard Zone X: Area of Minimal Flood Hazard. This zone represent areas outside the SFHA and higher than the elevation of the 0.2 percent chance of annual flooding (Figure 45).[388] Due to Minnesota's warmer and wetter climate, there is increased risk for damaging rain events and more frequent flooding; these events could impact the project by increasing the risk of potential flooding or extending the range of the designated floodway or flood hazard zones.

[386] FEMA, Flood Zones. Glossary. https://www.fema.gov/about/glossary/flood-zones.
[387] EA, Appendix D, Question 41.
[388] DNR. *FEMA Digital Flood Rate Insurance Maps (DFIRM), Minnesota*. Minnesota Geospatial Commons: https://gisdata.mn.gov/dataset/water-dnr-fema-dfirm.

Figure 45. FEMA Flood Map



Potential Impacts

The project is designed to avoid direct impacts to surface waters by avoiding placement of project components such as access roads, solar arrays, inverters, or transmission structures in surface waters. The solar arrays, inverters, switchyard, substation, and O&M building will be placed outside of the floodway and floodplains, and the collection line crossings that cross through the floodway and floodplain will be bored or overhung across the area. Project construction will primarily occur in areas that are currently used for agricultural production.

Construction of the project creates a potential for indirect impacts if sediment or fugitive dust created by excavation, grading, vegetation removal, and construction traffic reaches nearby surface waters. The majority of the land control area drains into the South Branch Vermillion River, and ultimately drains into the Vermillion River, water resources that provides important watershed drainage, ecosystem, and recreational functions as a designated trout stream. The South Branch Vermillion River is listed as an impaired water body, as is the main stem of the Vermillion River. If appropriate erosion controls are not implemented during construction of the project, increased deposition of sediment or fugitive dust into these surface waters from stormwater runoff could occur, augmenting or furthering impairment.

Operating construction equipment close to waterways increases risk of contaminants to surface waters and groundwater in the form of fuel spills, which can lead to long-term contamination if not properly mitigated for. A fuel spill resulting from equipment operation at the two proposed horizontal directional drilling locations along the South Branch Vermillion River has the potential to contaminate to surface waters. Contamination could spread downstream to the main stem of the Vermillion River.

Increased sedimentation resulting from inadequate stormwater management could negatively impact water quality. Negative impacts could be short-term or long-term depending on the size of the sediment loads deposited into the South Branch Vermillion River and the Vermillion River's main stem. Increased sedimentation via stormwater runoff could degrade these waterways by increasing turbidity, intensifying bank erosion, impacting channel morphology, or affecting aggradation and flood capacity – all factors influenced by river sediment load.[389] This could reduce the quality of trout habitat, which could result in trout population declines and the loss of the trout stream designation.

There is also the potential for flood risk at the site. Portions of the land control area are within a designated floodway and floodplains that have been designated as an area at risk for flooding. The site includes FEMA floodplains classified as Zone AE, a SFHA at risk for a 100-year storm event, and FEMA floodplains classified as Zone X, at risk for a 500-year storm event. The collection lines are also planned to cross a floodway, Zone AE floodplain, and Zone X floodplain (Figure 45). Damage to a river's flood capacity resulting from insufficient stormwater runoff management may change the predicted flood risk in the FEMA floodway and floodplain surrounding the South Branch Vermillion River. In addition, the project site has increased risk for 100-year storm events and 100-year flood events under hotter, drier and stormier future conditions. Therefore, areas of the project site along the South

[389] Vázquez-Tarrío, D., Ruiz-Villanueva, V., Garrote, J., Benito, G., Calle, M., Lucía, A., & Díez-Herrero, A. (2024). *Effects of sediment transport on flood hazards: Lessons learned and remaining challenges*. DOI: https://doi.org/10.1016/j.geomorph.2023.108976

Branch Vermillion River could experience flooding. Proper planning and emergency response in the case of a 100-year storm or flood event will be necessary to ensure additional impacts to floodplains and surface waters do not occur.

MITIGATION

Standard construction management practices, including, but not limited to, containment of excavated soils, protection of exposed soils, stabilization of restored soils, and controlling fugitive dust, would minimize the potential for eroded soils to reach surface waters. Mitigations to reduce risks of contamination include implementing secondary containment of fuel, keeping all refueling and maintenance activities over 100 feet from waterways, having a spill kit on site, and monitoring equipment regularly for leaks.

In addition, Castle Rock Solar will develop the project in compliance with NPDES permit requirements, develop a SWPPP, and utilize BMPs during construction to control soil erosion and sedimentation, minimizing the impact on surface waters. Castle Rock Solar indicates that the installation of vegetated buffers surrounding wetlands and streams alongside the addition of perennial vegetative cover throughout the project will likely improve infiltration, prevent soil erosion and other potential pollution from entering public waters, and decrease water and soil runoff. This will reduce the volume of water draining into surface waters, the floodway, and floodplains, and could improve stream conditions for trout downstream.[390]

Castle Rock Solar will manage stormwater by installing a series of vegetated swales with ditch checks throughout the project. The land control area is divided into 14 drainage basins; vegetated swales will collect surface runoff and drain to the low point of each drainage basin. While the final number, location, and size of the vegetated swales has not been determined, Castle Rock Solar anticipates that the final design will be similar to Figure 17. The vegetated swales will be designed to meet the rate control requirements regulated by the Vermillion River Watershed Joint Powers Organization and provide the necessary treatment, in compliance with the NPDES/SDS Construction Stormwater General Permit.[391] The vegetated swales will be seeded with a wet seed mix suitable for the site.[392]

Castle Rock Solar has designed the project to avoid impacts to surface waters, floodways, and floodplains by siting facility components to avoid these resources to the extent practicable. Castle Rock Solar notes that there are three road crossings and six collection line crossings in wetlands (discussed in Section 4.7.5) and two collection line crossings across the South Branch Vermillion River and the associated floodway and floodplain. Castle Rock Solar will avoid impacts to the South Branch Vermillion River, floodway, and floodplains by boring/spanning the collection line crossings beneath/above the watercourse.

Castle Rock Solar or its engineering, procurement, and construction contractor will work to identify and locate drain tile within the land control area. During construction, care will be taken to avoid drain tile, re-route drain tile away from locations where it could be damaged, or, in the case of fields with

[390] SPA, p. 103.
[391] SPA, Appendix G: Preliminary Stormwater Management Plan.
[392] SPA, Appendix E: Vegetation Management Plan.

pattern tile networks, coordinate with applicable landowners to establish acceptable criteria for rerouting, replacing, or abandoning in place drain tile that is within a solar array area. Castle Rock Solar plans to maintain drainage system integrity during construction, including repair or other methods outlined in the AIMP filed with the Site Permit Application.[393]

The DSP (**Appendix C**) has several standard conditions that address potential impacts to surface waters:

- Section 4.3.11 requires the permittee to "implement erosion prevention and sediment control practices recommended by the [MPCA]" and to "obtain a [CSW Permit]." A CSW Permit requires both temporary and permanent stormwater controls. This section also requires implementation of erosion and sediment control measures, contours graded to provide for proper drainage, and all disturbed areas be returned to pre-construction conditions. Castle Rock Solar will also develop a SWPPP that complies with MPCA rules and guidelines. The SWPPP describes construction activity, temporary and permanent erosion and sediment controls, BMPs, permanent stormwater management that will be implemented during construction and through the life of the project. Implementation of the protocols outlined in the SWPPP will minimize the potential for soil erosion during construction.
- Section 4.3.16 requires that "site restoration and management" practices enhance "soil water retention and reduces storm water runoff and erosion".
- Section 4.3.17 requires the permittee to develop a VMP, which will allow for revegetation of the area with native vegetation, creating deep-rooted systems that allow better ground infiltration of rainfall.
- Section 4.3.25 require the permittee to replace or repair any damaged drain tile for the life of the project, unless otherwise negotiated with the landowner.
- Section 8.12 requires permittees file an *Emergency Response Plan* with the Commission and local first responders prior to operation. The plan requirements have been amended to include specific training and response plans for impacts related to 100-year storm or flooding events.

The DSP (**Appendix C**) proposes the following special condition related to surface water protection:

- Section 5.17 requires that all equipment is refueled and serviced at least 100 feet from a water body, that secondary fuel containment is utilized, that a spill kit is available, and that equipment is inspected for leaks daily. If it is not possible to conduct such activities greater than 100 feet from the watercourse, these activities must occur within a containment area that is capable of preventing the accidental release of a deleterious substance from entering a water body or contamination of soils or vegetation.

[393] SPA, Appendix D: Agricultural Impact Mitigation Plan.

4.7.5 Wetlands

The ROI for wetlands is the land control area. The impact intensity level is anticipated to be **minimal to moderate**. Direct impacts to wetlands are expected as some construction will occur in wetland areas. There is also a potential for wetlands to be indirectly affected. These impacts will be short- or long-term, of a small size, and localized. Impacts can be mitigated.

Wetlands are areas with hydric (wetland) soils, hydrophilic (water-loving) vegetation, and wetland hydrology (inundated or saturated during much of the growing season). Wetland types include marshes, swamps, bogs, and fens. Wetlands vary widely due to differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors.[394]

Wetlands are important to the health of waterways and communities that are downstream. Wetlands can be one source of hydrology in downstream watercourses and water bodies, detain floodwaters, recharge groundwater supplies, remove pollution, and provide fish and wildlife habitat. Wetland health also has economic impacts because of their key role in fishing, hunting, agriculture, and recreation. These large infrastructure projects could temporarily or permanently impact wetlands if these features cannot be avoided through project design. During construction, temporary disturbance of soils and vegetative cover could cause sediment to reach wetlands which could in turn affect wetland functionality.

The applicant assessed the potential for wetlands within the solar farm footprint through a formal wetland delineation in October of 2022 and 2023. Castle Rock Solar submitted the Wetland Delineation Report to BWSR and was issued a Notice of Decision in December 2024. Since this delineation was completed, additional acreage was added to the land control area which was surveyed in April 2025. The wetland delineation report addendum for the additional parcels is provided in **Appendix H**. Castle Rock Solar will submit the wetland delineation report addendum to the Dakota County SWCD for review and boundary concurrence.[395] The Dakota County SWCD may recommend revisions to the wetland delineation report addendum. Castle Rock Solar will provide the final wetland delineation report addendum, revised as necessary, upon receipt of Dakota County SWCD's review. Castle Rock Solar will submit a report that includes the additional acreage to BWSR for review and will file an updated Notice of Decision when it becomes available. Additional wetland analysis, including wetland mapping and identification, was conducted for this EA using desktop reviews of available resource (i.e., National Wetlands Inventory (NWI) data, DNR Public Waters Inventory, etc.).

This EA uses the NWI-MN to identify wetlands. The NWI-MN is a publicly available GIS database that provides information on the location and characteristics of wetlands in Minnesota. The inventory is a 2008 update of the USFWS National Wetlands Inventory that was completed for Minnesota in the 1980s. Wetlands listed on the NWI-MN may be inconsistent with local wetland conditions; however, the NWI-MN provides an accurate and readily available database of wetland resources within the land control area that can be used to identify wetlands at the solar facility.

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[394] USEPA. 2022. *What is a Wetland* https://www.epa.gov/wetlands/what-wetland
[395] EA, Appendix D, Question 26.

The wetland mapping using the NWI-MN identified 31 wetlands totaling approximately 398.26 acres within the land control area (Table 31).[396] The South Branch Vermillion River is the only PWI feature mapped within the land control area. There are no calcareous fens within the project, the nearest calcareous fen is 12 miles to the northwest of the project. Wetland types in the area include those listed in Table 31 below, and the site is dominated by Freshwater Emergent Wetlands and Freshwater Shrub/Emergent Wetland.

Table 31. NWI-MN Wetlands in Project

Wetland Type	Acres
Freshwater Emergent Wetland	207.77
Freshwater Forested Wetland	2.12
Freshwater Forested/Emergent Wetland	3.46
Freshwater Pond	2.10
Freshwater Shrub Wetland	9.89
Freshwater Shrub Wetland/Pond	4.58
Freshwater Shrub/Emergent Wetland	168.33
Total	**398.26**

Onsite wetland delineation field investigations were completed in October 2022 and 2023 and April 2025 by consulting companies on behalf of Castle Rock Solar. Wetlands delineated total approximately 155.2 acres within the project, approximately 11 percent of the site. The 155.2 acres make up a total of 23 wetlands. Table 32 summarizes delineated wetlands within the area of land control, which were identified during Castle Rock Solar's wetland delineations.

Table 32. Delineated Wetlands

Wetland Type	Acres in Land Control Area
Degraded wet meadow	0.61
Degraded wet meadow, Farmed wetland, Hardwood swamp, Shrub-carr, Sedge meadow	60.10
Degraded wet meadow	0.50
Degraded wet meadow	0.64
Degraded wet meadow, Farmed wetland	0.02
Degraded wet meadow, Farmed wetland	0.31
Degraded wet meadow, Hardwood swamp	1.15
Degraded wet meadow, Farmed wetland, Hardwood swamp	13.61
Degraded wet meadow, Floodplain forest, Hardwood swamp, Shrub-carr, Shallow marsh, Sedge meadow	39.31

[396] DNR. National Wetland Inventory of Minnesota. (2015). https://resources.gisdata.mn.gov/pub/gdrs/data/pub/us_mn_state_dnr/water_nat_wetlands_inv_2009_2014/metadata/metadata.html#Distribution_Information

Degraded wet meadow, Farmed wetland, Hardwood swamp, Shrub-carr	4.99
Farmed wetland	0.86
Floodplain forest, Shrub-carr	14.84
Degraded wet meadow	1.47
Wet meadow, Degraded wet meadow, Floodplain forest	3.32
Degraded wet meadow	0.06
Degraded wet meadow, Shallow marsh	4.60
Farmed wetland	0.24
Degraded wet meadow, Shallow marsh, Shrub-carr	1.54
Farmed wetland	0.60
Degraded wet meadow, Shrub-carr	4.04
Farmed wetland	0.44
Farmed wetland	1.32
Farmed wetland	0.64
Total	**155.20**

Potential Impacts

The establishment of perennial vegetation at the solar facility can create a long-term positive impact on wetlands. The extent of these positive impacts will depend on the relative abundance of perennial native species within the project and success of plantings. Once perennial vegetation has established, there will be limited disturbance to ground cover aside from scheduled vegetation management activities. Pesticides and fertilizers can run off into nearby wetlands, creating toxic conditions and nutrient surpluses. The conversion of the land control area from agricultural production to perennial vegetation will positively impact wetlands by reducing pesticide and fertilizer inputs.

Perennial, deep-rooted native species have the greatest positive impact on water quality, as their extensive root systems protect against soil erosion. In contrast, shallower root systems can increase sedimentation to wetlands as they are more susceptible to soil erosion. Increased sedimentation into wetlands can alter nutrient cycling and damage ecosystem function. Additionally, increased sedimentation can bury the wetland native seed bank and allow invasives such as Reed Canary Grass (*Phalaris arundinacea*), which is already present on site,[397] to spread. The impacts and mitigation of the array seed mix are further discussed in Section 4.7.6 (Vegetation).

