Westwood

Site Permit Amendment Application

Jeffers Wind Energy Center Repower Project

Cottonwood County, Minnesota

March 25, 2019

Prepared For:

Jeffers Wind 20, LLC
133 Federal Street, Suite 1202
Boston, MA 02110

Application to the
Minnesota Public Utilities Commission for a
Site Permit Amendment to Repower the
50 MW Jeffers Wind Energy Center Large
Wind Energy Conversion System

Jeffers Wind Energy Center Repower Project

Cottonwood County, Minnesota

MPUC Docket Number: E-6465/WS-05-1220

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March 25, 2019

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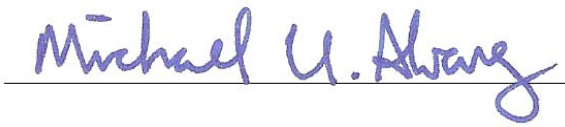
Signature:	
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ACRONYMS

ACRONYM	DEFINITIONS
2005 Site Permit	September 22, 2005 Commission Order Granting Site Permit
2012 Site Permit	May 10, 2012 Commission Order Granting Site Permit
AADT	Annual Average Daily Traffic
Act	Minnesota Wind Siting Act
ADLS	Aircraft Detection Lighting System
Amended PPA	Amended Power Purchase Agreement
Applicant	Jeffers Wind Energy Center Repower Project
Application	Site Permit Amendment Application for Jeffers Wind Energy Center Repower Project
ASOS	Automated Surface Observing System
BBCS	Bird and Bat Conservation Strategy
BMPs	Best Management Practices; prevents soil erosion and sedimentation
Capacity	The capability of a system, circuit, or device for storing electronic charge
CEG	Consulting Engineers Group
Corps	US Army Corps of Engineers
CN	Certificate of Need
CRP	Conservation Reserve Program
dB	Decibels
dB(A)	A-weighted decibel
DNR	Department of Natural Resources
DOC-EERA	Department of Commerce, Energy Environmental Review and Analysis
EMF	Electric and Magnetic Field
EPC	Engineering, Procurement and Construction
EQIP	Environmental Quality Incentive Program
FAA	Federal Aviation Administration
FBCI	Feathering below cut-in speed
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Maps
ft	foot/feet
Gearbox	An assembly of parts transmitting power between the low-rpm and high-rpm electric generator designed to transfer torsional power from the wind turbine rotor to the electric generator.
Generator	A machine by which mechanical energy is changed into electrical energy
GIA	Generator Interconnection Agreement
Hub	The central component of the wind turbine which connects the rotors to the generator.
IAV	inter-annual variability
IBA	Important Bird Area

Interconnection	Location of project connection to the power grid.
IPaC	Information Planning and Conservation
Interim Guidance	*Interim Guidance and Procedures for Repowering Large Wind Energy Conversion Systems in Minnesota* (Department of Commerce, 2017)
IRAC	Interdepartment Radio Advisory Committee
kV	kilovolt
kW	kilowatt
Longroad	Longroad Energy Management, LLC
LWECS	Large Wind Energy Conversion System
MCBS	Minnesota County Biological Survey
MDH	Minnesota Department of Health
MW	megawatt
MWh	megawatt-hour
m	meter
met	meteorological
m/s	meters-per-second
MISO	Midcontinent Independent Transmission System Operator
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPUC or Commission	Minnesota Public Utilities Commission
MWFRA	Migratory Waterfowl Feeding and Resting Areas
Nacelle	A streamlined enclosure (as for an engine), which houses the gearbox, generator, brake, cooling system and other electrical and mechanical systems
NOAA	National Oceanic and Atmosphere Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
O&M	Operations and maintenance facility
Phase I	Cultural Resources Reconnaissance Survey – physical inspection and identification of cultural resources within a specific area.
Pitch	The action or a manner of pitching; especially an up-and-down movement
POI	Point of Interconnection
PPA	Power Purchase Agreement
Project and Repower Project	Jeffers Wind Project
PWI	Public Waters Inventory
Repower (Partial)	Replacing select turbine or plant components
Repower (Full)	Complete dismantling and replacement of turbines and equipment
Repowering	Replacing select turbine or plant components
RF	Radio Frequency
Rotor	The rotor consists of three blades mounted to a rotor hub
RD	Rotor Diameter: Diameter of the rotor from the tip of a single blade to the tip of the opposite blade
RIM	Reinvest in Minnesota

SCADA	Supervisory Control and Data Acquisitions (communications technology)
SHPO	Minnesota State Historic Preservation Office
SPCC	Spill Prevention Control and Countermeasure
Step-up Transformer	A transformer that increases voltage
Substation	A subsidiary station in which electric current is transformed
SWCD	Soil and Water Conservation District
SWPPP	Storm Water Pollution Prevention Plan
TI	Turbulence Intensity – a measure of the standard deviation of wind speed over an hour, divided by the mean for the same time period
Transformer	An electrical device by which alternating current of one voltage is changed to another voltage
USFWS	US Fish and Wildlife Service
WCA	Wetland Conservation Act
Wind Farm	Jeffers Wind Energy Center Repower Project
WMA	Wildlife Management Area
WTG	Wind Turbine Generators

1.0 APPLICANT INFORMATION AND PROJECT BACKGROUND

1.1 Applicant Description

Jeffers Wind 20, LLC, ("Jeffers" or "Applicant"), a subsidiary of Longroad Energy Management, LLC ("Longroad"), respectfully submits this application ("Application") to the Minnesota Public Utilities Commission ("Commission") for a site permit amendment for the currently operating 50 megawatt ("MW") Jeffers Wind Energy Center ("Wind Farm"). The Wind Farm is a large wind energy conversion system ("LWECS"), as defined in the Wind Siting Act, Minn. Stat. § 216F (2018). The Wind Farm is located in Storden Township, within Cottonwood County in southwestern Minnesota.

Longroad is a Boston, MA-headquartered renewable energy developer focused on the development and operation of wind and solar energy projects throughout North America. Longroad staff have completed development for 33 projects with approximately 3,300 MW of nameplate capacity, including four high-voltage transmission lines. Longroad is a leader in developing, financing, constructing and operating wind and solar projects across the United States. In addition, Longroad provides operations and asset management services to wind and solar projects across the United States. Longroad has the ability to be the long-term operator and asset manager for the projects it develops or on behalf of third party owners. Longroad currently owns one other wind farm in Minnesota: the 30 MW Community Wind North Project located in Lincoln County, which is also proposed for repowering (MPUC Docket Number: IP-6712/WS-08-1494).

1.2 Project Background, Purpose, and Need

On September 22, 2005, the Commission issued an order granting a site permit to Summit Wind, LLC to construct the Jeffers Wind Energy Center (the "2005 Site Permit"). The 2005 Site Permit granted approval for construction of up to a 60 MW LWECS and associated facilities. The Wind Farm is an LWECS, as defined in the Wind Siting Act, Minn. Stat. § 216F, and is located in Cottonwood County in southwestern Minnesota near Jeffers, Minnesota within Storden Township (**Maps 1 and 2**). The Wind Farm was developed by Summit Wind, LLC ("Summit Wind"), and then was operated by NRG Energy, Inc, until Longroad purchased the project in 2017.