The preliminary project layout locates some solar arrays and associated facilities (roads, collection lines) in wetland areas. The proposed layout has been updated since the initial application was filed and includes three road crossings in wetlands (Figure 46).[398] The layout excludes the solar arrays in the southwestern corner of the project, and the associated road and collection line which are still depicted in Figure 46; these facilities are not considered in this analysis.[399] Based on the current design, part of the belowground collection system will be horizontally directionally drilled under three

[397] SPA, p. 112.
[398] EA, Appendix D, Question 40.
[399] EA, Appendix D, Question 40.

wetlands, two waterways, and 230th Street West.[400,401] The two waterway crossings are on the South Branch Vermillion River; Castle Rock Solar states that aerial spanning may be used for the two collection line crossings on the river in the final design.[402]

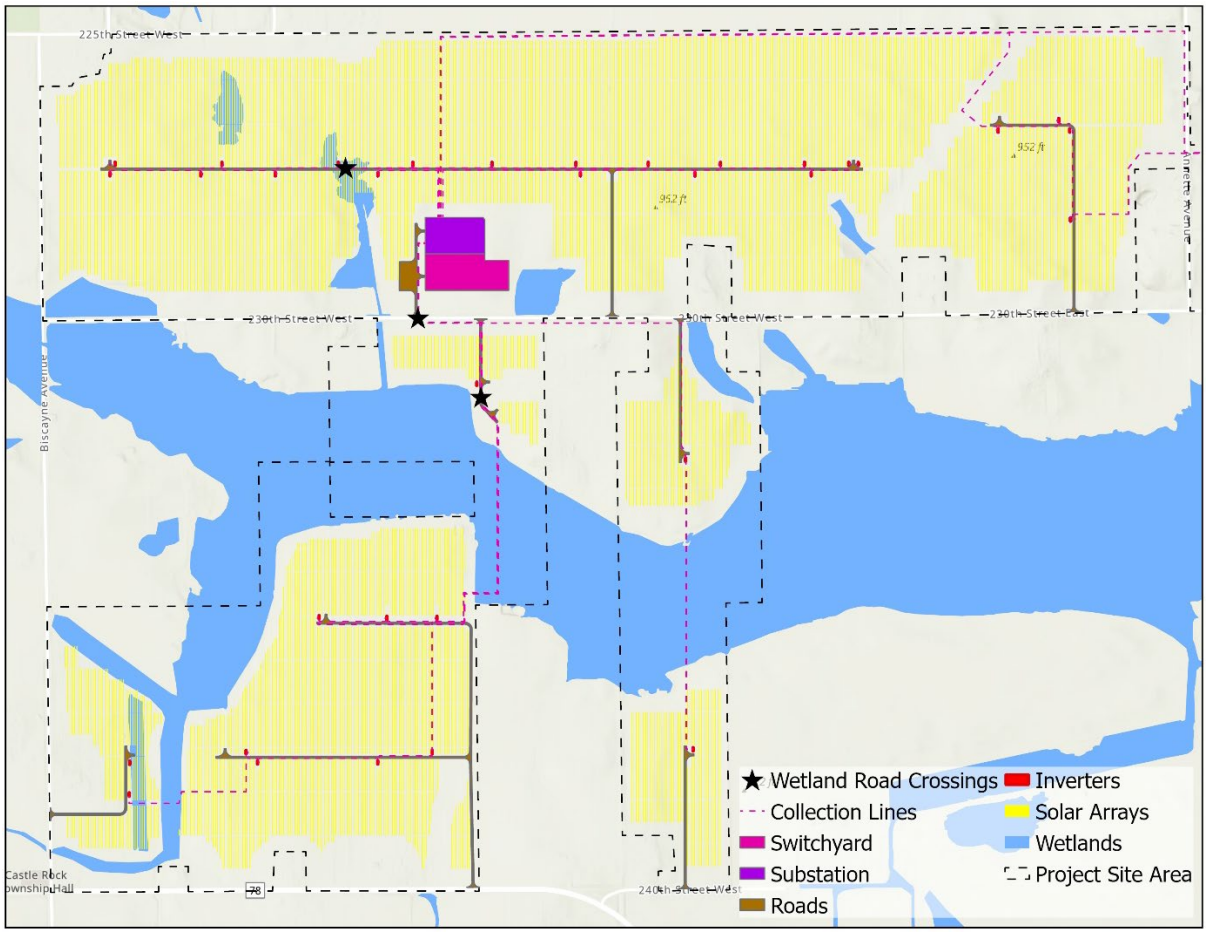
Castle Rock Solar states that no fill or excavation is proposed in wetland areas for installation of collection line poles, and all staging and stringing areas will be kept out of wetlands.[403] Castle Rock Solar mentions both horizontal directional drilling and vibratory plow[404] as methods that may be utilized for underground wetland crossings. Both methods proposed are trenchless, reducing ground disturbance impacts to wetlands. There is potential for temporary, short-term impacts to wetlands that occur during ground disturbing activities during installation of collection lines. No long-term impacts are anticipated from collection lines.

Castle Rock Solar states they will avoid use of heavy equipment within wetlands.[405] There is potential for temporary, short-term impacts to wetlands that occur during ground disturbing activities for the installation of access roads, collection lines, and solar arrays. There will be long-term ongoing impacts due to the continued use of the roads during the life of the project in the form of increased sedimentation and runoff.

Castle Rock Solar proposes constructing solar panel arrays on approximately 1.19 acres of wetland area, based on the results of field wetland delineations.[406] This does not include the arrays initially proposed in the southwestern part of the project, which have since been removed from consideration.[407] The 1.19-acre parcel proposed for solar arrays is currently farmed wetland. Each solar array is supported by driven piers and/or screw driven helical piles, and some may be placed within farmed wetland boundaries. Posts and pilings are typically not considered fill or as resulting in a wetland loss defined by the Minnesota Wetland Conservation Act (WCA). However, per WCA guidance specific to solar facilities, posts and pilings could be considered as wetland fill if they result in bringing a wetland into a nonaquatic use or if they significantly alter the wetland's function and value. The WCA program is focused on whether the panel arrays would result in a significant alteration of a wetland's function and value which in part, recognizes that not all projects negatively impact wetlands.[408]

[400] SPA, Appendix D: Agricultural Impact Mitigation Plan.
[401] EA, Appendix D, Question 22.
[402] EA, Appendix D, Question 3.
[403] EA, Appendix D, Question 3.
[404] SPA, p. 101.
[405] EA, Appendix D, Question 40.
[406] EA, Appendix D, Question 39.
[407] EA, Appendix D, Question 40.
[408] Minnesota Board of Water and Soil Resources. Guidance on Reviewing Solar Panel Projects for Wetland Conservation Act (WCA) Compliance, retrieved from: https://bwsr.state.mn.us/sites/default/files/2021-05/Solar%20Project%20guidance%20doc%205-14-21.pdf.

Figure 46. Wetland Road and Collection Line Crossings



MITIGATION

Castle Rock Solar will obtain any necessary permits and coordinate with the appropriate agency, such as the USACE under Section 404 and 401 of the Federal Clean Water Act (CWA) and the Dakota County SWCD under the Minnesota Wetland Conservation Act (WCA), prior to construction.[409]

If a permit is required, any proposed wetland impact would require full sequencing under the WCA to address wetland avoidance, impact minimization, rectification, and replacement. Additionally, under Section 404, discharge of dredged and fill material into waters of the U.S. would be regulated, most likely under the USACE Regional General Permit (Minnesota RGP-003). If the project needs approval under this general permit, Section 401 Water Quality Certification would be automatically granted as well.

Section 4.3.13 of the DSP (**Appendix C**) generally prohibits placement of the solar energy generating system or associated facilities in public waters and public waters wetlands. The permit condition does

[409] SPA, pp. 5-8, Table 3: Potential Permits/Approvals.

allow for electric collector or feeder lines to cross or be placed in public waters or public waters wetlands subject to permits and approvals by the DNR and the USACE, and local units of government as implementers of the WCA.

Section 5.18 of the DSP is a special condition that requires the permittee to consult with the Dakota County SWCD and the Vermillion River Watershed Joint Powers Association regarding the project site plan and potential wetland impacts due to construction activities.

4.7.6 Vegetation

The ROI for vegetation is the land control area. The solar facility will convert row crop farmland to perennial vegetation for the life of the project. Potential impacts of the solar facility are anticipated to be **minimal to moderate** and can be mitigated through development of a VMP.

The majority of the solar facility is located in the Oak Savanna (222Me) subsection of the Minnesota & NE Iowa Morainal Section (222M) of the Eastern Broadleaf Forest Province. This landscape of this subsection mostly consists of a gently rolling plain of loess-mantled ridges. The area was historically bur oak savanna with areas of tallgrass prairie and maple-basswood forest commonly encountered. Tallgrass prairie was concentrated on level to gently rolling portions of the landscape in the center of the subsection, bur oak savanna was found on rolling moraine ridges in the western edge of the subsection and dissected ravines in the eastern edge, and maple-basswood forests were restricted to steep, dissected ravines, which offered fire protection, or areas where steam orientation reduced fire severity or frequency. Fire was the most important natural disturbances before settlement, but tornados and high winds also created significant disturbances. Periodic flooding occurs in river and stream valleys. The current land-use in the subsection is predominately agricultural, but urban development is accelerating along the northern boundary.

A smaller portion of the solar facility is in the Rochester Plateau Subsection (222Lf) of the Paleozoic Plateau Section (222L) of the Eastern Broadleaf Forest Province. This landscape of this subsection consists of level to gently rolling older till plains. The area was historically made up of communities of bur oak savanna and tallgrass prairie. Fire was an important natural disturbance in upland prairie and oak savanna communities before settlement, but records of tornados and ice storms demonstrate that these disturbances locally impacted forested vegetation. The current land-use in the subsection is predominately agricultural, while species characteristic of oak openings and barrens are found to be abundance, the area of most of these remaining communities is small. [410]

The National Land Cover Database provides “spatial reference and descriptive data for characteristics of the land surface” nationwide.[411] The land cover within the project area is dominated by cultivated agriculture, with scattered areas of forest, native vegetation, wetlands, open water, and developed areas around roads and parcel boundaries.

[410] DNR (n.d.) *Ecological Classification System: Ecological Land Classification Hierarchy*, retrieved from: https://www.dnr.state.mn.us/ecs/index.html

[411] U.S. Geological Survey. *The National Land Cover Database*. (February 2012), retrieved from: https://www.usgs.gov/centers/eros/science/national-land-cover-database

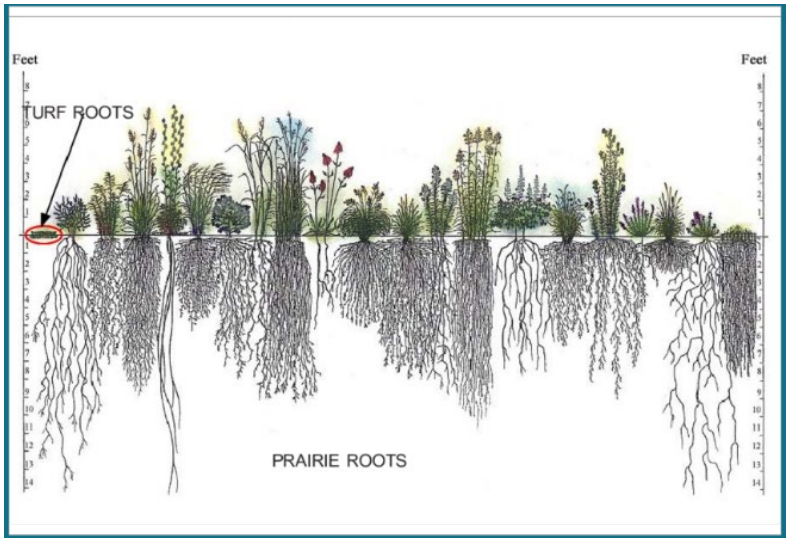
Potential Impacts

Construction of the solar facility will eliminate vegetative cover, including temporary vegetation removal and permanent tree removal, and create impermeable surfaces at access roads, inverter skids, the substation and switchyard, O&M building, and laydown yards. Removal of vegetative cover exposes soils and could result in soil erosion. Vegetation removal in the vicinity of the South Branch Vermillion River, the FEMA-designated floodplain, or the wetlands and open water feature within the land control area could be particularly impactful, as it could result in bank erosion and/or increased sedimentation into surface water systems. Temporary or permanent removal of vegetation also has the potential to affect wildlife habitat. Any tall growing woody vegetation in the preliminary development area will be removed.

Non-impervious portions of agricultural land within the solar facility would be converted to a native, low-growing vegetative cover in accordance with the project's vegetation management plan (VMP). The establishment of native vegetation will be compatible with the project's operations and beneficial to the natural areas within and adjacent to the site, resulting in a net benefit in vegetative cover for the life of the project.[412]

Establishment of diverse, native perennial vegetation will occur within the site, including, herbaceous species that flower during the growing season and act as a nectar source throughout the growing season to support native pollinators. A recent Minnesota study found that utility-scale solar habitats with pollinator vegetation increased native bee abundance, resulting in increased pollination visits to bordering agricultural fields.[413] In addition, the deep and varied root systems of native plant species (Figure 47) will penetrate the soil and increase water infiltration within the site,[414] reducing the potential for surface runoff to result in increased sedimentation or soil erosion.

Figure 47. Root Systems



[412] SPA, Appendix E: VMP.

[413] Walston, L., Hartmann, H., Fox, L., Macknick, J., McCall, J., Janski, J., & Jenkins, L. (2023). *If you build it, will they come? Insect community responses to habitat establishment at solar energy facilities in Minnesota, USA*, retrieved from: https://iopscience.iop.org/article/10.1088/1748-9326/ad0f72.

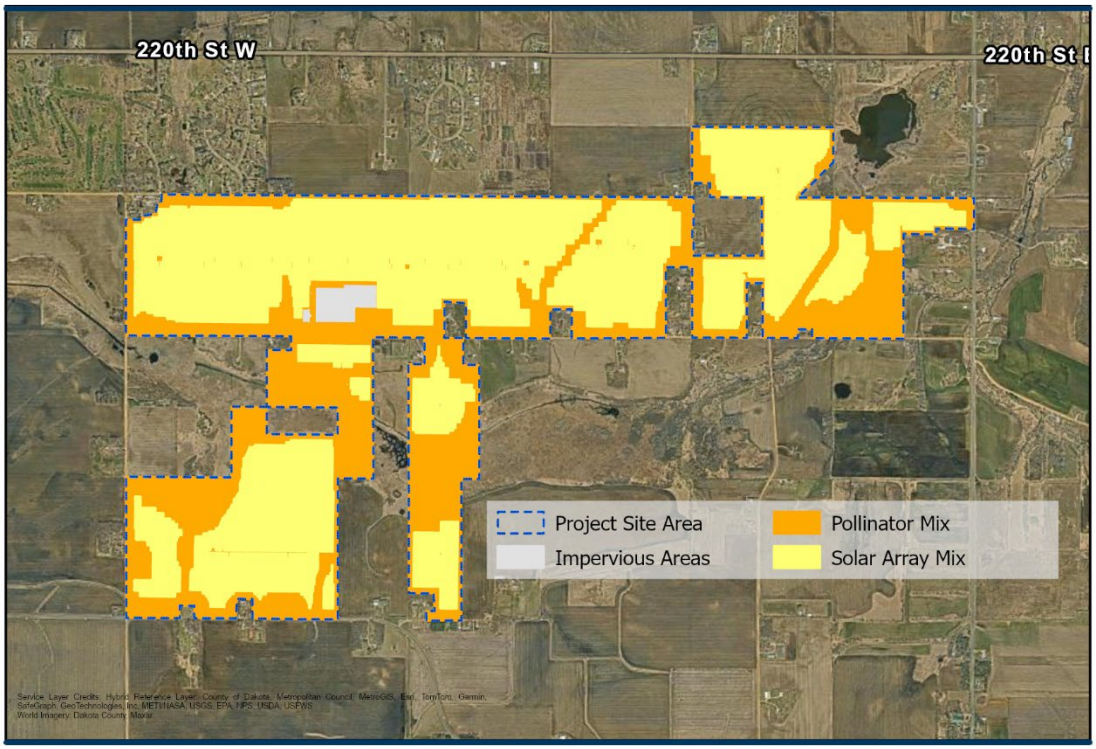
[414] MnDOT, *Minnesota Soil Bioengineering Handbook*. (2005). Retrieved from: https://www3.uwsp.edu/cnr-ap/UWEXLakes/PublishingImages/resources/restoration-project/MN%20Soil%20Bioengineering%20Handbook.pdf.

Castle Rock Solar plans to use two seed mixes to establish perennial vegetation throughout the project (Figure 48, Table 33). The Pollinator Mix, which consists of a diverse mix of native vegetation species, will be installed in disturbed areas outside of the array blocks. The Solar Array Mix, which consists of short-statured native vegetation species, will be installed under the arrays. The Solar Array mix utilizes species which do not typically grow taller than 2 feet and are therefore anticipated to not impede or shade solar panels or obstruct maintenance and access. However, the project proposes installing solar panels at a minimum of 18 inches above grade at maximum tilt. This height would impose further height restrictions on vegetation, and could limit success of native plantings and establishment. If native species are unable to develop and flower they will not persist at the site, and could be edged out by invasive species and noxious weeds.

Table 33. Project Vegetation Management Units Acreage

Vegetation Management Units	Acres
Solar Array Mix	814.8
Pollinator Mix	547.7
Total	**1,362.5**

Figure 48. Vegetation Management Units within Project



Construction activities at the solar facility could introduce or spread invasive species and noxious weeds and the early phases of site restoration and seeding of native species can result in populations of non-native and invasive species establishing on site. Seed mixes will have a harder time establishing during site restoration if there are large populations of invasive species or noxious weeds on site. Control of invasive species and noxious weeds will be ongoing during the construction and operation of the project.[415]

MITIGATION

Several sections of the DSP (**Appendix C**) address impacts to vegetation:

- Section 4.3.17 requires the permittee to develop a VMP in coordination with state agencies and to file the VMP prior to construction. The applicant has prepared a draft VMP as Appendix E of the Site Permit application. The VMP must include the following:
    - Management objectives addressing short term (Year 0-3, seeding and establishment) and long term (Year 4 through the life of the permit) goals.
    - A description of planned restoration and vegetation management activities, including how the site will be prepared, timing of activities, how seeding will occur (broadcast, drilling, etc.), and the types of seed mixes to be used.
    - A description of how the site will be monitored and evaluated to meet management goals.
    - A description of the management tools used to maintain vegetation (e.g., mowing, spot spraying, hand removal, fire, grazing, etc.), including the timing and frequency of maintenance activities.
    - Identification of the third-party (e.g., consultant, contractor, site manager, etc.) responsible for restoration, monitoring, and long-term vegetation management of the site.
    - Identification of on-site noxious weeds and invasive species (native and non-native) and the monitoring and management practices to be utilized.
    - A site plan showing how the site will be revegetated and that identifies the corresponding seed mixes. Best management practices should be followed concerning seed mixes, seeding rates, and cover crops.
- Section 4.3.18 requires the permittee to develop an AIMP which details methods to minimize soil compaction, preserve topsoil, and establish and maintain appropriate vegetation to ensure the project is designed, constructed, operated, and ultimately restored in a manner that would preserve soils to allow for the land to be returned to agricultural use. Castle Rock Solar has included a draft AIMP as Appendix D of its application.