In accordance with the issued 2005 Site Permit, Summit Wind installed 20, Clipper C96 2.5 MW wind turbines. The Wind Farm was commissioned in 2008. The Wind Farm has a 20-year Power Purchase Agreement ("PPA") with Xcel Energy and a Generator Interconnection Agreement ("GIA") with the Midcontinent Independent System Operator ("MISO").

On February 7, 2011, Summit Wind filed a request to transfer the 2005 Site Permit to Jeffers. An order approving permit transfer with conditions was issued to Jeffers on May 10, 2012. The issued 2012 Site Permit was also amended to authorize an up to 50 MW LWECS, down from 60 MW in the original permit ("2012 Site Permit"). The 2012 Site Permit expires on December 31, 2035. A copy of the 2012 permit is provided in **Appendix A** for reference.

Jeffers is seeking an amendment of the 2012 Site Permit to allow repowering all 20 turbines ("Repower Project") to improve overall turbine reliability and extend the service life of the turbines. Jeffers is proposing to repower the existing Clipper C96 2.5 MW turbines using the Vestas repower package. The repower package will require that the old nacelles and blades be removed, an adapter installed on top of the existing towers, followed by placement of new nacelles and blades. As part of the repower process, there will be a set of Clipper components (blades and nacelles) that require disposition. That disposition will take two possible paths: 1) scrap by the project Engineering, Procurement and Construction ("EPC") contractor, or 2) sell the used components to another Clipper project owner. The determination will be made based on the expected market for the used components.

With the Vestas repower package, the repowered turbines will be 2.2 MW machines with 110-meter ("m") rotors (Vestas 2.2 - 110). The 2.2 MW configuration upgrades the wind turbines to a newer, more efficient configuration with a 44 MW nameplate capacity. The Vestas turbines have a smaller generator rating than the Clipper turbines (2.2 MW compared to 2.5 MW). However, the Vestas turbines are more efficient than the Clipper turbines. For example, the Vestas blades are longer than the Clipper blades allowing them to catch more wind. The Vestas hub height will also be taller than the Clipper hub height, so the Vestas turbines will encounter faster wind speeds than Clipper (since wind speeds increase with height). Due to the Vestas turbines being more efficient than Clipper, lower cut-in speed, and having a taller hub height, the project with Vestas turbines is expected to produce more energy per year than with the Clipper turbines (even though the nameplate capacity has fallen). The Wind Farm's Point of Interconnection ("POI") will not change.

Via this Application, Jeffers is requesting amendments to the 2012 Site Permit to authorize the Repower Project and is providing information to the Commission in support of this request. Jeffers submits that the minor changes discussed within this Application do not substantively change the findings of the 2005 Site Permit and 2012 Site Permit. Jeffers has reviewed the 2005 Site Permit and 2012 Site Permit and provided supplemental information where warranted. With this submission, Jeffers respectfully requests Commission approval for an amendment to the 2012 Site Permit to support the repowering process with several minor modifications that are discussed in detail within this Application.

The previously permitted locations of turbine towers, access roads, collection lines, and other supporting infrastructure will remain the same, and the Repower Project will not result in a larger facility boundary, nor will it require reinforcement of the towers. A large construction crane will be used to remove the current rotors and nacelles, requiring a temporary crane path roughly 45-50 feet wide to each turbine. Some minor upgrading of public roadways and intersections may be needed to allow for delivery of the replacement rotors and nacelles to each turbine location. A temporary five-acre laydown yard will be constructed on agricultural lands to stage the turbine components prior to installation.

Jeffers would like to begin work during the 2020 construction season and is currently targeting the second quarter of 2020 for construction start. The work is anticipated to take up to eight months.

The purpose of the Repower Project is to improve turbine technology, maximize annual energy production, and extend the service life of the Wind Farm. The Applicant has received a determination from MISO that the proposed Repower Project would not constitute a substantive modification and therefore the project can proceed under an amended GIA; however, the amended GIA has not yet been executed and is expected during Q2 2019. The power delivered to the POI will be reduced to 44 MW, because of the reduction in nameplate capacity for each turbine, and the GIA will be amended to reflect a project size of 44MW. Jeffers anticipates that the term of the amended GIA will be for 30 years with automatic one-year extensions until the Wind Farm is decommissioned.

Jeffers has negotiated an amended PPA ("Amended PPA") with Xcel Energy. The Amended PPA reflects the changes to turbine technology resulting from the Repower Project and lowers the price of the energy sold to Xcel Energy. In addition to the Amended PPA, Jeffers and Xcel Energy also negotiated an Option Agreement, which grants Xcel Energy the option to purchase the Project, subject to certain conditions. Xcel Energy has filed a petition with the Commission seeking approval of the Amended PPA and Option Agreement (MPUC Docket No. E002/M-06-1234). Jeffers plans to complete the Repower Project regardless of the outcome in that docket because of the efficiency benefits of the Repower Project. However, if the Commission approves the Option Agreement and Jeffers and Xcel Energy successfully complete negotiations and close on a purchase agreement, Xcel Energy would become the new owner of the Wind Farm. Xcel Energy would need to seek a separate approval from the Commission to transfer the Site Permit.

1.3 Issued Site Permit and Changes Requested

In addition to evaluating the Repower Project against current *Interim Guidance and Procedures for Repowering Large Wind Energy Conversion Systems in Minnesota* (Department of Commerce, 2017) ("*Interim Guidance*"), the 2005 Site Permit was evaluated for existing permit conditions, and conditions that might need to be modified. **Appendix B** provides a comprehensive summary of the 2012 Site Permit conditions, and whether they can be satisfied by the repowering project or require modification. While the majority of the 2012 Site Permit requirements can be satisfied under the Repower Project, Jeffers is respectfully requesting that the Commission consider the following modifications within the amended Site Permit in addition to some statutory reference updates:

1. Cover: The Applicant requests that the expiration date for the permit be changed to 30 years following the date of amended Site Permit issuance.
2. Section II: Update turbine size.
3. Site Permit Section III.C.1: The Applicant requests that the Wind Access Buffer be changed to 3 rotor diameter ("RD") in the non-prevailing wind direction by 5 RD in the prevailing wind direction.
4. Site Permit Section III.E.1: The Applicant requests that this section be modified to indicate towers not taller than 87 m (283.1 feet).
5. Final Boundaries I.2: The Applicant requests that the Commission approve a smaller project boundary. The proposed boundary more closely aligns with parcels containing project infrastructure and with Section E.6. of the 2005 permit, Footprint

Minimization. The requested boundary is reflected throughout this Application, and is specifically defined in Table 4.1.

6. Site Permit Section III.L: The Applicant requests that the expiration date for the permit be changed to 30 years following the date of amended Site Permit issuance.

2.0 CERTIFICATE OF NEED

A certificate of need is required for large energy facilities, as defined in Minn. Stat. § 216B.2421, unless the facility meets one of certain specific exemptions. In 2005, the Wind Farm did not require a certificate of need because it was a Community-Based Energy Development (Minn. Stat. § 216B.243, subd. 8(7) (2006). The Repower Project is exempt under current law because it will reduce the nameplate capacity of the Wind Farm to 44 MW, below the threshold of a large energy facility. In addition, Minn. Stat. § 216B.243, subd. 8 (8) also exempts LWECS repowering projects such as this one from certificate of need requirements. Therefore, the Repower Project does not require a certificate of need.