[415] SPA, Appendix E: VMP.

- Section 4.3.15 requires the permittee to minimize the number of trees removed and to leave existing low growing species in the ROW undisturbed to the extent possible, or to replant to blend in with adjacent areas following construction.

Castle Rock Solar will require construction equipment arriving on site to be free of soil and existing vegetation, such as leaves. Designated cleaning areas will be used to remove noxious weeds and/or seeds from equipment, and the cleaning areas will be monitored for the presence of invasive species. Prior to departing the site, construction equipment will be cleaned, and all soil and existing vegetation will be removed.

No additional mitigation is proposed.

4.7.7 Wildlife and Habitat

The ROI for non-avian terrestrial wildlife and their habitats is the land control area, the ROI for birds is the local vicinity, and the ROI for aquatic wildlife and their habitats is the project area. Potential impacts may be positive or negative and are species dependent. Long-term, positive impacts to small mammals, insects, snakes, etc. would likely occur; impact intensity would depend on the amount and quality of habitat created by the project. Impacts to large wildlife species, for example, deer, will be **negligible**. **Significant negative impacts** could occur to individuals during construction and operation of the project.

Once restored, the land control area will provide native habitat for the life of the project. The project does not contribute to significant habitat loss or degradation or create new habitat edge effects. The introduction of PV panels and fencing creates the potential for bird collisions and funneling wildlife towards roads as they travel between the surrounding habitat patches. Potential impacts can be mitigated in part through project design and BMPs. The impact intensity level is expected to be **minimal to moderate**.

The project landscape is dominated by agriculture and developed areas (roads, housing communities, urban areas, and farmsteads). The city of Farmington is located approximately 500 feet from the project. Landscape types and vegetation communities vary throughout the local vicinity. Fencerows and ditches, riparian areas, as well as small pockets of wetlands and trees, provide habitat for terrestrial and avian wildlife. Directly east of the project, the Hampton Woods WMA provides habitat for terrestrial wildlife. Additional terrestrial and aquatic wildlife habitat is found approximately 2.25 miles north of the project in the Vermillion River Complex.

Wildlife utilizing the project area are common resident and migratory species associated with disturbed habitats and are accustomed to human activities (e.g., agricultural activities and road traffic) occurring in the area. Mammals, reptiles, amphibians, and insects are present. Species that may use habitats typical of land cover within the project area include:

- Mammals near agricultural areas such as white-tailed deer, mice, voles, raccoons, mammals nearer to woodland habitats such as bats, and opossum, and mammals such as muskrats possible near wetlands;
- Reptiles near plant diverse areas or wetlands such as garter and redbelly snakes, turtles, and skinks;
- Amphibians near agricultural, grassland, or wetland areas such as the northern leopard frog and American toads;

- A variety of insects including native bees, butterflies, and moths;
- Bird species near open fields and agricultural areas such as kildeers, pheasants, turkeys, red-tailed hawks, grackles, meadowlarks, bobolinks, horned larks, and American kestrels;
- Waterfowl and shorebirds near wetlands areas such as mallards, Canada geese, and red-winged blackbirds; and
- Common woodland bird species such as cardinals, chickadees, and nuthatches.

The project area is within the Level III Western Corn Belt Plains (47), and Level IV Lower St. Croix and Vermillion Valleys (47g) ecoregions. The South Branch Vermillion River is 303d listed downstream of the project until it reaches its confluence with the Vermillion River; this reach is also impaired for aquatic life and aquatic recreation.[416] The portion of the South Branch that bisects the project is not 303d listed but is impaired for aquatic recreation due to the presence of fecal coliform. More information about the South Branch is discussed in Section 4.7.4 (Surface Water and Floodplains).

There are several federally and state listed species present or potentially present within the project area or vicinity; these include the Loggerhead shrike, northern long-eared bat, and rusty patched bumble bee. There is also an MBS site for biodiversity significance present within the project. Each of these unique resources, along with impacts and mitigations, are discussed in detail in Section 4.7.8 (Rare and Unique Resources) below.

Potential Impacts

The impact intensity level is expected to be minimal to moderate. Impacts could be positive or negative and depend on species type. Potential impacts will be short- and long-term and can be mitigated.

Terrestrial Wildlife

Individuals will be displaced to adjacent habitats during construction. Because the land control area does not provide critical habitat, this should not impact life cycle functions, for example, nesting. Direct significant impacts to individuals might occur, that is, small species might be crushed or otherwise killed during construction. Population level impacts are not anticipated.

Plastic erosion control netting is frequently used for erosion control during construction and landscape projects and can negatively impact wildlife populations. Wildlife entanglement from plastic netting and other plastic materials has been documented in mammals and reptiles and can lead to injuries, such as lacerations or spinal damage, and even result in death due to strangulation or overheating.[417]

[416] MPCA, MPCA Impaired Waters Viewer, retrieved from: https://gisdata.mn.gov/dataset/impaired-waters-viewer.

[417] Stuart, J.N., Watson, M.L., Brown, T.L., & Eustice, C. (2001). *Plastic netting: An entanglement hazard to snakes and other wildlife*, retrieved from:

The largest impact to wildlife associated with solar facilities is fencing. Fencing can directly impact wildlife, through a physical interaction with the fence, or indirectly impact wildlife, by leading to a behavioral change. These impacts can be positive or negative, depending on the design and purpose of the fence. Potential positive impacts from project fencing are limited, as the fencing is designed to be an exclusion fence meant to protect the solar facility. Exclusion fences are impermeable to medium and large mammals and semi-permeable to small mammals, birds, and reptiles.[418] Small animals who can move through project fence openings may be protected within facility fences,[419] giving them a safe refuge for shelter or rearing their young.

Potential negative impacts from project fencing are more numerous. Project fencing will be 8 ft-high woven wire fences,[420] which is below the height recommended by the DNR.[421] This may increase the risk of larger wildlife, such as deer, getting stuck within the facility; the presence of project components may hinder wildlife from reaching the speed necessary to clear the fence from the inside. Additionally, although deer can jump many fences, they can become tangled in both smooth and barbed-wire fences, especially if the wires are loose or installed too closely together.[422] Wildlife that collides with fencing can be killed or injured, while those that become entangled may die from starvation or incur greater injuries in attempts to free themselves. Predators can use fences to corner and kill prey species,[423] and young animals that cannot cross fences can be separated from their mothers and die.[424]

Fences can act as barriers that block wildlife movement,[425] interrupt behavior patterns,[426] and prevent them from accessing resources. This can be particularly impactful if fences remove or reduce wildlife

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https://www.researchgate.net/publication/286280488_Plastic_netting_An_entanglement_hazard_to_snakes_and_other_wildlife

[418] Jakes, A.F., Jones, P.F., Paige, L.C., Seidler, R.G., & Huijser, M.P. (2018). *A fence runs through it: A call for greater attention to the influence of fences on wildlife and ecosystems*. DOI: https://doi.org/10.1016/j.biocon.2018.09.026

[419] Brooks, M.L. 1999. *Effects of protective fencing on birds, lizards, and black-tailed hares in the western Mojave Desert.* DOI: https://doi.org/10.1007/s002679900194

[420] SPA, p. 44.

[421] DNR. *Commercial Solar Siting Guidance*. (2023). Retrieved from: https://files.dnr.state.mn.us/publications/ewr/commercial_solar_siting_guidance.pdf

[422] Colorado Division of Wildlife. *Fencing with Wildlife in Mind.* (2009). https://cpw.state.co.us/Documents/LandWater/PrivateLandPrograms/FencingWithWildlifeInMind.pdf

[423] Marcel Huijser, et al. *Construction Guidelines for Wildlife Fencing and Associated Escape and Lateral Access Control Measures.* (April 2015). http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25%2884%29_FR.pdf, page 27.

[424] Harrington, J.L. & Conover, M.R. (2006). *Characteristics of ungulate behavior and mortality associated with wire fences*, https://doi.org/10.2193/0091-7648(2006)34%5b1295:COUBAM%5d2.0.CO;2

[425] Sawyer, H., Kauffman, M.J., Middleton, A.D., Morrison, T.A., Nielson, R.M., & Wyckoff, T.B. (2012). *A framework for understanding semi-permeable barrier effects on migratory ungulates*. https://doi.org/10.1111/1365-2664.12013

[426] Maida, J.R., Bishop, C.A., & Larsen, K.W. (2019). *Migration and disturbance: impact of fencing and development on Western Rattlesnake (Crolatus oreganus) spring movements in British Columbia.* https://doi.org/10.1139/cjz-2019-0110

travel corridors in fragmented landscapes where wildlife must increase movement between habitat patches to obtain adequate resources.[427] Even small animals may need to move between habitat patches in search of food, shelter, and mating opportunities.[428] Fences can also direct wildlife onto roads, increasing both wildlife and motorist fatalities where the ends of fence lines provide openings for road crossings. This "fence-end effect" can displace roadkill locations to road sections at fence end points,[429] creating high risk collision zones. Mobile wildlife that frequently cross roads between habitats experience increased wildlife-vehicle collision risk, and roads in connected landscapes with suitable wildlife habitat are more dangerous.[430]

The impacts of project fencing on animal movement must be considered in context with the project landscape. There is wildlife habitat in the form of public lands within a mile of the project location. Wildlife in the area move between these habitat patches to meet their resource needs. MN 50 runs north of the project, and many roads like Annette Avenue and 230th Street East and West bisect the project. Wildlife must cross these roads to move between the habitats in the surrounding area. Once project fencing is installed, the travel corridors of medium- and large-sized animals moving between habitat patches will be limited to the passages between fence lines.

Castle Rock Solar identifies county and township setbacks related to fencing[431], and states that their planned design will meet or exceed these setbacks.[432] As long as these setbacks are implemented, the design should be sufficient to meet standard DNR recommendations to mitigate disruptions to wildlife travel corridors.[433] Medium- and large-sized animals may face increased vehicle collision risk at fence ends as they attempt to cross roads adjacent to the project to access habitat.

This project proposes installing solar panels at a minimum of 18 inches above grade at maximum tilt. If installed at 18 inches, this short distance may limit success of plantings and establishment. This height would necessitate vegetation be kept at 18 inches high to prevent panel shading. Castle Rock Solar states that they will use low-growing seed mixes as part of their vegetation management for the array areas.[434]

Birds

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[427] Marable, K.M., Belant, J.L., Godwin, D., & Wang, G. (2012). *Effects of resource dispersion and site familiarity on movements of translocated wild turkeys on fragmentated landscapes*. https://doi.org/10.1016/j.beproc.2012.06.006

[428] Nordberg, E., Ashley, J., Hoekstra, A., Kirkpatrick, S., & Cobb, V.A. (2021). *Small nature preserves do not adequately support large-ranging snakes: Movement ecology and site fidelity in a fragmented rural landscape.* https://doi.org/10.1016/j.gecco.2021.e01715

[429] Plante, J., Jaeger, J.A.G., & Desrochers, A. (2019). *How do landscape context and fences influence roadkill locations of small and medium-sized mammals?* https://doi.org/10.1016/j.jenvman.2018.10.093

[430] Bénard, A., Lengagne, T., & Bonenfant, C. (2024). *Integration of animal movement into wildlife-vehicle collision models*. https://doi.org/10.1016/j.ecolmodel.2024.110690

[431] SPA, p. 33.

[432] SPA, p. 72.

[433] Minnesota Department of Natural Resources. *Commercial Solar Siting Guidance.* 2023. Retrieved from: https://files.dnr.state.mn.us/publications/ewr/commercial_solar_siting_guidance.pdf

[434] SPA, Appendix E: Vegetation Management Plan

The USFWS Information for Planning and Consultation (IPaC) report identified 17 species of Birds of Conservation Concern with potential to occur in the area; species include chimney swift, bobolink, grasshopper sparrow, lesser yellowlegs, and pectoral sandpiper. The species identified have varying probabilities of presence in the project area.

Bird injuries or mortality may occur due to lack of fencing visibility. Raptors in pursuit of prey may be vulnerable to the nearly invisible wire strands, although other low flying birds such as grouse, waterfowl, and owls are also vulnerable to fence collisions. The proximity of WMAs adjacent to the project may increase the risk of waterfowl-fence collisions, specifically the Vermillion River Complex, as this area provides habitat for waterfowl, pheasants, and turkey.

Risks to birds have been identified near PV solar facilities. Preliminary findings in one report, based on limited data, suspect a large expansive of dark panels may be reminiscent of a large body of water. Deemed the "Lake Effect Hypothesis", or LEH, the study suggests that migrating birds, confusing the solar facility with a body of water, attempt to land, consequently incurring trauma and related predation.[435] However, a separate study proposes that the LEH is a much more nuanced process; rather than a solar facility providing a signal of a lake to all aquatic birds at all times, only certain aquatic bird species are attracted to solar facilities, and this attraction is likely context-dependent. Water-obligate bird species in arid environments that lack water may be most susceptible to this "Lake Effect," as these species rely heavily on aquatic habitat to survive and reproduce.[436]

Overall, utility-scale solar facilities have been found to have avian mortality rates that are notably lower than mortality caused by other human structures, including communication towers, vehicles, and buildings and windows.[437] However, the proximity of solar panels, which waterfowl may confuse with a large body of water, to Waterfowl Production Areas (WPAs) and riverine habitats may increase waterfowl-panel collision risk. WPAs and riverine habitats are important nurseries and breeding habitat for North America's waterfowl, and the presence of a solar facility near these habitats could result in LEH impacts; the extent of any such impacts is uncertain.

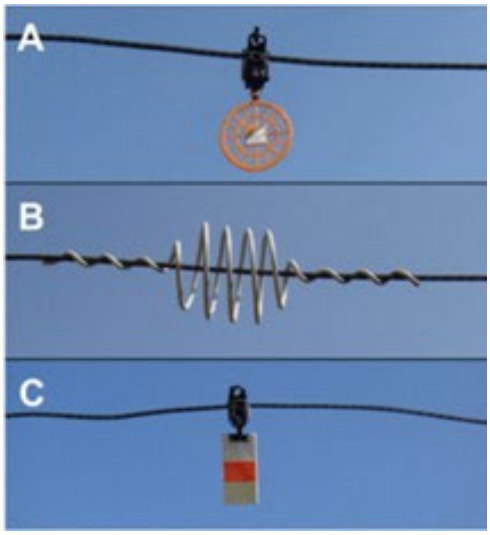
[435] USFWS Forensics Lab. *Avian Mortality at Solar Energy Facilities in Southern California*. (2014). http://www.ourenergypolicy.org/wp-content/uploads/2014/04/avian-mortality.pdf

[436] Kosciuch, K., Riser-Espinoza, D., Moqtaderi, C., & Erickson, W. (2021). Aquatic habitat bird occurrences at photovoltaic solar energy development in Southern California, USA. DOI: https://doi.org/10.3390/d13110524

[437] Walston, L., Szoldatits, K., Lagory, K., Smith, K., & Meyers, S. (2016). *A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States*. DOI: https://doi.org/10.1016/j.renene.2016.02.041

Birds are also susceptible to electrocution from transmission lines. Electrocution is a risk if the conductors or ground wires are close enough together that a bird can touch two conductors simultaneously with its wings or other body parts. Independent of the risk of electrocution, birds might be injured or killed by colliding with transmission line structures and conductors. The risk of collision is influenced by several factors including habitat, flyways, foraging areas, and bird size. Waterfowl, especially larger waterfowl such as swans and geese, are more likely to collide with transmission lines. If the final project design includes aerial span collection lines over the South Branch Vermillion River, the potential of these impacts occurring would be greater. Castle Rock Solar states that they will use avian diverters on the collection line if the aerial span method is chosen (Figure 49).[438]

Figure 49. Example Avian Diverters



Plastic erosion control netting can negatively impact bird populations. Both aquatic and terrestrial birds are susceptible to entanglement, experiencing injury, impaired mobility, and death.[439]

Aquatic Wildlife

Aquatic habitats present within the land control area include the South Branch Vermillion River, its tributaries, and its associated floodplains and wetlands. Drainage systems within project boundaries connect to the South Branch Vermillion River, extending the range of potential impacts to downstream habitats in the Vermillion River.

Monitoring of the South Branch Vermillion River subwatershed has indicated that levels of e. coli and total suspended solids exceed established water quality standards for this system.[440] Sediment has been identified as the primary pollutant of concern for this subwatershed. There have been past Conservation Plans in place on parcels adjacent to the project that were funded through the NRCS Environment Quality Incentives Program (EQIP) to address sediment and nutrient issues.[441] There are several DNR Aquatic Management Areas (AMA) to the north and northeast of the project, specifically the South Branch Vermillion River AMA which is downstream of the project.

The South Branch Vermillion River has been identified as a top priority for implementing projects to reduce nitrates, address nutrient management, restore wetlands and address water storage

[438] EA, Appendix D, Question 3.
[439] Ryan, P. (2018). Entanglement of birds in plastics and other synthetic materials. DOI: https://doi.org/10.1016/j.marpolbul.2018.06.057
[440] Dakota County Soil and Water Conservation District. 2022. *Subwatershed Analysis for South Branch Vermillion River*. Retrieved from: https://dakotaswcd.org/wp-content/uploads/2022/05/2022-South_Branch_Vermillion_River_SWA_Report.pdf
[441] Dakota County Soil and Water Conservation District. *Conservation Projects Map*. Retrieved from: https://dakotaswcd.org/conservation-projects/

practices.[442] A geomorphic report provided by DNR in 2020 recommends addressing culvert crossings and projects aimed at surface erosion reduction to address aquatic habitat sediment issues in the lower South Branch Vermillion River.[443]

The South Branch Vermillion River is a DNR designated trout stream[444] containing brown trout, brook trout, and rainbow trout, as well as northern pike, sunfish, and walleye. Non-game species observed in previous surveys include minnow, darters, dace, chubs, and sucker species.[445] Other aquatic wildlife that may utilize the stream and riparian habitats include salamanders, turtles, snakes, frogs, and toads. Previous Index of Biotic Integrity surveys have indicated good health of the aquatic community in the South Branch Vermillion River, which includes a survey of macroinvertebrate species and abundance.[446]

Ground disturbing activities, particularly near waterways, can increase sedimentation that can impact macroinvertebrate abundance by filling in interstitial spaces, subsequently reducing available habitat. Fish consume macroinvertebrates as part of their diet during multiple life stages, especially during development as fry. Therefore, a reduction in macroinvertebrate abundance can have a direct impact on food availability for fish and can cause a local decline in recruitment. Increased fine sediment can also affect fish by obstructing their feeding patterns with increased turbidity and reducing available spawning habitats.

The only activity proposed within riparian areas that has the potential to increase sediment to the South Branch Vermillion River is the horizontal boring of collection lines at two locations. Horizontal boring is a trenchless method of construction that reduces erosion and can reduce impacts to stream channels when compared to other methods. The horizontal boring activities include excavation of bore pits on both sides of the river and are proposed within a minimum distance of 10 feet from the channel (Figure 19). If appropriate erosion control measures and site rehabilitation are not implemented during and after horizontal boring, increased sedimentation could occur, augmenting or further impairing the river system in the long-term.

Impacts and mitigations related to surface water contamination from horizontal boring are discussed in Section 4.7.4 (Surface Water and Floodplains). Fuel spills and other contaminants can cause aquatic

[442] Vermillion River Watershed Joint Powers Organization. *Vermillion River Watershed Management Plan*. 2016. Retrieved from: https://www.vermillionriverwatershed.org/wp-content/uploads/2022/09/FINAL-VRW-Watershed-Management-Plan-as-Amended-9_22_22-web.pdf

[443] Minnesota Department of Natural Resources. *South Branch Vermillion River: Minnesota Department of Natural Resources Geomorphic Overview*. 2020. Retrieved from: https://www.vermillionriverwatershed.org/wp-content/uploads/2024/06/MN-DNR-South-Branch-Vermillion-Geomorphology-Report.pdf

[444] Minnesota Department of Natural Resources. *Trout Fishing Streams and Lakes*. Retrieved from: https://www.dnr.state.mn.us/fishing/trout/map.html

[445] Minnesota Pollution Control Agency. *Surface Water Data*. Retrieved from: https://webapp.pca.state.mn.us/surface-water/station/08LM118

[446] Minnesota Pollution Control Agency. *Surface Water Data*. Retrieved from: https://webapp.pca.state.mn.us/surface-water/station/08LM118

wildlife kills, even in small amounts. If fuel storage and spill prevention measures are implemented, contamination is unlikely to occur.

There is little established data on the impacts of horizontal boring on aquatic organisms. During construction, horizontal boring could have short-term impacts to fish due to underwater noise pollution and vibrations; these stressors can cause physiological responses in the form of behavioral changes and stress. The most likely response to these stressors from short-term construction activities is displacement and habitat avoidance. Short-term and localized impacts to fish are anticipated from this activity, however no long-term impacts are anticipated.

Construction and operation of the facility can create fugitive dust from soil movement or transportation on unpaved roads. Castle Rock Solar has indicated they plan to use water or other dust control agents to suppress fugitive dust. Dust control agents used during construction frequently contain chloride, which can persist in the environment and accumulate to toxic levels. Chlorides readily spread through water systems and harm aquatic wildlife. Low concentrations of chloride exposure can impact growth, reproduction, and physiology, while high concentrations can result in death.[447] Castle Rock Solar states that they are committed to using non-chlorine dust control measures.[448] No road construction is proposed over live stream channels and there will be no unpaved road stream crossings, therefore there are no impacts anticipated from travel on unpaved roads.

Aquatic wildlife can be injured or killed by entanglement in plastic erosion control netting. Additionally, the use of erosion control methods containing plastic, such as plastic erosion control netting or hydro-mulch products with synthetic plastic fibers, can result in macro- or micro-plastic drainage into aquatic systems. Plastic pollution has consequences across aquatic trophic levels; it can be ingested by a variety of aquatic wildlife, impacting their growth and survival.[449]

Malachite green dye is commonly used in hydro-mulch erosion control products, and it can easily drain into aquatic systems. Malachite green dye has a wide range of negative toxicological effects on aquatic wildlife, including, but not limited to, carcinogenesis, mutagenesis, respiratory toxicity, multi-organ tissue injury, and developmental abnormalities.[450]

Nocturnal Wildlife

The presence of facility lighting has the potential to interrupt the daily cycle of light and dark for animals in the surrounding area. Exposure to artificial light at night impacts the physiology, behavior, and survival of a variety of wildlife: restricting their movement, impairing their foraging, inhibiting

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[447] Southeastern Wisconsin Regional Planning Commission. 2024. *Impacts of Chloride on Biological Systems.* Retrieved from: https://www.sewrpc.org/SEWRPCFiles/Environment/ChlorideImpactStudy/TR-62-Chapter3PreliminaryDraft.PDF

[448] SPA, p. 86.

[449] Ali, N., Khan, M.H., Ali, M., Sidra, Ahmad, S., Khan, A., Nabi, G., Ali, F., & B, M. (2024). *Insight into microplastics in the aquatic ecosystem: Properties, sources, threats, and mitigation strategies.* DOI: https://doi.org/10.1016/j.scitotenv.2023.169489

[450] Srivastava, S., Sinha, R., & Roy, D. (2004). *Toxicological effects of malachite green.* DOI: https://doi.org/10.1016/j.aquatox.2003.09.008

their communication, and even leading them to their death.[451] Light color can influence the impacts of nighttime artificial light exposure, with blue- and white-rich lighting having greater negative effects on wildlife, particularly to highly sensitive groups such as insects.[452] The only permanent lighting proposed is security lighting for the substation, switchyard, and O&M facility. Temporary lighting will be utilized for construction in the main laydown areas. Castle Rock Solar states that all temporary and permanent lighting will follow DNR's facility lighting guidance.[453,454]

Noise Pollution

The noise pollution emitted by human activities can impact the health and behavior of wildlife. Over prolonged periods, extremely high noise levels can physically harm wildlife, while lower noise levels may increase stress or impair wildlife communication, which can impact foraging ability, predator avoidance, and mating success.[455,456]

As discussed in Section 4.3.2 (Noise), noise produced during construction and operation would become less the farther from the source. Wildlife utilizing habitats at the nearby habitats described above may experience some reaction to noise produced by project activities. It is difficult to determine the full extent to which project-generated noise may impact wildlife in the local vicinity. Unlike human residences which are fixed in location as noise receptors, wildlife move throughout their habitat, bringing them closer to or further away from generated noise. Additionally, the noise standards used to evaluate project noise impacts are set with respect to human perception, not wildlife, so the dBA at which each species would be impacted is unknown. As wildlife move further from the project into the habitat patch, noise would continue to dissipate.

The highest levels of noise will be generated during project construction, with pile-driving identified as the most significant source of noise. The noise generated by pile-driving during renewable energy project construction has been shown to impact foraging success,[457] deter animals,[458] and alter

[451] McNaughton, E.J., Beggs, J.R., Gaston, K.J., Jones, D.N., & Stanley, M.C. (2021). *Retrofitting streetlights with LEDs has limited impacts on urban wildlife.* DOI:https://doi.org/10.1016/J.BIOCON.2020.108944

[452] Longcore, T., Rodríguez, A., Witherington, B., Penniman, J.F., Herf, L., & Herf, M. (2018). *Rapid assessment of lamp spectrum to quantify ecological effects of light at night*. DOI: https://doi.org/10.1002/jez.2184

[453] EA, Appendix D, Question 15.

[454] Minnesota Department of Natural Resources. *Commercial Solar Siting Guidance.* 2023. Retrieved from: https://files.dnr.state.mn.us/publications/ewr/commercial_solar_siting_guidance.pdf

[455] Brumm, H., (2010). *Anthropogenic Noise: Implications for Conservation*. DOI: https://doi.org/10.1016/B978-0-08-045337-8.00289-8

[456] Slabbekoorn, H. (2010). *Anthropogenic Noise: Impacts on Animals*. https://doi.org/10.1016/B978-0-08-045337-8.00010-3

[457] Jones, I.T., Peyla, J.F., Clark, H., Song, Z., Stanley, J., & Mooney, T. (2021). *Changes in feeding behavior of longfin squid (Doryteuthis pealeii) during laboratory exposure to pile driving noise*. https://doi.org/10.1016/j.marenvres.2020.105250

[458] van der Knaap, I., Slabbekoorn, H., Moens, T., Van den Eynde, D., & Reubens, J. (2022). *Effects of pile driving sound on local movement of free-ranging Atlantic cod in the Belgian North Sea*. https://doi.org/10.1016/j.envpol.2022.118913

behavior.[459] While construction noise may reach significant levels, similar to what is anticipated at some surrounding human receptors, any impacts will be short-term, intermittent, and will occur during daylight hours to the extent practicable. Wildlife within the analyzed habitats may be stressed or frightened by construction noise, and it may act as a distracting stimulus when they are foraging or communicating. Mobile wildlife species may avoid certain louder habitat patches during peak construction activity.

Both the trackers and inverters will create noise during the operation of the project. The noise generated by the rotation of the trackers following the sun will be short in duration and intermittent. Wildlife may occasionally be startled by the rotational noise. The primary noise levels during operation of the project derive from the inverters. These levels are expected to be constant throughout the day and sound akin to a humming or buzzing sound. Chronic noise in wildlife habitat may impact wildlife by masking their auditory processing abilities or prompting them to avoid areas altogether.

There is little established data on the dBA ranges at which wildlife species are impacted by ambient noise. Certain acoustically specialized predators, such as owls, appear to be highly sensitive to chronic noise even at low ranges.[460] In general, bird reproductive success does decline in chronically noisy habitats.[461] These trends have been documented in habitats along roadsides and in proximity to other types of energy infrastructure, but thus far there is no research documenting how chronic noise from solar facilities impacts wildlife. The available literature indicates that is not only the intensity of the sound that matters; the frequency can also interfere with wildlife perception. Given the available research on this subject, it is difficult to make any determination about the impacts of facility sound on wildlife.

Habitat

There are no Important Bird Areas (IBA) designated by the National Audubon Society within the land control area; the Lake Byllesby IBA is located approximately 6.5 miles southeast of the project and encompasses approximately 2,000 acres.[462] There are no Wildlife Management Areas or Waterfowl Production Areas within the project, although Hampton Woods WMA is 0.75 miles to the east of the

[459] Bailey, H., Senior, B., Simmons, D., Rusin, J., Pick, G., & Thompson, P.M. (2010). *Assessing underwater noise levels during pile-driving at an offshore windfarm and its potential effects on marine mammals*. https://doi.org/10.1016/j.marpolbul.2010.01.003

[460] Mason, J.T., McClure, C.J.W., & Barber, J.R. (2016). *Anthropogenic noise impairs owl hunting behavior*. https://doi.org/10.1016/j.biocon.2016.04.009

[461] Francis, C.D., Ortega, C. P., & Cruz, A. (2009). *Noise Pollution Changes Avian Communities and Species Interactions*. https://doi.org/10.1016/j.cub.2009.06.052

[462] Audubon Upper Mississippi River, Important Bird Areas, retrieved from: https://gis.audubon.org/portal/apps/sites/?_gl=1*l1cu1c*_gcl_au*NTc0NTM3OTM3LjE3NTY4MTgzMTY.*_ga*OTY2NjE5MTkuMTc1NjgxODMxNw..*_ga_X2XNL2MWTT*czE3NTY4MTgzMTYkbzEkZzEkdDE3NTY4MTgzNzAkajYkbDAkaDA.#/nas-hub-site.

project and the Vermillion River Complex is 2.25 miles north of the project. There are no active RIM easements within or near the project area.[463]

Wildlife habitat in the area is currently highly fragmented. The row crop habitat at the solar facility being converted is not crucial to wildlife populations, although the land control area may be used as a travel corridor or, occasionally, as a food source (for example, standing corn). The riparian area around the South Branch Vermillion River provides the best available habitat for wildlife in the surrounding area. Given the agricultural landscape and adjacent road system, the riparian corridor provides a safe travel route for wildlife and is likely utilized for its water and riparian vegetation. With the exception of horizontal boring for construction of the collection lines, there is no activity proposed within the riparian areas. Construction activity will likely disrupt animals that are utilizing riparian habitats within the project, however these impacts will be short term and localized. In the long term, project fencing will alter movement of wildlife through the project, however the riparian areas will not be fenced and will remain accessible.

Once restored, the developed area within the solar facility will provide cover and habitat for the life of the project. The extent and quality of this habitat will depend on the relative abundance of perennial native species that provide forage and nesting resources. Fencing will restrict ingress and egress of larger wildlife, and habitat benefits will be limited to small-sized mammals, birds, and reptiles who can successfully cross the fence.

A recent Minnesota study found that utility scale solar habitats with pollinator vegetation increased native bee abundance, resulting in increased pollination visits to bordering agricultural fields.[464] Solar habitat can also enhance bird species richness and diversity in agricultural landscapes,[465] likely because these sites provide beneficial foraging and nesting habitat in a resource-limited landscape. The magnitude of these benefits is determined by the extent of habitat restoration within the solar facility; if the applicant chooses a two in-portrait panel configuration, panels would be 18 inches above ground at full tilt, potentially limiting the success of vegetative plantings. The conversion of the land control area from annual agricultural production to perennial vegetation will positively impact terrestrial wildlife within the land control area, as well as aquatic wildlife in the South Branch Vermillion River and surrounding wetlands by reducing pesticide use.

[463] Minnesota Board of Water and Soil Resources. Reinvest in Minnesota Overview; RIM Online Interactive Map, retrieved from: https://bwsr.state.mn.us/reinvest-minnesota-overview

[464] Walston, L., Hartmann, H., Fox, L., Macknick, J., McCall, J., Janski, J., & Jenkins, L. (2023). *If you build it, will they come? Insect community responses to habitat establishment at solar energy facilities in Minnesota, USA*, retrieved from: https://iopscience.iop.org/article/10.1088/1748-9326/ad0f72

[465] Jarčuška, B., Gálffyoá, M., Schnürmacher, R., Baláź, M., Mišík, M., Repel, M., Fulín, M., Kerestúr, D., Lackovičova, Z., Mojžiš, J., Zámečník, M., Kaňuch, P., & Krištín, A. (2024). *Solar parks can enhance bird diversity in agricultural landscape*. DOI: https://doi.org/10.1016/j.jenvman.2023.119902

The VMP states that mowing will be done at least once annually during the growing season over the first few years of the project. For long term maintenance, mowing will be used to maintain vegetative health, prevent weed spread, and prevent vegetation from shading panels.[466]

Overall, the project does not contribute to significant habitat loss or degradation.

MITIGATION

Several sections of the DSP (**Appendix C**) specify measures that will minimize impacts to wildlife:

- Section 4.3.16 requires use of "site restoration and management practices that provide for native perennial vegetation and foraging habitat beneficial to gamebirds, songbirds, and pollinators".
- Section 4.3.32 requires the permittee to coordinate with the DNR to ensure that the fence used in the project minimizes impacts to wildlife.
- Section 8.14 requires permittees to report "any wildlife injuries and fatalities" to the Commission on a quarterly basis.

Other potential mitigation measures include:

- Siting facilities away from wildlife movement corridors can avoid or minimize impacts to wildlife movement.
- Checking open trenches and removing any wildlife caught in trenches before backfilling mitigates impacts.
- Installing high visibility markers on fences to increase perceptibility for birds and other wildlife.
- Incorporating fencing modifications, such as small openings along the bottom or wildlife escape ramps, that allow wildlife to move in and out of the fenced area.
- Using luminaries with the lowest levels of blue hue, backlight, and glare possible to minimize impacts to nocturnal wildlife.
- Once permanent vegetation is established, restricting mowing from April 15 to August 15 to improve the potential for ground nesting habitat.

The DSP (**Appendix C**) proposes special conditions related to the mitigating impacts to wildlife resulting from the project's adjacency to various roads, proximity to wildlife habitat, and connection to the South Branch Vermillion River:

- Section 5.19 requires the permittee to use down-lit, shielded lighting around and within the Project. The nominal color temperature of Project lighting should not exceed 4,000 kelvin.