3.0 STATE POLICY

Pursuant to Minn. Stat. § 216F.03, the Applicant will further state policy by repowering and operating the Wind Farm in an orderly manner compatible with environmental preservation and sustainable development to more efficiently utilize the site's wind resources. The Applicant plans to repower turbines to maximize wind energy production while minimizing impacts on land resources. Through the Repower Project, the Applicant is also extending the life of the Wind Farm, which avoids completely rebuilding a new project and decommissioning.

This Application has been prepared following the Interim Guidance and provides information necessary to comply with Minn. R. Ch. 7854 and Minn. Stat. § 216F.

4.0 PROJECT DESCRIPTION AND OVERVIEW

4.1 Project Description and Location

The Applicant is requesting modification of the project boundary permitted in 2005, which contains approximately 8,320 acres. The Applicant is seeking footprint minimization as described in Section E.6 of the 2005 Site Permit, which has the effect of minimizing the amount of land that is impacted by the project. The Repower Project infrastructure is physically located on approximately 2,560 acres of privately owned and leased land in Cottonwood County (Table 4.1), generally south of Highway 30 (**Map 1**). All of these acres are located within the previously evaluated, and permitted, project boundary. Approximately 5,760 acres of the 2005 permitted boundary contains no Wind Farm infrastructure, and has therefore been eliminated from the Repower Project area for permit amendment purposes. Typical landscapes within the reduced Wind Farm area are shown on **Map 3** and consist largely of agricultural fields and wind energy infrastructure.

Table 4.1: Sections in Project Area		
Township	**Range**	**Sections**
107N	R37W	22-24; 27

The wind turbines will be mounted on steel tubular towers and have steel reinforced foundations. Associated facilities include electrical collection and communications lines, an electrical substation, permanent meteorological ("met") tower and gravel access roads.

Jeffers has an executed GIA with MISO for a 20-year term, but will negotiate an amended GIA to reflect the Repower Project. The negotiation process with MISO is expected to be complete in May 2019. The overall capacity at the POI will be lower than the original GIA, and the Wind Farm's POI will not change.

Only minor facilities and systems upgrades will be required for the Repower Project, which currently has all of the needed equipment and software to comply with the requirements of the GIA and what Jeffers anticipates will be the requirements of the amended GIA.

4.2 Size of the Project Area in Acres

The Repower Project boundary has been reduced to 2,560 acres in this application. The 2005 Site Permit area was roughly 8,320 acres. Jeffers is negotiating with a couple additional landowners for wind rights only leases to accommodate the 3RD x 5RD Wind Access Buffer setback for the longer blades. Leased parcels are shown on **Map 4**. **Map 4** shows the existing wind easements and the parcels Jeffers is acquiring wind rights only leases for.

4.3 Rated Capacity

The Vestas V110 has a lower nameplate capacity but higher energy generation than the Clipper C96, which results in a corresponding decrease in the nominal capacity of the Wind Farm from 50 MW to approximately 44 MW, a 12 percent decrease in nameplate capacity. The Vestas V110 was selected for its increased rotor swept area and hub height, reliability, and extended turbine operational life. Jeffers anticipates that the amended GIA also will be reduced to 44 MW.

4.4 Number of Turbine Sites

Jeffers is actively pursuing repowering approval from the Commission for all 20 of the currently operating turbines.

4.5 Meteorological Towers

The Wind Farm currently has a single, permanent, free-standing, 81 m (265.7 feet) tall met tower that meets Federal Aviation Administration ("FAA") and local requirements for lighting and marking. Jeffers is not currently planning to construct any new permanent met towers and will dismantle the existing met tower. In lieu of an on-site permanent met tower, reported wind speed will come from turbine nacelle anemometers.

4.6 Percent of Wind Rights Secured

Jeffers's existing wind lease agreements allow for the activities required under the Repower Project. Jeffers is working to execute and record amendments to extend the term of these agreements, consistent with this Application. In addition, Jeffers is currently in the process of seeking additional wind rights only leases to add to the periphery of the Wind Farm (**Map 4**) to satisfy the 3RD x 5RD wind buffer setback with the longer rotors. The percentage of wind rights secured to date is approximately 92 percent. Based on recent conversations with affected landowners, Jeffers anticipates acquiring all wind rights agreements to satisfy setback requirements .

4.7 Role of Applicant in Construction and Operation

Jeffers plans to construct, own, and operate the Wind Farm after the Repower Project, but may opt to sell the facility at some point in the future. Further discussion of a potential sale of the Wind Farm to Xcel Energy is provided in Section 1.2.

4.8 Ownership Statement

Subsidiaries of Longroad currently own the Community Wind North Project (Lincoln County) and Jeffers Wind Energy Center (Cottonwood County) projects in Minnesota, which combined provide about 80 MWs of renewable wind energy to the state.

4.9 Compliance Status of Project

Prior to submittal of this Petition, Jeffers completed an internal audit of its compliance with the 2012 Site Permit. Jeffers has largely complied with all 2005 Site Permit conditions, although the internal audit identified several compliance filings that had not been submitted. These documents were e-filed on January 23, 2019. Jeffers is committed to ensuring ongoing compliance with the Site Permit.

5.0 PROJECT DESIGN

5.1 Description of Project Layout

Because Jeffers is repowering already sited and operating turbines by installing larger rotors and internal components, there is no proposed change to the previously permitted locations of turbine towers, access roads, collection lines, the project substation or other supporting infrastructure. The project layout, as it currently exists, is shown on Map 2. The Wind Farm consists of 20 currently operating Clipper C96 2.5 MW turbines. The wind turbines are connected via an underground electrical collection system that transfers the generated power to the project substation, located directly west of the Wind Farm. A system of gravel roads leading to each turbine provides access for routine turbine maintenance. Existing project facilities were strategically sited primarily on agricultural lands to minimize impacts to area resources. Individual components of the project layout are discussed in greater detail throughout this Application.

5.2 Description of Turbines and Towers

Jeffers is requesting that the Commission review and approve the repowering upgrades proposed on the existing Clipper C96 2.5 MW turbines using the Vestas repower package. With the Vestas repower package, the repowered turbines will be 2.2 MW machines with 110-m rotors (Vestas 2.2 - 110). The 2.2 MW configuration upgrades the wind turbines to a newer, more efficient configuration. Vestas will deliver new Mk10D 2.2 nacelles to the site with all new major components (gear box, generator, transformer, etc.). Consequently, Vestas will not require a generator refurbishment station. Table 5.2 provides a pre- and post-repowering comparison of wind turbine characteristics. The primary differences between the two are the rotor diameter and total height. Total height of the turbines will increase from 128 m (419.9 feet) to 141.3 m (463.6 feet), with an RD increase of 14 m (45.9 feet). The foundations and towers will remain the same.

Table 5.2: Wind Turbine Characteristics Comparison

Design Features	Existing Clipper C96 2.5 MW Wind Turbines	Repowered Vestas V110 2.2MW Wind Turbines
Nameplate Capacity	2,500 kW	2,200 kW
Hub Height	262.5 ft (80 m)	283.1 ft (86.3 m)
Adapter	N/A	6.3m adapter for Vestas turbines will be installed on top of existing towers
Total Height	419.9 ft (128 m)	463.6 ft (141.3 m)
Rotor Diameter	314.9 ft (96 m)	360.9 ft (110 m)
Design Life	Minimum of 20 years	Minimum of 20 years
Cut in Wind Speed	8.9 mph (4m/s)	6.7 mph (3m/s)
Power Regulation	The rotor utilizes blade pitch regulation and variable speed operation to achieve optimum power output at all wind speeds. Unit is also equipped with low voltage ride through technology.	The rotor utilizes blade pitch regulation and variable speed operation to achieve optimum power output at all wind speeds. Unit is also equipped with low voltage and over voltage ride through technology.
Generation	2.5 MW per turbine	2.2 MW per turbine
Tower	Multi-coated, conical tubular steel with safety ladder to the nacelle	Multi-coated, conical tubular steel with safety ladder to the nacelle
Nacelle Bedplate	2 part - cast iron front part; girder structure rear part	2 part - cast iron front part; girder structure rear part
Main Bearings	Spherical roller bearings	Spherical roller bearings
Supervisory Control and Data Acquisition (SCADA)	Each turbine is equipped with SCADA controller hardware, software and database storage capability	Each turbine is equipped with SCADA controller hardware, software and database storage capability
FAA Lighting	Standard FAA lighting	Standard FAA lighting (Light in tower, nacelle, and hub). Equipped with emergency light in case of the loss of electrical power.

5.3 Structural Assessments and Reliability

Structural assessments of the existing foundations were performed by Barr Engineering in May 2018. The objectives of the structural assessment were to determine if the existing foundation

design could accommodate specified design loads for the Vestas V110 wind turbine using 2017 industry design standards or variations, identify those foundation elements that do not meet standards, and if necessary, make recommendations as to the course of action to be undertaken. The Barr Engineering study is provided in **Appendix C**.

A desktop comparison of load documents for the Clipper C96 and the Vestas V110 wind turbines found that the extreme loads for the Vestas V110 were lower than the Clipper C96. The operating loads for the Clipper C96 were also higher than the Vestas V110. When comparing damage equivalent loads, the fatigue loads for the Vestas V110 are somewhat lower than the Clipper C96. Using 2017 standards, the foundations passed all design checks for stability, bearing capacity, stiffness, strength and fatigue.

The Wind Farm has been operating reliably since 2008, producing the power that was expected each year and it is anticipated that the project will continue to do so through the end of the PPA term. To date, no issues have arisen that call into question the ability of the plant to continue operating through the end of the PPA and the current 2012 Site Permit term. The balance of plant equipment and improvements, including the foundations, electrical system and roads, continue to perform as designed. The proposed repower is driven by the improved project economics that result from the repower rather than by issues with plant reliability.

Additionally, testing and inspection of the balance of plant equipment and facilities have been undertaken to ensure the turbine towers, foundations and electrical system can accommodate the repower nacelles and rotors. Vestas is estimating a 30-year post-repower useful life. The following studies have been completed: Wind Turbine Foundation Evaluation Report; and a Wind Turbine Tower Evaluation Report. These are discussed in Section 10.4.2.

A Cable Ampacity Analysis Report was prepared by Consulting Engineers Group ("CEG") in January 2019 (**Appendix D**). The purpose of the medium voltage cable ampacity study is to determine whether the current carrying capacity (ampacity) for below grade medium voltage (MV) collection system cable is sufficient for the replacement 2.2 MW Vestas Wind Turbine Generators ("WTGs"). All existing cables were found to be sufficiently sized for the replacement turbines as currently installed.

5.4 Description of Electrical System

The electrical system is essentially the same as permitted in 2005 and 2012. Each turbine has its own individual step-up transformer located in a separate locked room in the back of the nacelle. The transformer is a three-phase, two-winding, dry-type transformer that is self-extinguishing and designed to IEC standards. The transformer in each nacelle will increases the voltage at the turbine terminals to the medium voltage level (34.5 kV) of the buried collector circuits that transmit the power from the turbines to the project substation. At the project substation, the power from the collector circuits is then combined into circuits that connect to Interstate Power & Light Company's Storden Junction Substation. Within the Storden Junction Substation, the voltage is again increased to the transmission level voltage (115 kV).

6.0 DESCRIPTION AND LOCATION OF ASSOCIATED FACILITIES

Associated facilities exist in the locations previously permitted and constructed to support the operation of the wind turbines and facilitate the delivery of the electricity to consumers. The previously permitted locations of permanent associated facilities such as access roads, collection lines, and substation facilities will remain the same.

6.1 Transmission and Project Substations

The Repower Project does not require a new transmission line, and the Wind Farm will continue to connect with the existing Interstate Power & Light Company Storden Junction Substation via the separate project substation. The Storden Junction Substation is owned by Interstate Power & Light Company, and is not affiliated with Jeffers.

The existing project substation is located at 39607 State Highway 30, Storden, Minnesota, and is approximately 0.5-acre inside the fence. Collection lines are routed to a nominally rated 60 Mega Volt Amp ("MVA") 34.5 kV/69 kV transformer located within the project switchyard. The power is then routed to the point of grid interconnection at the Storden Junction Substation located directly west of the switchyard. A 34.5/115 kV 120 MVA transformer steps-up the voltage to transmission voltage. No changes will occur outside of the existing footprint of the project substation. Jeffers expects interconnection studies and an amended interconnection agreement by June 1, 2019. This study will outline any needed modifications to the existing facilities. Based on information received to date, there may be some minor upgrades required in the control building (e.g., relays, SCADA), but Jeffers is not aware of any planned material changes (e.g., replacement of major equipment, new equipment, fenced area) within the substation.

The project substation is monitored by a SCADA system capable of monitoring and controlling most aspects of the substation facility. As with the individual wind turbines, the substation is monitored from Longroad's Remote Operations Center ("ROC") in Portland, Maine.

The project substation has a small building provided within the fenced substation that houses the control and relaying equipment, station batteries, and SCADA system. The entire substation is enclosed by a looped chain link fence.

6.2 Collector Lines and Feeder Lines

The following equipment is existing and will continue to be used with the repower. Power from each turbine generator is converted, controlled, and fed inside the tower from the generator down and through the power conditioning equipment and breaker panel. The turbine output voltage is stepped up to the collector system voltage of 34.5 kV by means of an individual step-up transformer located in a separate locked room in the back of the nacelle. Each transformer is connected to the project substation through underground collector lines.

The collector lines combine the electrical output of the wind turbines through separate 34.5 kV underground collector circuits. The project substation steps up voltage from these 34.5 kV collector lines to 115 kV and delivers the power to the grid.

6.3 Other Associated Facilities

6.3.1 O&M Facility

The Wind Farm currently owns an off-site Operation & Maintenance ("O&M") facility. The approximately 4,000 square-foot O&M building is located roughly 1 mile east of the project area at 308 South County Road 52, Jeffers, Minnesota. The building is used for storing spare parts and equipment to maintain the wind turbines. Jeffers currently has a contractual agreement with a Longroad fully-owned subsidiary, Longroad Energy Services, to provide service and maintenance for the Wind Farm. The Repower Project will shift service and maintenance responsibility to Vestas as the third party provider for operational support under a new service contract. Vestas will continue to utilize the existing, off-site O&M building.