[466] SPA, Appendix E: Vegetation Management Plan.

- Section 5.20 requires the permittee to use dust suppression agents that do not contain chloride.
- Section 5.21 requires the permittee to use erosion control materials that do not contain plastic or synthetic fibers or malachite green dye.

4.7.8 Rare and Unique Resources

The ROI for rare and unique resources is the local vicinity. The impact intensity level is anticipated to be **minimal to moderate** during construction, and minimal during operation Impacts could be both short and long term and could be positive (e.g., through introduction of habitat), or negative (e.g., by removing trees during migratory season). Impacts can be mitigated.

Construction and operation of solar facilities may adversely impact rare and unique resources through the taking or displacement of individual plants or animals, invasive species introduction, and habitat alteration or loss. Conversely, in some cases solar sites can be managed to provide habitat. For example, the introduction of native vegetation into a landscape otherwise dominated by cultivated row crops could create habitat for pollinators, such as the rusty patched bumble bee or monarch butterfly.

The DNR classifies rare plant or animal communities across the state. These include Scientific and Natural Areas, High Conservation Value Forest, Minnesota Biological Survey (MBS) Native Plant Communities, and MBS Sites of Biodiversity Significance

The Division of Ecological and Water Resources within DNR manages the Natural Heritage Information System (NHIS). The NHIS "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."[467] NHIS data includes federally endangered, threatened, or candidate plant species, and endangered or threatened animal species. The system also includes state endangered, threatened, or special concern species. The NHIS database is a source of information, but not the sole source for identifying these resources, as some areas surveys have not been conducted extensively or recently making.

The DNR and the BWSR administer conservation easements for the state. The purpose of a conservation easement is to protect critical natural resource land throughout Minnesota, allowing landowners to participate by stopping crop/grazing of the land, and establishing conservation practices such as native grass and forbs, trees, or wetland restorations.[468] The Minnesota Conservation Reserve Enhancement Program (CREP) is a voluntary, federal-state funded natural resource conservation program that places land into conservation easements, targeting environmentally sensitive land such as riparian areas and marginal agricultural land.[469] Minnesota's

[467] Department of Natural Resources (n.d.) *Natural Heritage Information System*, http://www.dnr.state.mn.us/nhnrp/nhis.html.
[468] BWSR, What are Conservation Easements? https://bwsr.state.mn.us/what-are-conservation-easements.
[469] BWSR, MN CREP, https://bwsr.state.mn.us/mn-crep-landowners.

Reinvest in Minnesota (RIM) reserve program accomplishes conservation goals by placing lands in perpetual conservation easements, restoring certain marginal and environmentally sensitive agricultural land to protect soil and water quality and support fish and wildlife habitat.[470]

Minnesota is home to over 2,000 known native wildlife species and over 300 of these species have been identified as Species in Greatest Conservation Need (SGCN) because they are rare, their populations are declining, or they face serious threats that can cause them to decline and thus have populations below levels desirable to promote their long-term health and stability. Minnesota's Wildlife Action Plan 2015-2025 includes a habitat approach, which focuses on sustaining and enhancing terrestrial and aquatic habitats for SGCN in the context of the larger landscapes. The Wildlife Action Plan lays out the basis for the long-term vision of a Wildlife Action Network composed of terrestrial and aquatic habitat cores and corridors to support biological diversity and ecosystem resilience with a focus on SGCN. Wildlife Action Network corridors are scored using five scalable metrics: SGCN population viability scores, SGCN richness, spatially prioritized Sites of Biodiversity significance, ranks of Lakes of Biological Significance, and Stream Indices of Biological Integrity. Scores range from low to high; low scores indicate that the five scalable metrics had relatively low scores, while high scores indicate that the five scalable metrics had overlapping high scores. The Wildlife Action Network is a metric that can be used to assess buffers and connectors of habitats representing the diversity of habitat quality, supporting SGCN.[471]

The USFWS provides information for use in National Environmental Policy Act (NEPA) documents, and reviews and provides comments on these documents. Through this process, the USFWS seeks to ensure that impacts to plant and animal resources are adequately described, and necessary mitigation is provided. One such resource is the distribution lists of federally listed threatened, endangered, and candidate species by county.

The EA does not map federal- or state-listed species found in the NHIS database, because DNR requires that public display of NHIS data either mask the identity or location of rare features due to the vulnerability of some species to exploitation. Moreover, the NHIS database masks the occurrence of rare species of by randomly incorporating their location into a larger map polygon.

[470] BWSR, Reinvest In Minnesota Reserve, https://bwsr.state.mn.us/sites/default/files/2019-01/RIM_overview_0.pdf.

[471] DNR. *Minnesota's Wildlife Action Plan 2015-2025.* Online. 2016. Available from: https://www.dnr.state.mn.us/mnwap/index.html.

POTENTIAL IMPACTS

NATURAL COMMUNITIES

The MBS systematically collects, interprets, and provides baseline data on the distribution and ecology of rare plants, rare animals and native plant communities.[472] The MBS uses four classifications denoting the level of biological diversity to rank sites:[473]

- **Below**. Sites lack occurrences of rare species and natural features or do not meet MBS standards for outstanding, high, or moderate rank. These sites may include areas of conservation value at the local level, such as habitat for native plants and animals, corridors for animal movement, buffers surrounding higher- quality natural areas, areas with high potential for restoration of native habitat, or open space.
- **Moderate**. Sites contain occurrences of rare species, moderately disturbed native plant communities, and/or landscapes that have strong potential for recovery of native plant communities and characteristic ecological processes.
- **High**. Sites contain very good quality occurrences of the rarest species, high-quality examples of rare native plant communities, and/or important functional landscapes.
- **Outstanding**. Sites contain the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most ecologically intact or functional landscapes.

There are several MBS sites of biodiversity significance throughout the area. An MBS site of outstanding biodiversity significance, Castle Rock 1, which contains a Bitternut Hickory Forest native plant community (NPC), is located approximately 0.4 miles east of the project, and an MBS site of biodiversity significance ranked below, Castle Rock 15, is located approximately 0.95 miles south of the project.[474] There is one MBS site of moderate biodiversity significance located within the land control area, as noted by the DNR in the Natural Heritage Review Letter.[475] The MBS site within the project, Castle Rock 10, is along the South Branch Vermillion River and contains a sedge meadow NPC (Figure 50). Sedge meadows are associated with streams and drainage ways, and consist of open wetlands with abundant broad-leaved graminoids, with shrub cover typically making up less than one-quarter of the area.[476] The DNR recommends that the project be designed to avoid impacts to these ecologically significant areas.

The Castle Rock 10 MBS site will be crossed in two separate areas by collection lines, using either horizontal bore or aerial span methods. In addition, some areas of the Castle Rock 10 MBS site, while

[472] DNR. *Minnesota County Biological Surveys*, http://www.dnr.state.mn.us/eco/mcbs/index.html.
[473] DNR, *Minnesota Biological Survey*, MBS Site Biodiversity Significance Ranks, https://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html.
[474] Minnesota Natural Resource Atlas, retrieved from https://mnatlas.org/gis-tool/.
[475] DNR, Natural Heritage Review Letter, May 2, 2025, eDockets No: 20255-218560-02.
[476] DNR, *WMN82 Wet Meadow/Carr System Northern Floristic Region,* retrieved from: https://files.dnr.state.mn.us/natural_resources/npc/wet_meadow_carr/wmn82.pdf.

outside the project fence line, are in proximity to areas planned for solar array installation. Erosion, sedimentation, or vegetation clearing resulting from construction activities and vehicle disturbance in areas outside the Castle Rock 10 MBS site, such as the adjacent solar array blocks, or within the Castle Rock 10 MBS site, if necessary for the installation of the collection line crossings, could negatively impact the Castle Rock 10 MBS site and associated sedge meadow NPC. The spread of invasive species into the Castle Rock 10 MBS site and associated sedge meadow NPC resulting from the introduction of invasive species from construction equipment, contaminated mulches, and/or seed mixes, or the uncontrolled spread of invasive species already present within the project, could negatively impact this ecologically significant area.

CONSERVATION EASEMENTS

Castle Rock Solar has secured 100% land control within the project through leases or easements, and the project is comprised entirely of private land. The project avoids lands actively enrolled in conservation programs or with conservation easements, such as CREP or RIM; there is one expired RIM easement within the site. The nearest active conservation easement is a Reinvest in Minnesota (RIM) more than 5.5 miles southwest of the site. Impacts to conservation easements are not anticipated.

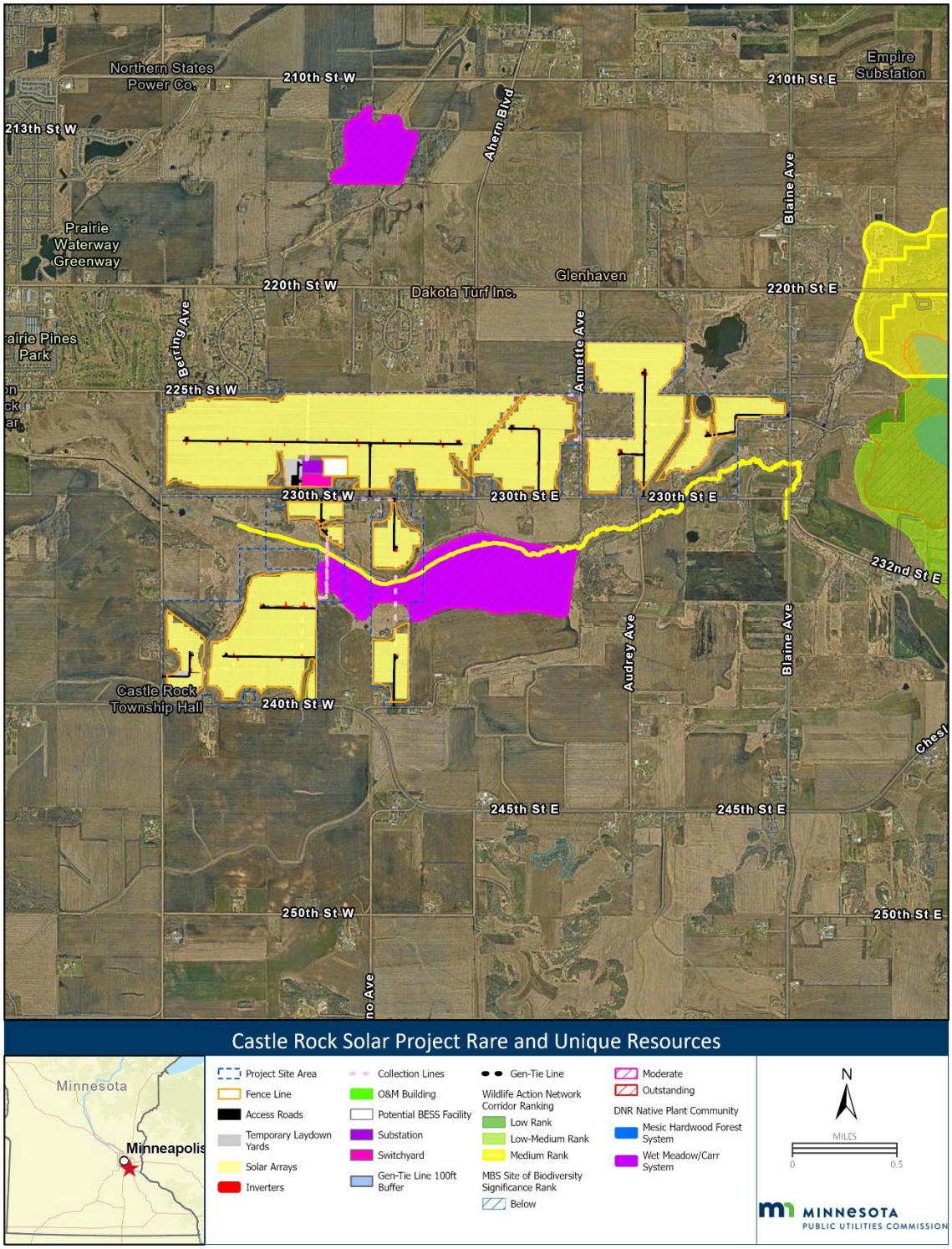
WILDLIFE ACTION NETWORK

There are several Wildlife Action Network corridors scattered throughout the area. A Wildlife Action Network corridor complex consisiting of one corridor ranked low, one corridor ranked low-medium, and one corridor ranked medium is located approximately 0.39 miles east of the project. There is one Wildlife Action Network corridor located within the land control area, along the South Branch Vermillion River. The South Branch Vermillion River Wildlife Action Network corridor within the project is ranked medium due to its Stream Index of Biotic Integrity. The Stream Index of Biotic Integrity represents the ability of an aquatic ecosystem to support and maintain a balanced and adaptive community of organisms that have a species composition, diversity, and function reflective of a natural habitat.[477]

The South Branch Vermillion River Wildlife Action Network corridor will be crossed in two separate areas by collection lines, using either horizontal bore or aerial span method, and the waterway's course takes it near some solar array blocks. Construction activities, vehicle disturbance, or vegetation clearing in solar array areas or at the locations of the collection line crossings could result in increased sedimentation into the South Branch Vermillion River. As discussed in Section 4.7.7 (Wildlife and Habitat), increased sedimentation into waterways can impact the organisms that make up the aquatic ecosystem community. Changes in species composition or a loss of diversity in the aquatic organism community resulting from sedimentation could negatively impact the South Branch Vermillion River Wildlife Action Network corridor (Figure 50).

[477] MPCA. *Index of Biological Integrity*. Online. Available from: https://www.pca.state.mn.us/air-water-land-climate/index-of-biological-integrity.

Figure 50. Rare and Unique Resources in Project Area



RARE SPECIES – FEDERALLY LISTED

Northern Long Eared Bat (Myotis septentrionalis)

The Northern Long Eared Bat (NLEB) is a federally listed species and state listed species of concern. During the winter this species hibernates in caves and mines, and during the active season (approximately April-October) it roosts underneath bark or in cavities or crevices of both live and dead trees. The spread of white-nose syndrome across the eastern United States has become the major threat to the species. Activities that might impact this species include, but are not limited to, any disturbance to hibernacula and destruction or degradation of habitat including tree removal.

The land control area is primarily agricultural lands with little forested habitat, and the NLEB would be limited to shelterbelts or windbreaks. According to the Minnesota DNR and USFWS, there are two known hibernacula in Dakota County, neither of which are located within Castle Rock Township.[478] Potential impacts to individual northern long-eared bats may occur if clearing or construction takes place when the species is roosting in its summer habitat, in trees outside of the hibernacula. Bats may be injured or killed if occupied trees are cleared during this active window. Tree clearing activities conducted when the species is in hibernation and not present in the landscape will not directly impact bats, however, could result in indirect impacts due to the removal of suitable roosting habitat. The preferred mitigation strategy to avoid impacts to the NLEB is avoidance of tree-clearing to the extent possible. When tree clearing is necessary, it should be done outside the pup rearing season from June 1 to July 31 and outside the active NLEB season from April 1 to October 31.[479]

Rusty Patched Bumble Bee (Bombus affinis)

The Rusty Patched Bumble Bee (RPBB) is a federally listed species, and the State Bee of Minnesota. The species has historically occurred across eastern North America, extending from Quebec to Georgia and west to North Dakota. The RPBB was once one of the most common bumblebees encountered in Minnesota, but the species has experienced rapid declines in abundance since the 1990s. Currently, it is estimated that their geographic distribution has declined by 70-87 percent, and their abundance has declined by 92-95 percent.