6.3.2 Permanent Meteorological Towers

The Wind Farm currently has a single, permanent, free-standing, 81m (265.7 feet) tall met tower that meets FAA and local requirements for lighting and marking. Jeffers is not currently planning to construct any new permanent met towers and will dismantle the existing met tower. The met tower will be re-used if possible on another project. If not re-used, it will be recycled or disposed of at an appropriate disposal facility. In lieu of an on-site permanent met tower, reported wind speed will come from turbine nacelle anemometers.

6.3.3 Turbines Access Roads/Temporary Laydown/Staging Areas

Previously permitted access road networks for the Wind Farm will remain in the same locations. A large construction crane will be used to remove the old rotors and nacelles, and to re-install the rotors and upgraded nacelles, requiring a temporary crane path roughly 45-50 feet wide to each turbine. Proposed crane paths were sited using original project construction plans to closely adhere to previous crane path locations where feasible. In addition, some intersections will require temporary improvements in order for rotor and repower components to be delivered to the base of each turbine. As shown on **Map 2**, the temporary crane path and laydown area have been sited primarily on previously disturbed agricultural lands. The entire length of the crane path construction corridor and other temporary improvement areas were reviewed for wetlands, calcareous fens, potential native prairies, and cultural resources in fall 2018. No significant constraints such as native prairies, fens, or cultural resources were identified.

The Repower Project will also require grading of a temporary laydown area of approximately five acres to serve both as a parking area for construction personnel and staging area for turbine components during construction. The laydown area will be sited on previously disturbed agricultural lands outside of native landscapes. The laydown area will be in place for 6-8 months and then restored. A one-acre working area around each turbine will be required for construction in addition to the 50-feet x 50-feet crane pad. Other temporary staging areas may be needed for parking and unloading of large equipment deliveries. Temporary laydown and staging areas, and restoration of these areas, are described more fully in Section 10.3.3.

7.0 WIND RIGHTS

7.1 Status of Project Wind Rights and Modifications

Jeffers is currently on track to have all the agreements needed to satisfy setback requirementsas shown on **Map 4**. New wind rights only leases are being negotiated for purposes of including landowners who fall within the 3RD x 5RD wind access buffer. Jeffers is also executing and recording amendments to extend the terms of existing agreements with landowners.

Repower Project setbacks are discussed in greater detail within Section 8.2.1.3; **Map 5**.

8.0 ENVIRONMENTAL IMPACTS

In accordance with Minn. R. Ch.7854, the Applicant provides the following description of the environmental conditions of the Repower Project area. Because this is an operating project, Jeffers has focused on addressing substantive changes and/or updates rather than a complete revisit of items and resources previously addressed in the 2005 Site Permit application and with respect to the 2012 Site Permit.

The Repower Project location is rural with an agricultural-based economy; typical landscapes within the Repower Project area are shown on **Map 3**.

The Jeffers team has communicated with relevant agency staff prior to filing this Application. A list of contacted individuals and agencies is provided in **Appendix E**. On October 3, 2017, Jeffers conducted a meeting with Department of Commerce, Energy Environmental Review and Analysis ("DOC-EERA") staff members to discuss the Repower Project and gain feedback in regard to the Application content and process for repowering the project.

In addition, on September 14, 2018, Jeffers mailed letters to individuals representing local, state, and federal entities requesting comment. Some of those agencies included the U.S. Fish and Wildlife Service ("USFWS"), the U.S. Corps of Engineers ("Corps"), the State Historic Preservation Office ("SHPO"), Minnesota Department of Natural Resources ("DNR"), Minnesota Department of Transportation ("MnDOT"), Minnesota Department of Health ("MDH") and Cottonwood County. To date, comments have been received from Cottonwood County, DNR, SHPO, MnDOT and the USFWS. Responses have been incorporated into this Application, where appropriate. Agencies contacted and comments received are provided in **Appendix E**.

8.1 Demographics

Population

The Repower Project is located within a lightly populated rural area in southwestern Minnesota in Cottonwood County near the city of Jeffers, in Storden Township. Agricultural land use is predominant within the area, including agricultural-related businesses and dispersed rural residential use. According to U.S. Census Data (U.S. Census 2018), the population in Cottonwood County has decreased slightly since 2010. The estimated 2010 population for

Cottonwood County was 11,716, and the 2017 total population estimate was 11,295. The total number of housing units was estimated at 5,412, with a slight increase to 5,434 by 2017. Total occupied housing units in Storden Township in 2010 was 82, falling to just 69 by 2016. The 2016 American Community Survey 5-year estimates for population is 111, for a population density in Storden Township of less than 5 people per square mile.

The primary occupations in Storden Township, as shown in Table 8.1, include those related to agriculture, forestry, fishing, hunting, and mining, followed by manufacturing.

Table 8.1: Primary Occupations in Storden Township (2016)

Occupation Class	Percentage of Population
Agriculture, forestry, fishing and hunting, and mining	30.5.%
Construction	8.5%
Wholesale trade	5.1%
Retail trade	6.8%
Information	3.4%
Finance and insurance, and real estate and rental and leasing	1.7%
Professional, scientific, and management, and administrative and waste management services	1.7%
Educational services, and health care and social assistance	27.1%
Arts, entertainment, and recreation, and accommodation and food services	1.7%
Other services, except public administration	11.9%
Public administration	1.7%

Sources: https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml, and factfinder.census.gov

8.1.1 Potential Impacts

No significant demand increases are anticipated on long-term housing or regional demographics is anticipated. The repower effort will require temporary housing, which is anticipated to be accommodated by local short-term lodging providers. The continuing operations and maintenance of the facility currently requires approximately 4 full-time site technicians, including Plant Supervisor and additional support staff. After completion of the repowering, Vestas anticipates that 2 full-time technicians will be required for long-term servicing of project equipment. While there may be opportunities for some owner-representative positions, there is the potential for an overall staff reduction of approximately 2-3 positions.

8.1.2 Mitigation Measures

Minor, temporary losses in agricultural production for temporary construction crane access, laydown, staging, and work areas around turbines will be compensated through payments to landowners. Additional mitigation measures are not proposed by Jeffers.

8.2 Land Use

8.2.1 Local Zoning, Comprehensive Plans, and Setbacks

The primary regulatory approval required for the construction and operation of the Repower Project is a Site Permit amendment issued by the Commission. Pursuant to the Minnesota Wind Siting Act ("Act"), the Commission has been given the responsibility and authority to accept, evaluate and grant permits for wind projects in Minnesota. The Act provides that "No person may construct an LWECS without a site permit issued by the Public Utilities Commission" (Minn. Stat. § 216F.04(a)). The Act defines an LWECS as any combination of wind turbines and associated facilities with a nameplate rating equal to or greater than 5,000 kW. Furthermore, Minn. Stat. § 216F.07 states that, "A permit under this chapter is the only site approval required for the location of an LWECS. The site permit supersedes and preempts all zoning, building, or land use rules, regulations, or ordinances adopted by regional, county, local and special purpose government."

8.2.1.1 Comprehensive Plans and County or Local Ordinances

Jeffers is located in Cottonwood County. Cottonwood County Renewable Energy Ordinance (Section 25) applies to projects with a rated capacity of less than 25,000 kW or 25 MW. The ordinance does not contain provisions regulating repowering of an existing wind energy conversion system (Cottonwood County, 2016). Jeffers has been in communication with Cottonwood County regarding the Repower Project and will coordinate with the county in regard to any needed permits or approvals related to road use.

8.2.1.2 Project Setbacks

The repowered turbines will involve increasing the rotor diameter from 96 m (315 feet) to 110 m (360.9 feet). Jeffers has reviewed the effects of adding larger rotors upon the permitted and current setback standards for wind projects as shown on **Maps 4** and **5**. The following table summarizes the setbacks that: a) were approved in the 2005 Site Permit, b) are specified under current Commission standards (*MPUC Order Establishing General Wind Permit Standards; Docket No. E,G-999/M-07-1102 – MPUC 2008*), and c) that are possible under proposed repowering.

The Applicant is seeking a change to the 2005 Site Permit language in regard to the 5RD wind access buffer setback, and is offering wind rights only leases to landowners that would fall within a 3RD x 5RD setback due to the repowering. The 3RD x 5RD wind access buffer has since become the standard for new and repowered projects. The Applicant does plan to honor any existing lease agreements with landowners that fall within the larger 5RD setback established in the original site permit. While still in process, Jeffers will have agreements in place for all properties overlapped by the 3RD x 5RD wind access buffer

As noted in table 8.2.1.3, one turbine, turbine T-6, is currently located 241 feet from the center of the turbine to the public road right-of-way. This distance is 9 feet short of the guidance setback distance to public roads. Original construction documents were unavailable for review, and it is

unclear if the turbine moved slightly during micro-siting to avoid a constraint identified in the field, or if the county right-of-way changed after the permit was issued. Regardless, Jeffers has no plans to move the turbine, and the turbine has operated without incident for the past 10 years. Repowering turbine T-6 will not result in the turbine tower being closer to the public road.

Table 8.2.1.3: Project Setbacks Comparison

Setback	2012 Site Permit	Current MPUC Guidance	Possible with Repowering
Wind Access Buffer	5RD from the perimeter of the site where Permittee does not have wind rights.	3RD on east-west axis and 5RD on north-south axis from non-participating property lines.	All turbines will meet the standard 3RD x 5RD setback with the addition of new wind rights only leases.
Occupied Residential Dwellings	500 feet and sufficient distance to meet state noise standard.	500 feet and sufficient distance to meet state noise standard.	500 feet and sufficient distance to meet state noise standard.
Meteorological Towers	Not specified	250 feet from the edge of road right-of-way and boundaries of developer's site control.	No new met towers will be installed.
Other Structures	None specified	None specified	None specified
Public Roads	250 feet from the edge of the nearest public road right-of-way.	250 feet from the edge of the nearest public road right-of-way.	One turbine, turbine T-6, is currently located 241 feet from the public road right-of-way.
Recreational Trails	Not specified	250 feet from the edge of public trails, but on a case-by-case basis.	250 feet from the edge of public trails. There are no public trails within the project boundary.
Public Lands	Not specified	3RD east-west axis and 5RD on north-south	3RD east-west axis and 5RD on north-south
Wetlands, Streams and Ditches	Avoid public waters wetlands as defined in Minn. Stat. § 103G.005, subp. 15a	No turbines, towers or associated facilities allowed. Electric collector and feeder lines may cross or be placed subject to DNR, USFWS and/or Corps permits.	No turbines, towers or associated facilities are placed within Public Waters and Wetlands. Permits will be acquired for proposed temporary crossing of wetlands and streams from the DNR, Corps and County, as needed.
Internal Turbine Spacing	No closer than 3 RD for crosswind spacing and 5RD for downwind spacing. Four towers, or 20%, can exceed the threshold.	3RD on east-west axis and 5RD on north south axis. Twenty-percent can exceed threshold.	All but one turbine (T-5) meet the internal spacing requirement. The project is permitted up to 4, or 20%.
Public Conservation	Avoid with infrastructure; non-	Avoid with infrastructure; non-participating property	Avoid with infrastructure; provide wind access

Table 8.2.1.3: Project Setbacks Comparison			
Setback	**2012 Site Permit**	**Current MPUC Guidance**	**Possible with Repowering**
Lands	participating property line setback.	line setback.	buffer.
Native Prairies	Turbines and associated facilities shall not be placed in native prairies, unless addressed in a native prairie protection plan.	Turbines and associated facilities shall not be placed in native prairies, unless addressed in a native prairie protection plan.	Native prairies are avoided by turbines and associated facilities as confirmed by DNR review. Consequently, a prairie Protection and Management Plan is not needed.
Sand and Gravel Operations	Turbines and associated facilities shall not be placed in active sand and gravel operations, unless negotiated with the owner.	Turbines and associated facilities shall not be placed in active sand and gravel operations, unless negotiated with the owner.	Sand and gravel operations are avoided by turbines and associated facilities.
Aviation	Not specified	Turbines and associated facilities shall not be located so as to create an obstruction to navigable airspace of public and private airports.	Turbines and associated facilities have been placed in a way that avoids obstruction to navigable airspace of public and private airports.

8.2.1.3 Current and Future Zoning

Jeffers will work with Cottonwood County and Storden Township to confirm that the Repower Project is in alignment with applicable current and future zoning.

8.2.2 Conservation Easements

The proposed temporary crane paths, laydown yards required for repowering will be sited outside of known conservation easement areas (**Map 6**). USFWS, Cottonwood County Soil and Water Conservation District ("SWCD"), and the Natural Resource Conservation Service ("NRCS") offer conservation programs that encourage setting aside wetlands and grasslands for conservation purposes, or implementation of conservation practices on private land. Some of these programs include the Conservation Reserve Program ("CRP"), Reinvest in Minnesota ("RIM"), Wetland Reserve Program ("WRP"), and the Environmental Quality Incentive Program ("EQIP). CRP and WRP areas will be verified by evaluating current land lease agreements for participating landowners prior to construction.

8.2.3 Potential Impacts

No changes to local zoning are required to implement the Repower Project. The Repower Project will not negatively affect uses already permitted per the zoning designations. Agricultural use of the Repower Project area will continue. The Repower Project will positively

impact local economies by continuing to provide a diversified and consistent income stream for landowners, possible temporary jobs for local workers, and long-term tax benefits to the local governments that do not fluctuate very much from year to year. No impacts to local zoning are anticipated.