This species is highly social, and the workers and queens require consistent forage throughout the entire growing season, from spring through fall, to provision the colony. The RPBB is a generalist forager that utilizes a wide array of flowers, and they have been observed in a variety of habitats. Most colonies nest underground; abandoned rodent burrows in open grasslands or forest edges appear to be suitable nesting locations for this species. The primary factors thought to cause

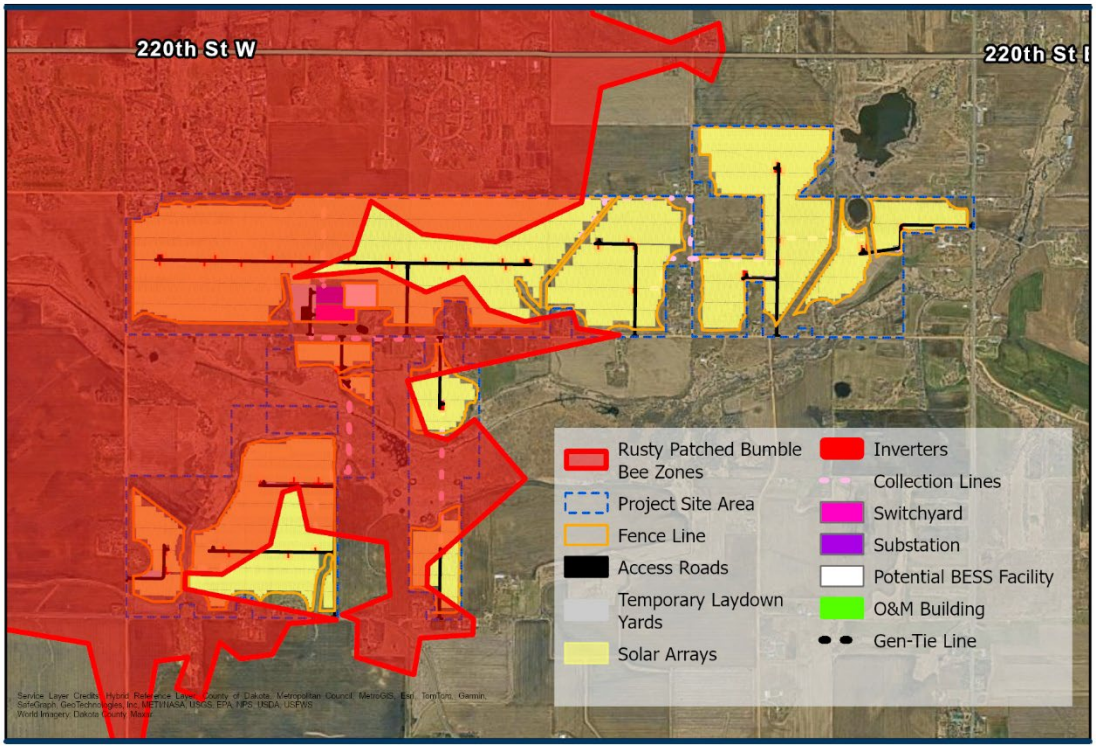
[478] DNR. (2016). *Townships Containing Documented Northern Long-Eared Bat (NLEB) Maternity Roost Trees and/or Hibernacula Entrances in Minnesota*, retrieved from: https://mn.gov/frc/assets/MFRC%20Presentation_May%202016_Update%20on%20the%20Northern%20Long%20eared%20Bat%20in%20MN_tcm1162-495967.pdf

[479] DNR. *Rare Species Guide: Northern Long-eared Bat*. Retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=AMACC01150

population declines are pathogen spillover from commercial bumble bee colonies, pesticide use, and habitat loss.[480]

The land control area overlaps with a USFWS RPBB High Potential Zone (Figure 51). High Potential Zones are areas where species presence should be presumed for Section 7 purposes.[481] If underground nests are present in the land control area during project construction, ground disturbance could result in the destruction of RPBB colonies. However, this is considered unlikely, as the largely agricultural landcover within the site suggests that suitable RPBB nesting habitat is likely limited in the land control area. The native seed mixes designed for the project include a variety of forb species;[482] once vegetation has been established the project can provide valuable foraging habitat for RPBB.

Figure 51. RPBB High Potential Zone



[480] DNR, *Rusty Patched Bumblebee*. Retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=IIHYM24020.
[481] USFWS, *Rusty Patched Bumble Bee Map*. [September 22, 2025] Retrieved from: https://www.arcgis.com/home/webmap/viewer.html?webmap=2716d871f88042a2a56b8001a1f1acae&extent=-100.6667,29.7389,-48.8551,50.9676.
[482] SPA, Appendix E: Vegetation Management Plan.

Monarch Butterfly (Danaus plexippus)

The monarch butterfly is a federal candidate species (proposed threatened). The species is common throughout Minnesota during summer months and is most frequently found in habitats where milkweed and native plants are common, including roadside ditches, open areas, wet areas, and urban gardens. Monarchs require milkweed plants for the completion of the immature lifecycle.

Monarchs overwinter in Mexico and fly north in the spring, with ensuing generations eventually reaching Minnesota. Several generations of monarchs build up during the summer in Minnesota. The super-generation that returns to the overwintering grounds in Mexico is produced in the fall.[483] Due to the agricultural landscape, suitable monarch butterfly habitat is generally limited in the land control area. The native seed mixes designed for the project include at least one milkweed species;[484] once vegetation has been established the project will provide foraging habitat for monarchs.

Western Regal Fritillary (Argynnis idalia)

The Western Regal Fritillary is a federal candidate species (proposed threatened) that has suffered catastrophic declines in the eastern half of its range. The regal fritillary is faring better in the western half of its range, but is considered vulnerable in Minnesota. Kansas is the only state where this species is considered secure. Regal fritillaries are restricted to native prairie habitats; while adults are observed in both upland prairies and wet prairies, larval development may be restricted to upland prairie. With less than 1 percent of Minnesota's native prairie remaining, this limits available habitat to the widely scattered, mostly small fragments of native prairie in the state that are surrounded by agriculture and development. Only a few of these prairie remnants are large enough to maintain persistent populations if the remnant is genetically isolated, and it is unlikely that any prairie remnants are large enough to provide a secure future for a genetically isolated population. The regal fritillaries survival in Minnesota is dependent upon the concentration of prairie remnants within the flight range of adults that can collectively support large populations.

The regal fritillary lays eggs in late summer, which hatch into larvae after a few weeks. The larvae enter dormancy until the following spring when they emerge to feed and grow, pupating in June and emerging as adults from mid-June into July. Regal fritillaries require violet plants for the completion of the immature lifecycle. In Minnesota, the Prairie Bird's-Foot Violet (*Viola palmata* var. *pedatifida*) of upland prairies has been identified as the principal larval host, although Bird's-Foot Violet (*Viola pedate*) is also used in the southeastern portion of the state.[485] Due to the agricultural landscape, suitable regal fritillary habitat is generally limited in the land control area. The native seed mixes designed for the project do not include violets;[486] once vegetation has been established the project will provide some foraging habitat for adult regal fritillaries but not for developing larvae.

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[483] DNR, *Monarch Butterfly*. Retrieved from: https://www.dnr.state.mn.us/insects/monarchbutterfly.html
[484] SPA, Appendix E: Vegetation Management Plan.
[485] DNR, *Regal Fritillary Butterfly*. Retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=IILEPJ6040.
[486] SPA, Appendix E: Vegetation Management Plan.

Bald Eagles (Haliaeetus leucocephalus)

In Minnesota, the bald eagle nesting season is generally January through early July. Bald eagles are primarily found near rivers, lakes, and other waterbodies in remote and, more recently, within metropolitan areas.[487]

Bald eagles are afforded additional protections under the Bald and Golden Eagle Protection Act, which is administered by the USFWS. Bald eagle incidental take permits and nest removal permits are considered to be voluntary permits, meaning a project proposer must make the determination to pursue a permit based on the respective risk of their project's potential to take a bald eagle.

Bald eagles typically nest in mature trees near large lakes or streams. No eagle nests were observed within or adjacent to the land control area during habitat assessment.[488] The USFWS will coordinate appropriate mitigation measures for bald eagles for the project, if necessary. Mitigation measure may include setbacks from nests, timing restriction for construction activities, and possibly seeking a USFWS permit for removal of a nest.

Whooping Crane (Grus americana) – Non-Essential Experimental Population

The whopping crane is endemic to North America. Historically, more than 10,000 whooping cranes populated North America, with a north-south range from Canada to Mexico and an east-west range from the East Coast to the Rocky Mountains. Hunting and habitat distribution led to significant population declines, with the species reaching an all-time low of 15 wintering individuals in 1941. All whooping cranes alive today descended from those 15 individuals. Whooping cranes are a flagship species for North America's conservation movement, and recovery efforts continue to this day.

Whooping cranes winter in the south, along the Gulf of Mexico, and migrate north for the summer. This species utilizes a variety of habitats, including coastal marshes and estuaries, inland marshes, lakes and open water bodies, wetlands, swales, wet meadows and rives, and pastures and agricultural fields. In summer, whooping cranes forage on large nymphal or larval forms of insects, frogs, rodents, small birds, minnows, and berries. Whooping cranes are monogamous and nest on the ground, typically on a raised area in a marsh.

The site falls within the potential range of the Eastern Migratory Population, a non-essential, experimental population of whooping cranes that was reintroduced from 2001 and 2010. This experimental population migrates between Wisconsin and Florida.[489] USFWS notes that consultation under Section 7 is only required if the project activities will occur within a National Wildlife Refuge or National Park.[490] The site is not within a National Wildlife Refuge or National Park, and impacts to whooping cranes are not anticipated.

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[487] DNR, *Bald Eagles in Summer*. Retrieved from: https://www.dnr.state.mn.us/birds/eagles/summer.html
[488] SPA, p. 110.
[489] USFWS, *Whooping Crane*. Retrieved from: https://www.fws.gov/species/whooping-crane-grus-americana.
[490] SPA, Appendix C: Agency Coordination and Correspondence.

RARE SPECIES – STATE LISTED

Castle Rock Solar coordinated with the Minnesota DNR to identify state-listed species within the area. The DNR's Natural Heritage Information System database identified no state listed species within the land control area; however, four state-listed species were identified within one mile of the site. One of the identified species, the Rusty Patched Bumble Bee, is a watchlist species in the state. The RPBB is a federally listed species and is discussed above.

Loggerhead Shrikes (Lanius ludovicianus)

The loggerhead shrike is a state-listed endangered species. The species has historically occurred across a large geographic area, throughout most of the continental United States and the southern part of Canada's Prairie Provinces. This species is a summer resident of Minnesota, where it lives in areas of upland grasslands, but it can also be found in agricultural areas with short grass vegetation and perching sites such as hedgerows, shrubs, and small trees. Loggerhead shrikes are found in both native and non-native grasslands, including native prairie, pastures, old fields, shelterbelts, farmyards, and cemeteries. Loggerhead Shrikes are solitary migrants who nest in pairs. Nests are well hidden in trees or brush and are low to the ground, usually less than two meters above the surface. The loggerhead shrike exhibits a unique behavior, individuals impale prey on thorns and barbed wire – an adaptation that allows the species, roughly the size of a robin, to eat large prey even though they lack strong feet and talons.

Some regions within the Loggerhead Shrike's range have experience population declines from factors such as tree encroachment on grassland and increasingly intensive row-cropping practices. The loggerhead shrike population has declined sharply in Minnesota. Dakota County and Clay County are the only counties where loggerhead shrikes have been consistently found over the last 25 years. The factors responsible for this species' decline in Minnesota include habitat destruction and ingestion of contaminated prey, such as grasshoppers treated with an insecticide. However, the reproductive rate and success of this species is high, so if the factors responsible for decline are fully identified and eliminated, the overall population should increase.[491] Loggerhead shrikes have been documented in the vicinity of the project site.[492]

Impacts to individual loggerhead shrikes could occur if clearing or construction takes place when the species is breeding, nesting in trees and shrubs within the landscape. Loggerhead shrikes and their offspring may be injured or killed if occupied trees and shrubs are cleared during this active window. Tree and shrub clearing activities conducted when the species is not breeding will not directly impact loggerhead shrikes, however, it could result in indirect impacts due to the removal of suitable nesting or prey-impaling habitat. The preferred mitigation strategy to avoid impacts to the loggerhead shrike is avoidance of tree- and shrub-clearing during the breeding season.

[491] DNR, *Loggerhead Shrike*. Retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABPBR01030.
[492] DNR, Scoping Comments, May 2, 2025, eDockets No: 20255-218560-01 and 20255-218560-02.

Big Tick Trefoil (Desmodium cuspidatum)

Big tick trefoil is a state-listed threatened species that occurs in mesic hardwood forests in the southeast portion of the state. The primary threat to the species is habitat loss, encroachment of invasive species, over-abundance of white-tailed deer, which damage native forest vegetation. Big tick trefoil populations are closely associated with southern mesic oak-basswood forests. Big tick trefoil is a short-lived perennial, and the species is shown to have low recruitment and reproductive success compared to other *Desmodium* species. Plants flower from early-July through August, with fruiting running from mid-August through September. This species has experienced population declines in its range due to the loss of nearly 90 percent of forests in the southeast portion of the state and subsequent degradation of the remaining fragments.[493] The probability of species occurrence within the land control area is considered to be low due to the heavy agricultural use and lack of mesic hardwood forest habitat suitable for big tick trefoil.

American Ginseng (Panax quinquefolius)

American ginseng is a state-listed special concern species that occurs in mesic hardwood forests in eastern North America. Historically, this species was very common in the state, but overharvesting for the ginseng trade significantly reduced populations. American ginseng is uncommon in Minnesota today, and harvesting remains a primary threat to the species, even in protected habitats. American ginseng populations only grow in well-developed forest soil, and are mostly found in closed-canopy forests with mature maple, basswood, or northern red oak communities. American ginseng is a long-lived perennial herb that only reproduces by seed that must spend two winters in the soil before germination. Plants flower in June, with fruiting running from mid-June through September. Due to overharvesting, populations are significantly depleted, and the destruction of mesic hardwood forest habitat has resulted in fragmented forest patches and a lack of suitable habitat.[494] The probability of American ginseng occurring within the land control area is considered to be low due to the heavy agricultural use, lack of suitable mesic hardwood forest habitat, and depleted population numbers of the species.

MITIGATION

The project has the potential to impact rare and natural resources, including areas of biological significance and wildlife habitat. Impacts will likely be indirect, short-term, and temporary. Techniques for minimizing impacts to wildlife and vegetation also minimize impacts to rare species. Avoiding identified areas of species occurrence or preferred habitat is a preferred mitigation measure. Castle Rock Solar states that it will minimize impacts to these sensitive ecological resources by avoiding habitat features such as wetlands and waterways to the extent possible. MBS sites and NPCs will be avoided and collection lines crossing the NPC will be bored or aerial spanned to avoid disturbance.[495]

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[493] DNR. *Rare Species Guide: Big Tick Trefoil*. Retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PDFAB1D0D2

[494] DNR. *Rare Species Guide: American Ginseng*. Retrieved from: https://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=PDARA09010

[495] SPA, pp. 114-115.

Construction and operation of the solar facility are not likely to permanently impact state-threatened, endangered, or special concern species. Castle Rock Solar submitted a Natural Heritage Review (NHR) request through the DNR MCE (Project ID 2024-00760) for the Project on August 29, 2024. The DNR responded with a letter on October 23, 2024.[496] The letter identified actions the DNR recommends Castle Rock Solar adopt to avoid or minimize disturbance to NPCs and listed species.

The DSP (**Appendix C**) proposes special conditions related to the rare and sensitive resources.

- Section 5.22 requires the permittee to comply with DNR recommendations provided in the Natural Heritage Review Letter to avoid or minimize impacts to ecologically significant areas, including MBS site Castle Rock 10. The permittee must inform the DNR of the method used to install the collection line crossings through MBS site Castle Rock 10 and implement any BMPs suggested by the DNR. If impacts to resources occur, the permittee shall document the impact and consult with the DNR to determine mitigation strategies.
- Section 5.23 requires the permittee to comply with the USFWS and DNR guidance and requirements in effect regarding NLEB, including tree clearing restrictions if applicable.
- Section 5.24 requires the permittee to avoid tree and shrub removal during the Loggerhead Shrike breeding season, April through July. If avoidance is not feasible, the permittee must identify a qualified surveyor to conduct a survey for active nests before any trees or shrubs are removed. The qualified surveyor must be on the DNR certified list of surveyors, and the surveys must be conducted in accordance with DNR survey requirements.

No additional mitigation is proposed.

4.7.9 Climate Change

The project will help to shift energy production in Minnesota and the upper Midwest toward carbon-free sources. Construction emissions will have a short- term **negligible** increase in greenhouse gases that contribute to climate change. Overall, the project will generate energy that can be used to displace energy otherwise generated by carbon-fueled sources. The total GHG emissions produced by construction and operation of the project will be **minimal** when compared to the reduction in GHG emissions long-term. The project's design incorporates design elements that minimize impacts from the increase in extreme weather events such as increased flooding, storms, and heat wave events that are expected to accompany a warming climate.

Climate change refers to any significant change in measures of climate lasting for an extended period. Greenhouse gases (GHS) are gaseous emissions that trap heat in the atmosphere and contribute to climate change. These emissions occur from natural processes and human activities. The most common GHGs emitted from human activities include carbon dioxide, methane, and nitrous oxide. A change in climate can have a wide range of impacts on living species, as well as infrastructure, and

[496] DNR, Natural Heritage Review Letter, May 2, 2025, eDockets No: 20255-218560-02.

may create compounding weather related events. An increase of extreme weather events, such as flooding, storms, and heat waves, is expected to accompany a warming climate.