8.2.4 Mitigation Measures

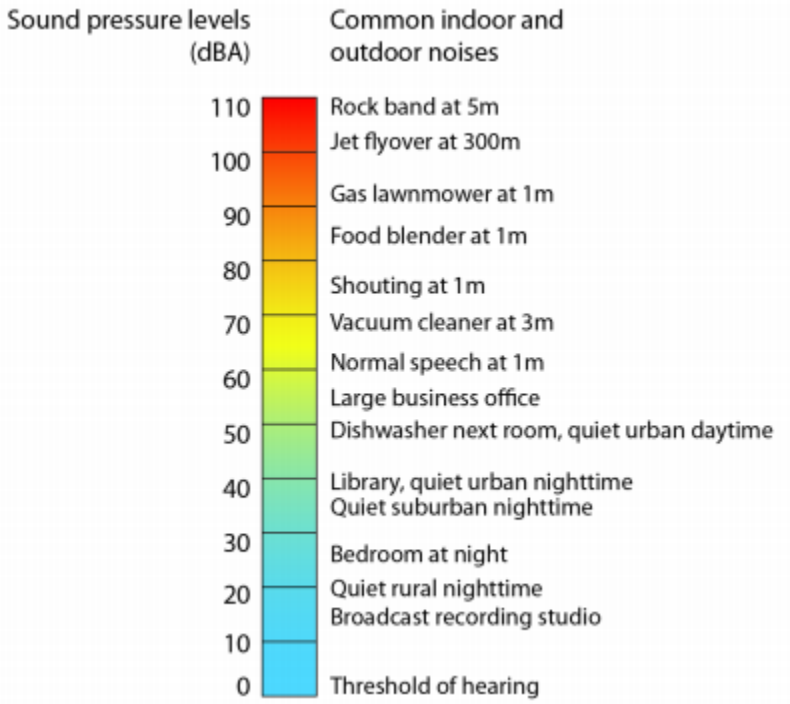
Jeffers is not proposing mitigation measures, as negative impacts to local zoning and comprehensive plans are not expected. No mitigation measures are proposed for conservation easements because impacts to lands subject to conservation easements are not anticipated. However, if these lands are unavoidable, Jeffers will work collaboratively with the NRCS, as well as the landowner, to remove the impacted portion of the parcel from the program and provide appropriate mitigation.

8.3 Noise

Noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. According to Minn. Stat. § 116.06, subd. 15, "Noise" means "any sound not occurring in the natural environment, including, but not limited to, sounds emanating from aircraft and highways, and industrial, commercial, and residential sources." Sound is an audible variation of air pressure, and can vary in both intensity and frequency. The intensity of a sound wave is measured on a logarithmic scale in units called decibels ("dB"). The sound level in decibels measured or calculated using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear. All sound (noise) levels in this report are A-weighted.

Table 8.3 shows sound levels associated with some common sources and/or locations that has been prepared by the Minnesota Pollution Control Agency ("MPCA"):

Table 8.3: Common Noise Sources and Sound Levels



Source: MPCA, November 2015.

8.3.1 Description of Resources

The term "background or ambient noise" as described in the MPCA Guide to Noise Control in Minnesota refers to all noise sources other than the noise source of concern. Common background sound sources within an agricultural and/or rural environment include, but are not limited to, sound from farm equipment such as tractors and combines and sound generated from traffic on roadways. Natural sounds include those from birds and wind rustling through the vegetation.

The MPCA has adopted the standards summarized in Table 8.3.1.

Table 8.3.1: MPCA State Noise Standards — Hourly A-Weighted Decibels

Land Use	Code	Daytime (7:00 AM - 10:00 PM) dBA		Nighttime (10:00 PM - 7:00 AM) dBA	
		L_{10}	L_{50}	L_{10}	L_{50}
Residential	NAC-1	65	60	55	50
Commercial	NAC-2	70	65	70	65
Industrial	NAC-3	80	75	80	75

Household units, including farm houses, are included in NAC-1 and all identified receptors within the Repower Project area governed by the NAC-1 limits. The most restrictive standard,

the hourly L50 or median, is 50 (A-weighted decibel) ("dBA") during the nighttime and 60 dBA during the daytime.

8.3.2 Potential Impacts

The proposed Repower Project consists of replacing each of the existing 20 Clipper Windpower, LLC (Clipper) wind turbine nacelle and blades with Vestas Wind Systems A/S (Vestas) V110's wind turbines equipped with low-noise serrated trailing edge (STE) blades as well as increasing the hub height from 80 to 87 m (266 to 285 feet). The number and location of the wind turbines is not changed by the Repower Project. Jeffers has been in continuous commercial operation since 2008. There have been no noise complaints filed with the Commission during its operational history. The rated sound level of the proposed Repower Project's Vestas wind turbines with STE blades is 1 dBA less than that of the existing Clipper wind turbines. The existing Clipper wind turbines have a sound power level of 107 dBA, and the Vestas V110, with low-noise STE blades, have a sound power level of 106 dBA.

The Clipper wind turbines utilized a gear box and nacelle design which differs from the more conventional modern turbine in use in North America (e.g., Vestas, General Electric). While this design had several advantages, the configuration of the equipment within the nacelle and the nacelle design itself did not lend itself readily to the addition of silencing techniques. The Clippers also experienced an episodic clacking or clanking noise associated with the internal nacelle equipment that was noticeable at times from the ground. The proposed Vestas 2.2MW turbines have the latest noise minimization technology implemented, which will yield a reduction in mechanical sound from the nacelle compared with the existing Clipper machines.

Acoustical modeling was completed by Jacobs on behalf of Jeffers for the Repower Project (**Appendix F**). A maximum predicted Repower Project sound level of 47 dBA plus a non-wind turbine nighttime sound level of 34 dBA yields a total sound level of 47 dBA. When a non-wind turbine nighttime sound level of 39 dBA is added to a Repower Project sound level of 47 dBA the resulting total sound level is 48 dBA. In both instances the total nighttime sound level does not exceed the nighttime requirement of 50 dBA. A non-wind turbine sound level of 48 dBA would be required for a Repower Project sound level of 47 dBA to yield a total sound level that nominally exceeds 50 dBA.

Similarly, a predicted Repower Project sound level of 47 dBA plus a non-wind turbine daytime sound level of 40 dBA yields a total sound level of 48 dBA. When a non-wind turbine daytime sound level of 45 dBA is added to a Repower Project sound level of 47 dBA the resulting total sound level is 49 dBA. In both instances the total daytime sound level does not exceed the daytime requirement of 60 dBA. A non-wind turbine sound level of more than 60 dBA would be required for a total sound level to exceed 60 dBA and the addition of a Repower Project sound level of 40 dBA to this level would not increase the overall total sound level.

Minor, temporary construction noise will be generated by repowering from typical construction equipment such as cranes, component delivery trucks, dump trucks and graders. In general, construction noise will be less than experienced during project construction as access roads, turbine pads, towers and collection lines will remain in place. Deliveries will also be fewer as the repower will not require concrete for turbine foundations. Jeffers is committed to working

within the constructs of the Cottonwood County Zoning Ordinance to reduce construction noise below levels that would be considered objectionable. Machinery will be properly muffled, as required by law, and hours of operation will be consistent with County standards for similar construction projects. Because of the rural nature of the project location, construction-related noise is expected to be typical of farming operations during the height of planting and harvest seasons.