In 2022, the electricity generation sector was the third largest source of Minnesota GHG emissions at 25.6 million tons of 126.1 million tons, or 20 percent.[497] GHG from electricity generation have decreased by about 50 percent in Minnesota from 2005 to 2022 due to a shift in generation to lower- and non-emitting sources and an increase in end-use energy efficiency.[498]

POTENTIAL IMPACTS

GENERAL

The DNR's Minnesota Climate Explorer Tool was used to determine current climate conditions for Dakota County. Annual average temperature trends show a temperature increase of 0.18 °F per decade from 1895 to the present, and 0.61 °F per decade from 1970 to present. For precipitation, total annual precipitation has increased at a rate of 0.37 inches per decade from 1895 to present, and a rate of 0.11 inches per decade from 1970 to present.[499]

The DNR's Minnesota Climate Explorer tool was also used to project climate conditions for Dakota County. Temperature models were created to project climate data for two scenarios, Representative Concentration Pathway (RCP) 4.5 and RCP 8.5. RCP is a measure adopted by the Intergovernmental Panel on Climate Change to represent various GHG concentration pathways. The numbers (i.e., 4.5 and 8.5) represent the amount of net radiative forcing the earth receives in watts per meter squared, where a higher RCP signifies a more intense GHG effect resulting in a higher level of warming. RCP 4.5 represents an intermediate scenario where emissions begin to decrease around 2040, and RCP 8.5 represents a scenario with no emissions reductions through 2100.[500]

The climate models predict that under RCP 4.5, the average temperature for Dakota County is projected to increase by approximately 4°F by Mid-Century (2040 to 2059) compared to current conditions (1980 to 1999). Late-Century (2080-2099) air temperature is projected to increase by approximately 6°F for RCP 4.5, and approximately 10°F for RCP 8.5. Mid-Century annual precipitation is projected to increase by approximately one-quarter inch for RCP 4.5. Late-Century annual precipitation is projected to increase by 0.6 inches for RCP 4.5, and 3.27 inches for RCP 8.5.[501]

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[497] Minnesota Pollution Control Agency, Greenhouse gas emissions data, retrieved from: https://data.pca.state.mn.us/views/Greenhousegasemissionsdata/TotalGHGemissionsgoals?%3Aembed=y&%3AisGuestRedirectFromVizportal=y

[498] Minnesota Pollution Control Agency, Greenhouse gas emissions data, retrieved from: https://data.pca.state.mn.us/views/Greenhousegasemissionsdata/TotalGHGemissionsgoals?%3Aembed=y&%3AisGuestRedirectFromVizportal=y

[499] Minnesota Climate Explorer, retrieved from: https://climate-explorer.dnr.state.mn.us/

[500] Noe, Ryan R; Keeler, Bonnie L; Twine, Tracy E; Brauman, Kate A; Mayer, Terin; Rogers, Maggie. (2019). Climate change projections for improved management of infrastructure, industry, and water resources in Minnesota. Retrieved from the University of Minnesota Digital Conservancy, https://hdl.handle.net/11299/209130.

[501] Minnesota Climate Trends Map, retrieved from: https://arcgis.dnr.state.mn.us/ewr/climatetrends/

Castle Rock Solar also provides a summary of current and future climate predictions in their application.[502]

GREENHOUSE GASES

Construction activities will result in short-term increases in GHG emissions from the combustion of fossil fuels in construction equipment and vehicles. The project's construction emissions are estimated to be 696 tons of CO_2.[503] The GHG emissions from construction are an insignificant amount relative to Minnesota's overall emissions of approximately 126.1 million tons in 2022.[504] Potential impacts due to construction GHG emissions are anticipated to be negligible.

Once operational, the project will generate minimal GHG emissions. Emissions that do occur would result from vehicle usage to and from the solar array and substation for maintenance and operation of the substation and switchyard. GHG emissions for project operation are estimated to be approximately 9.6 tons of CO_2 annually.

It is estimated that the project will offset approximately 146,915 short tons of CO_2 annually.[505] Thus, compared to non-renewable energy generation, the project would be beneficial with respect to GHG emissions. Total GHG emissions resulting from construction and operation of the project are anticipated to be minimal when compared to the long-term reduction in GHG emissions facilitated by the project.

CLIMATE AND WEATHER

Tree and vegetation loss from construction eliminates related climate resilience benefits, leading to more intense runoff during storms or flooding (thus increasing erosion and reducing water retention), increased heat extremes, and potential reductions in air quality. Removal of or impacts to wetlands due to construction eliminates the ability for the land to retain and absorb stormwater, leading to more intense stormwater runoff and nutrient loading. Revegetation is expected to offset effects, therefore impacts should be temporary and minimal.

Online climate screening tools were utilized to determine storm intensity impacts. The EPA Climate Resilience Evaluation and Awareness Tool anticipates an increase in 100-year storm intensity of 2.9 to 13.7 percent in 2035, and 5.6 to 26.6 percent in 2060 for the project area.[506] Because of this, there is potential for waterways to be subject to more erosion. Periods of drought may also be possible. The EPA Streamflow Projections Map anticipates a change in average streamflow of the Vermillion River by a ratio of 1.22 (90^{th} percentile) under wetter conditions, and a ratio of 0.87 (10^{th} percentile), respectively under drier conditions from 2071 to 2100 (RCP 8.5) compared to baseline historical flow

[502] SPA, pp. 118-122
[503] SPA, Appendix M: Greenhouse Gas Calculations.
[504] Minnesota Pollution Control Agency, Greenhouse gas emissions data, retrieved from: https://data.pca.state.mn.us/views/Greenhousegasemissionsdata/TotalGHGemissionsgoals?%3Aembed=y&%3AisGuestRedirectFromVizportal=y
[505] SPA, Appendix M: Greenhouse Gas Calculations.
[506] EPA CREAT Climate Chance Scenarios Projection Map, retrieved from: https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=3805293158d54846a29f750d63c6890e.

(1976 to 2005).[507] The Vermillion River is located approximately 2.5 miles north of the project; the South Branch Vermillion River is a tributary of the Vermillion River that flows within the project. Portions of the site adjacent to the South Branch Vermillion River are within a FEMA Zone AE mapped floodplain, Castle Rock Solar states that they will follow DNR requirements for these areas.[508]

A warming climate is expected to cause increased flooding, storms, and heat wave events. These events, especially an increased number and intensity of storms, could increase risks to the project. More extreme storms also mean more frequent heavy rainfall events, which can cause localized soil erosion or flooding. Climate and weather impacts are considered in the design of the facility and include impacts from extreme storms such as stormwater runoff, strong winds and hail. Castle Rock Solar will design stormwater ponds in compliance with state and county requirements for reducing runoff rates, and the project has been designed to maintain the existing drainage patterns within the site.

The FEMA National Risk Index[509] rates Dakota County as having "relatively high" risk for hail, a "very high" risk for strong winds, and "relatively moderate" risk for ice storms. Castle Rock Solar states that project equipment will be engineered and selected to withstand the potential for an increase in the frequency of severe weather events.[510] In the event of an extreme damage scenario due to severe weather, Castle Rock Solar would be financially responsible for repairs.

MITIGATION

Mitigation to reduce emissions during construction is discussed in Section 4.7.1 (Air Quality) of this EA. Strategies to reduce emissions include keeping vehicles in good working order, which will reduce the amount GHG emissions from diesel or gasoline.

Project developers can employ location, design, and construction strategies to mitigate impacts resulting from a warmer, wetter, and more energetic climate by:

- Avoiding sites with high probability for extreme weather events to the extent possible.
- Designing solar panels and solar arrays to withstand stronger storms and winds.
- Planning for the potential repair and replacement of solar arrays damaged by storms.
- Designing the project's stormwater system to prevent flooding during heavy rainfall events.
- Designing the project's electrical collection system to be resistant to flooding damage.

Castle Rock Solar states that erosion will be minimized through the implementation of the SWPPP, mitigating the additional erosion impacts due to the anticipated increase in 100-year storm intensity.

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[507] US EPA, *Streamflow Projections Map*, retrieved from: https://epa.maps.arcgis.com/apps/MapSeries/index.html?appid=48dcf8ca136a49a298a60e31422d58f0
[508] SPA, Appendix G: Preliminary Stormwater Management Plan
[509] FEMA National Risk Index. https://hazards.fema.gov/nri/
[510] SPA, p. 118

Appropriate permits would be obtained prior to appropriating water during construction or operation, if needed.[511]

4.8 Unavoidable Impacts

Resource impacts are **unavoidable** when an impact cannot be avoided even with mitigation strategies.

Potential impacts and the possible ways to mitigate against them are discussed in this chapter. However, even with mitigation strategies, certain impacts cannot be avoided. Most adverse unavoidable impacts are associated with construction; therefore, they would be temporary.

Unavoidable adverse effects associated with construction of the project (in some instances a specific phase of construction) would last through construction and include:

- Fugitive dust.
- Noise disturbance to nearby residents and recreationalists.
- Visual disturbance to nearby residents and recreationalists.
- Soil compaction and erosion.
- Vegetative clearing (loss of shelter belts).
- Disturbance and temporary displacement of wildlife, as well as direct impacts to wildlife inadvertently struck or crushed.
- Minor amounts of marginal habitat loss, including temporary wetland impacts.
- Possible traffic delays.
- Minor GHG emissions from construction equipment and workers commuting.

Unavoidable adverse impacts associated with the operation would last as long as the life of the project, and include:

- Visual impacts of the project.
- Cultural impacts due to a change in the sense of place for local residents.
- Loss of land for agricultural purposes.
- Injury or death of birds that collide with PV panels, Gen-Tie equipment, or collection lines spanned over the South Branch Vermillion River.
- Injury or death of wildlife from fencing.
- Minor amounts of marginal habitat loss, including permanent wetland impacts.

[511] SPA, pp. 5-7.

- Infrequent vehicle trips from maintenance vehicles.
- Potential decrease to property values.

4.9 Irretrievable or Irreversible Impacts

Resource commitments are **irreversible** when it is impossible or very difficult to redirect that resource to a different future use; an irretrievable commitment of resources means the resource is not recoverable for later use by future generations.

Irreversible and irretrievable resource commitments are primarily related to project construction, including the use of water, aggregate, hydrocarbons, steel, concrete, wood, and other consumable resources. Some, like fossil fuel use, are irretrievable. Others, like water use, are irreversible. Still others might be recyclable in part, for example, the raw materials used to construct PV panels would be an irretrievable commitment of resources, excluding those materials that may be recycled at the end of the panels' useful life. The commitment of labor and fiscal resources to develop, construct, and operate the project is considered irretrievable. Project infrastructure has been designed to avoid or minimize impacts on residences, the environment, and other sensitive resources. Nearby environmentally sensitive resources include wetlands, streams, and rivers, and the project is not anticipated to cause any irretrievable or irreversible impacts to these resources.

4.10 Resource Topics Receiving Abbreviated Analysis

Resource topics that will have **negligible** impacts from the project and that do not impact the Commission's site permit decision receive less study and analysis.

Many environmental factors and associated impacts from a project are analyzed during the environmental review process. However, if impacts are negligible and will not impact the permit decision, those resource impacts receive less study and analysis. The following resource topics meet this threshold, which is based on information provided by the applicant, field visits, scoping comments, environmental analysis, and staff experience with similar projects.

4.10.1 Displacement

Displacement can occur when residences or other buildings are located within a proposed site or right-of-way. If the buildings would potentially interfere with the safe operation of a project, they are typically removed from the site or ROW and relocated. Displacements from large energy facilities are rare and are more likely to occur in heavily populated areas where avoiding all residences and businesses is not always feasible than in rural areas where there is more room to adjust site boundaries or ROWs to accommodate the proposed energy facility.

There are no residences, business, or structures such as barns or sheds located within the area of land control, and none will be displaced by the project. No mitigation is proposed.

4.10.2 Communications

Electronic interference from the proposed project is not anticipated. The project area is served by 26 AM radio stations, 33 FM radio stations,[512] and 12 digital television channels.[513] There are no radio, microwave, or television towers are located within the boundary of the solar facility. There are no cell phone towers located within the land control area; the closest cell tower is approximately 0.04 miles south of the northwestern portion of the project along 230th Street West.[514] Cellular phone service in the service area is provided by national operators.[515] There are no ARMER towers, used for improving communication for emergency operators, in the project. The nearest ARMER tower is located near city of Randolph, approximately 4.8 miles east of the project.[516]

Because the solar facilities are relatively low (less than 20 feet tall), they are well below the line of sight used in many communication system signals. Electronic interference associated with communications infrastructure is related to a phenomenon known as corona. Impacts are not expected, because anticipated electric fields are below levels expected to produce significant levels of corona.

Section 4.3.24 of the DSP requires the permittee to take whatever action is feasible to restore or provide equivalent reception should interference occur to "radio or television, satellite, wireless internet, GPS-based agriculture navigation systems or other communication devices" as a result of the project. Additional mitigation is not proposed.

4.10.3 Implantable Medical Devices

Electromagnetic fields (EMF) might interfere with implantable electromechanical medical devices, such as pacemakers, defibrillators, neurostimulators, and insulin pumps. Impacts to implantable medical devices and persons using these devices are not expected to occur, but, if they did occur, moving away from the project would return the pacemaker to normal operation. Section 4.3.30 of the DSP requires the permittee to provide educational materials about the project to adjacent landowners. Additional mitigation is not proposed.

4.10.4 Forestry

Active forestry operations, including commercial timber harvest, woodlots, or other forestry resources do not occur within the land control area. Impacts to forestry operations will not occur.

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[512] Theodric Technologies, LLC. Radio-Locator. [Online]. [Cited September 23, 2025]. Retrieved from: https://radio-locator.com/cgi-bin/locate?select=city&city=5&x=15&y=5

[513] Federal Communications Commission. DTV Reception Maps. [Online]. [Cited September 23, 2025]. Retrieved from: https://www.fcc.gov/media/engineering/dtvmaps

[514] SCADACore. United States Cell Tower Map. [Online]. [Cited September 23, 2025]. Retrieved from: https://www.scadacore.com/tools/rf-path/cell-tower-map-united-states/

[515] Federal Communications Commission. National Broadband Map. [Online]. [Cited March 12, 2025]. Retrieved from: https://broadbandmap.fcc.gov/location-summary/mobile?version=jun2024&lon=-95.800983&lat=44.227964&addr_full=44.227964%2C+-95.800983&zoom=15.58&env=0&tech=tech4g

[516] SPA, p. 44.

4.10.5 Mining

There are no mining operations within the area of land control. There are several aggregate pits within a mile of the project, and the closest rock quarry location is 2 miles southeast of the project.

Construction of the project will require the use of sand and aggregate for backfill and access roads. The demand for sand and gravel will be temporary and is not expected to require new or expanded sand or aggregate operations.

Impacts to mining will not occur and no mitigation is proposed.

4.10.6 Topography

While grading will occur, significant impacts to topography, such as the creation of abrupt elevation changes or modifications to natural drainage patterns, are not expected. Project components will be constructed at grade to the extent possible. Appropriate permanent stormwater management measures will address drainage from the newly established impervious areas. Impacts to topography will be negligible.

4.11 Cumulative Potential Effects

Cumulative potential effects result from the incremental effects of a project in addition to other projects in the environmentally relevant area.

Minnesota Rule 4410.0200, subpart 11a, defines "cumulative potential effects," in part, as the "effect on the environment that results from the incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects ... regardless of what person undertakes the other projects or what jurisdictions have authority over the project."

The "environmentally relevant area" includes locations where the potential effects of the project coincide with the potential effects of other projects to impact the elements studied in this EA.

Consideration of cumulative potential effects is intended to aid decision-makers so that they do not make decisions about a specific project in a vacuum. Effects that may be minimal in the context of a single project may accumulate and become significant when all projects are considered.

4.11.1 Analysis Background

The ROI for cumulative potential effects varies across elements and is consistent with the ROI identified in potential impacts and mitigation throughout this document. Cumulative potential effects—where they coincide—increase or decrease the breadth of the impact to the resources and elements studied in potential impacts and mitigation. This may or may not change the impact intensity level assigned to the resource or element.

Cumulative potential effects are impacts to the environment that results from "the incremental effects of a project in addition to other projects in the environmentally relevant area that might reasonably be expected to affect the same environmental resources, including future projects actually planned or for which a basis of expectation has been laid, regardless of what person undertakes the

other projects or what jurisdictions have authority over the projects."[517] The "environmentally relevant area" includes locations where the potential effects of the project coincide with the potential effects of other projects to impact the elements studied in this EA. Generally, this area includes the ROI for the different resource elements.

Castle Rock Solar reviewed the Metro District MnDOT highway projects to identify foreseeable projects. Additionally, staff analyzed the unit's active project dockets, the Environmental Quality Board's interactive project database,[518] the MISO queue,[519] the Dakota County website,[520] and the city of Farmington website[521] to identify additional foreseeable projects. Foreseeable projects are identified in Table 34.

Cumulative effects are discussed here for projects that are foreseeable in the next five years in the project area. It is assumed that the construction-related impacts of these projects are short-term, for example, construction impacts will cause local disturbances, such as increased noise levels, and traffic delays/and reroutes. Thus, the discussion here is focused on the potential long-term impacts of these projects.

Table 34. Current and Reasonably Foreseeable Future Projects

Project	Location	Anticipated Timeframe	Description
Tract Management Company, LP – Farmington Technology Park	Dakota County, city of Farmington, directly northwest and west of the project	2025-?	Construction of data centers with a combined total power of 708 MW.
Castle Rock Solar, LLC – BESS Facility	Within the Castle Rock Solar Project land control area	?	Construction of a BESS within the Castle Rock Solar Project land control area.

Both identified future projects within the environmentally relevant area, the Farmington Technology Park (FTP) and Castle Rock Solar's BESS facility (Castle Rock BESS project), are likely to result in cumulative potential impacts for the city of Farmington and surrounding area. Tract Management

[517] Minn. R. 4410.0200, subp. 11a
[518] Minnesota EQB. Environmental Review Projects Database & Interactive Map. (n.d.). Retrieved from: https://www.eqb.state.mn.us/environmental-review/environmental-review-data
[519] MISO. Generation Interconnection Queue Database & Interactive Map. (n.d.). Retrieved from: https://www.misoenergy.org/planning/resource-utilization/GI_Queue/
[520] Dakota County. Planned Road Construction. (n.d.). Retrieved from: https://www.co.dakota.mn.us/Transportation/PlannedConstruction/Pages/default.aspx
[521] City of Farmington. Development Project Updates. (n.d.). Retrieved from: https://www.farmingtonmn.gov/163/Community-Development

Company, LP has proposed to construct a data center with a combined total power of 708 MW on the land directly northwest of the project, currently occupied by the Fountain Valley Golf Course, and the land directly west of the project, property of Farmington Public Schools and currently used for agriculture.[522] Castle Rock Solar plans to apply for approval to construct a BESS facility within the solar facility site. The BESS site would be located adjacent to the solar facility switchyard and substation. Castle Rock Solar does not have specific design information or specifications for the BESS at this time, but will provide said details when a site permit application is submitted.[523]

Unless otherwise indicated, the described project components and potential impacts are sourced from FTP's Final Alternative Urban Areawide Review,[524] the city of Farmington's Ordinance No. 2024-12 establishing development standards for the FTP,[525] the Snowshoe Energy Storage Project EA,[526] and the Northern Cresent Solar Facility and Energy Storage System EA.[527] The Snowshoe Energy Storage Project and Northern Crescent Solar Facility and Energy Storage System proposed constructing utility-scale BESS facilities. Both projects have been granted site permits by the Commission. The EAs for these projects were used to identify potential impacts of a utility-scale BESS facility, as Castle Rock Solar has not yet prepared a site permit application for the BESS facility within the site.

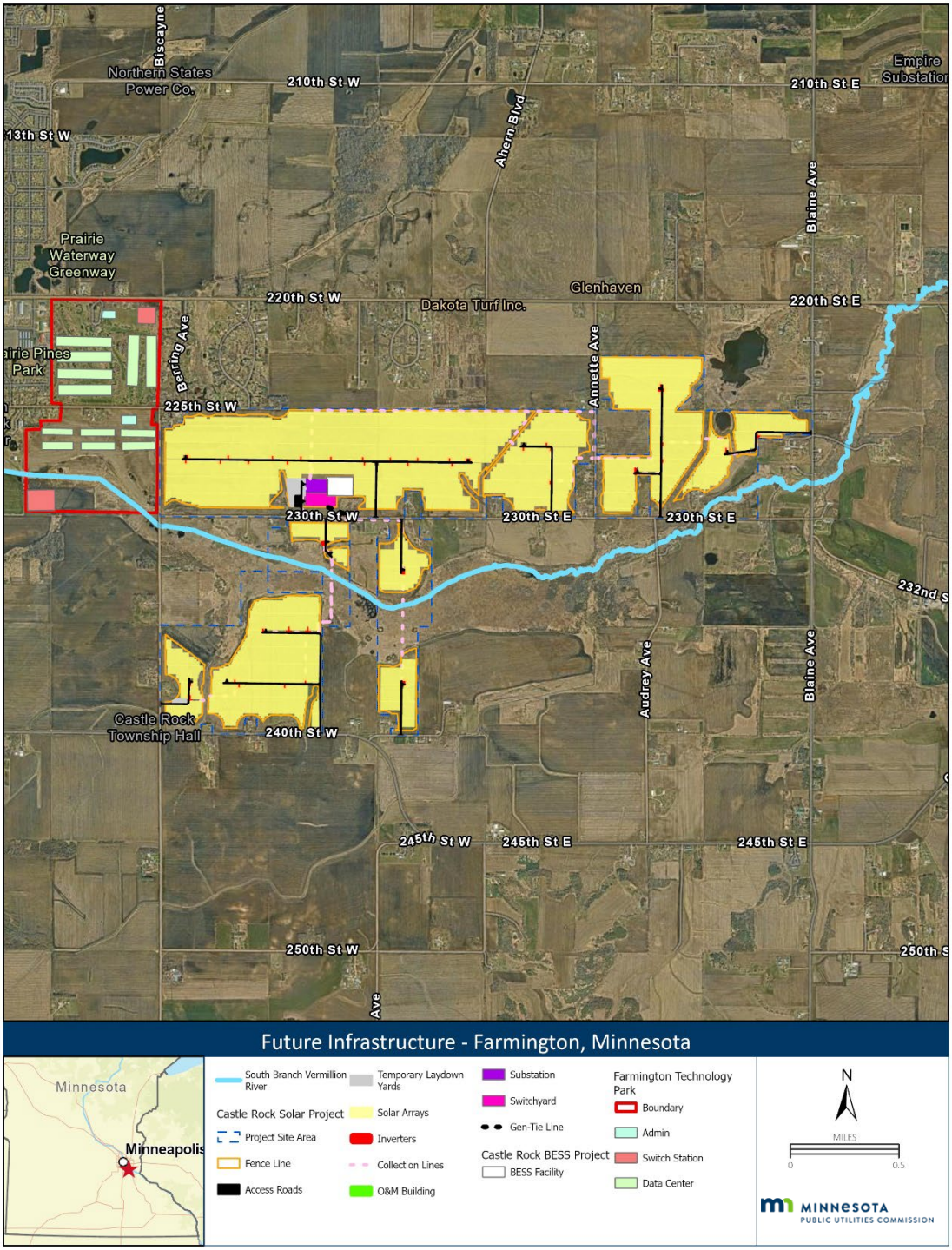
If the Castle Rock Solar project, the Castle Rock Solar BESS project, and FTP are all permitted, the landscape surrounding the city of Farmington will experience notable change (Figure 52). This area on the edge of Farmington, currently used for agricultural production, recreation, and residential development, would house:

- The 1,442-acre Castle Rock Solar project;
- The 345 kV gen-tie line connecting the Castle Rock Solar project to the existing Chub Lake to Hampton Corners 345 kV transmission line;
- The approximately 7 acre Castle Rock BESS project, within the solar facility;
- Six individual data center buildings totaling 408 MW, an administrative facility, and a 345 kV/34.5 kV switch station on the site currently occupied by the Fountain Valley Golf Course;

[522] Tract Management Company, LP. Farmington Technology Park, Final Alternative Urban Areawide Review: https://www.farmingtonmn.gov/DocumentCenter/View/1234/Farmington-Tech-Park-Final-AUAR-PDF?bidId=.
[523] Castle Rock Solar LLC, Site Plan Update, September 15, 2025, eDocket No. 20259-223007-01.
[524] Tract Management Company, LP. Farmington Technology Park, Final Alternative Urban Areawide Review: https://www.farmingtonmn.gov/DocumentCenter/View/1234/Farmington-Tech-Park-Final-AUAR-PDF?bidId=.
[525] City of Farmington, Ordinance No. 2024-12, November 18, 2025, retrieved from: https://www.farmingtonmn.gov/DocumentCenter/View/1258/2024-12-Amending-Title-10-Farmington-Technology-Park-PDF?bidId=
[526] DOC EERA, Environmental Assessment for the Snowshoe Energy Storage Project, April 9, 2025, eDocket No. 20254-217407-01.
[527] DOC EERA, Environmental Assessment for the Northern Crescent Solar Facility and Energy Storage System, February 12, 2025, eDocket No. 20252-215301-01.

- Six individual data center building totaling 300 MW, an administrative facility, a 345 kV/34.5 kV switch station, and a potential electric substation on the Farmington Public Schools' property, currently occupied by agriculture.

Figure 52. Future Farmington Area Infrastructure



Cumulative effects are discussed here for the Castle Rock BESS project and FTP. Construction of FTP is anticipated to begin in 2025, but is currently delayed. Construction of the Castle Rock Solar project is anticipated to begin in 2027. The construction timeline of the Castle Rock BESS project is currently unknown. If construction schedules for any of the project overlap, potential cumulative impacts include increased noise levels and traffic delays and reroutes. It is assumed that the majority of the construction-related impacts for these projects are short-term. The discussion here is focused on the potential long-term impacts of these projects, thus, this section largely focuses on operational impacts, with a few longer-term construction-related impacts included.

Where cumulative effects are anticipated, a written description is provided. Where cumulative potential effects are not anticipated no further analysis is provided. For the purposes of this EA, actions that have occurred in the past and their associated impacts are considered part of the existing environmental and were analyzed in this section.

4.11.2 Human Settlement

Cumulative potential effects on human settlements are anticipated to be minimal to moderate, with increased potential for some significant impacts, depending on viewer sensitivity and distance to the projects, such as a neighboring landowner.

AESTHETICS

The Castle Rock Solar project, the Castle Rock BESS project, and FTP will all result in aesthetic impacts (Section 4.3.1). A new high-voltage transmission line, the solar facility, the BESS facility, and the data center buildings, associated switch stations, substation, and administrative facilities will introduce several new visual elements into the landscape. The Castle Rock BESS project facility will likely consist of batteries housed in enclosures approximately 10 feet tall and 20 feet long; typical specifications for a standard battery enclosure structure. The FTP data center buildings will be a maximum of 80 feet high, and the sites will include switch stations and a potential substation of unknown dimensions. Thus, aesthetic impacts will increase in the project area as a result of these future projects. The concentrated area in which these projects are proposed to be constructed will significantly alter the current landscape and may cause dramatic changes in the viewshed at certain vantage points.

NOISE

Construction of the projects will create increased noise, through vehicle activity and construction. Once operational, noise from the Castle Rock Solar project facility is anticipated to be negligible (Section 4.3.2); noise coming from the inverters, transformer, and tracking system will dissipate, falling below L_{50} dBA standards at the nearest resident to levels similar to those created by a washing machine. Operational noise from the Castle Rock BESS project facility is anticipated to range from negligible to significant at nearby residences. The notable noise sources from the BESS facility are the cooling system in the BESS enclosures, which intermittently activates during operation, and the noise generated by power transfer in and out of the BESS. Unlike solar facilities, BESS facilities can be expected to operate at all hours of the day, including during the night. As Castle Rock Solar has not yet designed the BESS facility, operational noise has not been modeled, and it is unknown if noise from the BESS facility will fall within daytime and nighttime state noise standards. However, even if the BESS facility falls within state standards, it is possible that the noise may be noticeable to nearby residents.

The primary sources of operational noise from FTP will be the computers and ventilation systems within the buildings, and the use of generators tested once a month and in case of emergency. Operational noise levels have not been modeled for the FTP, so it is unknown if the data center facility will fall within daytime and nighttime state noise standards. However, given that the data center will operate continuously throughout the day, similar to the BESS facility, it is possible that operational noise from FTP may be noticeable to nearby residents, even if it falls within state standards. The resulting sound environment from all three projects combined has not been estimated. There is potential for additive noise to result in increased cumulative noise impacts for adjacent residences, and noise is expected to occur throughout all hours of the day.

Property Values

Property values may be affected at homes within 0.5 miles of the Castle Rock Solar project compared to homes 2-4 miles away, with a potential reduction in home sale prices of approximately 4 percent (Section 4.3.5). The Castle Rock BESS project may negatively impact property values depending on how the battery enclosures affects property aesthetics, the operational noise is audible at nearby residences, and if potential buyers have concerns over fires at the BESS facility. FTP may similarly impact property values depending on how the data center buildings and associated facility components affect property aesthetics, the operational noise is audible at nearby residences, and if potential buyers have concerns over overheating. Residences within the local vicinity might see some combination of the solar facility, the BESS facility, and the data center facilities in their viewsheds. The overall impact intensity level is anticipated to dissipate with distance. Because of the uncertainty associated with property value impacts, potential impacts to specific properties could be moderate to significant.

Tourism and Recreation

The construction of the Castle Rock Solar project will require rerouting Snowmobile Trail 123 (Section 4.3.6), and the visibility of the solar facility components from the trail may lessen enjoyment for certain users. Visibility of the Castle Rock BESS project from the trail could further reduce enjoyment for trail users depending on the extent to which battery enclosures are noticeable from the trail. The construction of the FTP will result in the loss of the Fountain Valley Golf Course, removing a recreational opportunity for surrounding residents. If the reroute of Snowmobile Trail 123 moves the trail closer to the proposed site of FTP, the combined visibility of the Castle Rock Solar project, Castle Rock BESS project, and FTP from the trail may lessen enjoyment for certain users to a greater extent than the Castle Rock Solar project would on its own.

Cultural Values

The construction and operation of these projects will undoubtedly change the character of Farmington and Castle Rock Township, impacting residents' sense of place. The intensity of this impact is extremely difficult to assess, as each individual in the area has their own opinions and ideas that influence their sense of place. Although the impact intensity cannot be explicitly determined, moderate impacts to cultural values are expected. Some residents of Farmington and Castle Rock Township will likely experience significant impacts to cultural values. These impacts are unavoidable.

4.11.3 Public Health and Safety

Cumulative potential effects on public health and safety are generally anticipated to be negligible to minimal. There is potential for moderate to significant impacts; impacts can be minimized.

FIRE

As an electrical system, the Castle Rock Solar project represents a fire risk (Section 4.4.2). The Castle Rock BESS project creates an additional potential fire hazard through battery failure leading to thermal runway, which can spread to nearby batters and containers. Thermal runway is a phenomenon when a battery cell generates heat at a greater rate than the heat can dissipate from the cell, resulting in a cascading chemical reaction which produces additional heat. Thermal runway events can result in extremely high temperatures, smoke, fire, and potentially ejection of gas, shrapnel, and particulates. Emergency response to fires or thermal runaway events at BESS facilities require specialized response, as the fires at BESS facilities present unique challenges to firefighters. BESS facilities do not have a single point of disconnect and, although separate parts of the system can be disconnected, the batteries will remain energized. First responders should not approach or enter the containers because of the gases that accumulate within containers during a thermal runaway event or fire, first responders should not approach or enter the containers. These fires are difficult to extinguish, the risk that some batteries will remain energized exists, and there is the potential for exposure to toxic gas. The industry recommends that first responders monitor the event and allow fires to burn themselves out as the energy is depleted from the batteries. The installation of the Castle Rock BESS project within the Castle Rock Solar project will increase the potential impacts from a fire on site by installing a new fire source, the batteries, as well as introducing additional public safety risks such as gas release and explosion. Employing best practices in facility design and operation, including identifying hazards and developing training for emergency responders can mitigate potential impacts. A fire within the FTP site does not pose specific risks to the Castle Rock Solar project or Castle Rock BESS project aside from the potential for the fire to spread into the solar and/or BESS facility if it is not appropriately contained.

4.11.4 Land-based Economies

Cumulative potential effects on land-based economies are anticipated to be minimal. Additional energy infrastructure in the form of a BESS facility will not result in conversion of agricultural land as the site will already have been cleared for the solar facility. Infrastructure related to the data center and associated facilities will result in conversion of agricultural land, but the loss of agricultural land is anticipated to be minimal overall.

4.11.5 Archaeological and Historical Resources

Because archaeological resources are unidentified, cumulative potential effects are unknown. With proper mitigation measures, such as the Unanticipated Discoveries Plan developed by Castle Rock Solar and amended in Special Condition 5.12, impacts to these resources can be minimized.

4.11.6 Natural Resources

Cumulative potential effects on the natural environment are anticipated to be minimal to moderate. The foreseeable projects are in cultivated agricultural areas or golf courses, resulting in minimal loss of high-quality habitat. Wildlife might be inadvertently harmed or killed during construction. Long term and permanent impacts include a greater risk of bird electrocution or collision due to increased transmission lines and electrical infrastructure on the landscape. Potential impacts can be mitigated. The overall impact intensity level is expected to remain minima however extreme weather events could result in minimal to significant impacts as discussed below.

SURFACE WATER AND FLOODPLAINS

Portions of the Castle Rock Solar project are located within a floodway and designated floodplains (Section 4.7.4). The Castle Rock BESS project will be located within the solar facility site, which contains floodway and designated floodplains. The FTP site also contains floodway and designated floodplain areas. Portions of the Castle Rock Solar project site, Castle Rock BESS project site, and FTP site drain to the South Branch Vermillion River, the location of the floodway and designated floodplains. All three projects will increase impervious surface area within the respective sites, increasing the runoff rate. Each project will design and install a stormwater management system that will be sized to accommodate projected runoff rates. The stormwater management systems will be designed to follow existing flow patterns, meaning some amount of stormwater runoff in each project is anticipated to be routed towards the South Branch Vermillion River. The South Branch Vermillion River flows east through the FTP site where it then flows through the Castle Rock Solar project and Castle Rock BESS project site, before connecting with the main stem of the Vermillion River. In the event of an extreme rainfall event, increased runoff from the projects could result in a flood event. Employing best practices in facility design and operation, including appropriate setbacks between facility components and designated floodplains and floodway, appropriate design of stormwater management systems, and developing training for emergency responders can mitigate potential impacts

4.11.7 Rare and Unique Resources

Cumulative potential effects on rare and unique natural resources are uncertain and difficult to determine. There are relatively few rare and unique species in the project area (Section 4.7.8). As the identified projects are improvements in cultivated agricultural areas or golf courses, these areas generally do not provide habitat for rare and unique species, nor do they typically support rare communities.

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