8.3.3 Model Used to Determine Noise Levels

The commercial software used to prepare the acoustical model is Cadna/A by DataKustik GmbH, Version 2019 (build: 167:4905). The sound propagation factors used in the acoustical model have been adopted from International Organization for Standardization 9613-2 (ISO 9613-2), Acoustics—Sound Attenuation During Propagation Outdoors Part 2: General Method of Calculation (1996). Cadna/A as well as ISO 9613-2 have been used by researchers and regulatory bodies throughout the world in similar wind turbine sound evaluations. The ISO 9613-2 parameters used in this assessment are mixed ground (G = 0.5, where G may vary between 0 for hard [e.g., water, pavement, or concrete) and 1 for acoustically absorptive ground (e.g., plowed earth]) with all the turbines operating at their rated sound power level simultaneously. The model used a receptor height of 1.5 m (4.9 feet). No screening from topography or vegetation was considered in the model. These modeling parameters are consistent with those identified in guidelines prepared for the Commission (National Association of Regulatory Utility Commissioners, 2011). Atmospheric absorption for conditions of 10 degrees Celsius (50 degrees Fahrenheit) and 70 percent relative humidity (conditions that favor propagation) was computed in accordance with ISO 9613-1, Acoustics—Sound Attenuation During Propagation Outdoors, Part 1: Calculation of the Absorption of Sound by the Atmosphere (ISO, 1993).

8.3.4 Noise Mitigation Measures

Jeffers has been in continuous commercial operation since 2008. There have been no noise complaints filed with the Commission during its operational history. The rated sound level of the proposed Repower Project's Vestas wind turbines incorporating the low noise STE blades is 1 dBA less than that of the existing Clipper wind turbines. Jeffers is committed to operating the Repower Project in compliance with the applicable standard and no additional noise minimization or mitigation measures are anticipated.

8.4 Visual Impacts

8.4.1 Visual Impacts on Private Lands and Homes

Visual impacts to private lands and homes are not anticipated to be substantially changed from the current, operating condition. Existing wind turbine locations in the project vicinity are provided on **Map 7**. Minor, temporary visual impacts to the existing agricultural landscape will occur with the presences of construction cranes for replacement of nacelles and blades, and from erosion control BMPs such as silt fence and fiber blanket within soil disturbance areas. Cranes, equipment, and temporary BMPs will be removed following the repowering activities. Because most of the areas proposed for disturbance are agricultural lands, visual impacts associated with erosion control BMPs should be relatively minor (see Section 10.2). Aside from slightly taller

turbines and longer blades, no permanent change to the visual landscape is anticipated as a result of repowering.

The FAA requires obstruction lighting or marking of structures over 200 feet above mean sea level because they are considered obstructions to air navigation. Jeffers submitted revised applications and lighting plans to the FAA for all 20 wind turbines for determinations of proposed construction. Determinations of No Hazard for the increased turbine heights based on the longer rotors were received on September 6, 2018. The result of the determinations include recommendations for marking and lighting pursuant to FAA standards as described in Chapter 13 of FAA Advisory Circular 70/7460-1L. The standards indicate that turbines should be painted white or light grey, and obstruction lighting should consist of FAA L-864 aviation red flashing, strobe, or pulsed obstruction lights. Specific lighting and marking plans for the repower project will be closely coordinated with the FAA.

Jeffers will abide by the FAA's recommendations in regard to required obstruction lighting. Lights will be synchronized. All but four of the 20 currently operating turbines have FAA obstruction lighting. Generally the FAA does not require that every turbine have lights.

8.4.2 Visual Impacts on Public Lands

Because no change to infrastructure is proposed other than slightly larger blades and taller hub heights, visual impacts to public lands and homes are not anticipated to be substantially changed from the current, operating condition. Jeffers has received no visual impact complaints during the last 10 years of operation.

8.4.3 Visual Mitigation Measures

Jeffers will work to avoid or minimize visual impacts related to the proposed repowering project.

Jeffers proposes the following mitigation measures:

1. Repowered turbine parts will be uniform in color;
2. Turbines will be illuminated only as necessary to meet the minimum FAA requirements for obstruction lighting (e.g., reduce number of lights on turbines and synchronized red flashing lights);
3. Temporarily disturbed areas will be converted back to cropland or otherwise reseeded with native seed mixes appropriate for the region.

8.4.4 Shadow Flicker

Shadow flicker is the term used to refer to the alternating changes in light intensity that can occur at times when the rotating blades of wind turbines cast moving shadows on the ground or on structures. Shadow flicker occurs only when the wind turbines are operating during sunny conditions, and is most likely to occur early and late in the day when the sun is at a low angle in the sky. The intensity of shadow flicker is defined as "the difference or variation in brightness at a given location in the presence or absence of a shadow" (National Research Council [NRC], 2007). The intensity of the shadows cast by moving blades of

wind turbines, and thus the perceived intensity of the flickering effect, is determined by the distance of the affected area from the turbine, with the most intense, distinct, and focused shadows occurring closest to the turbine (Department of Energy & Climate Change [DECC], 2009). Multiple independent conditions must be met in order for shadow flicker to occur, and these conditions play a role in the intensity and frequency at which a receptor may experience shadow flicker. These conditions and interacting factors are further described below:

1. Number, size, and position of windows: In order for shadow flicker to be perceived within a building, the rotating turbine blade must be between the window and the sun.
2. Ambient lighting conditions: When inside, having lights on may significantly diminish the perception of shadow flicker.
3. Cloud cover: When the sunlight is obscured by clouds, shadow flicker is reduced or eliminated.
4. Time of day: In the middle of the day the shadow does not extend as far from the base of the turbine as it does when the sun is lower in the horizon (e.g. during the morning or late afternoon). .
5. Visual Screening: Objects such as trees, topography, buildings, awnings, blinds and drapes can all reduce or eliminate the potential perception of shadow flicker.
6. Operation of the wind turbine: When wind turbine blades are not spinning, the turbine casts a stationary shadow and does not cause shadow flicker. Turbine blades may be stationary when the wind is above or below its operating speeds, or they may be offline for maintenance.
7. Orientation of the wind turbine: An operating wind turbine rotates and faces into the wind, which may or may not be into the sun. The shape and size of a wind turbine's shadow changes based on which direction it is facing relative to the sun. If the turbine is facing directly into or away from the sun, it will cast the largest shadow.

8.4.5 Potential Impacts

Shadow flicker modeling was completed by Jacobs for the Repower Project (**Appendix G**). Jacobs used the WindPRO software to model shadow flicker at identified receptors. As expected with slightly taller turbines and longer blades, shadow flicker is anticipated to increase at some receptors. Table 8.4.5 summarizes the shadow flicker results for the ten receptors with the highest levels of predicted flicker with the Repower Project.

Table 8.4.5: Shadow Flicker at Receptor Locations

Structure ID	Participating Status	Predicted Average Annual Hours of Shadow Flicker (hrs/yr)		
		Existing	Repower Project	Change
H31	Participating	53:17:00	73:44:00	20:27:00
H30	Participating	51:32:00	67:59:00	16:27:00
H7	Participating	38:16:00	54:58:00	16:42:00
H34	Participating	36:22:00	46:28:00	10:06:00
H8	Participating	26:41:00	38:31:00	11:50:00

H43	Nonparticipating	23:35:00	34:49:00	11:14:00
H6	Participating	24:26:00	32:15:00	7:49:00
H5	Participating	14:43:00	19:52:00	5:09:00
H39	Participating	12:00:00	17:59:00	5:59:00
H33	Participating	11:06:00	17:54:00	6:48:00

Shadow flicker modeling incorporates annual average monthly cloud cover and wind direction statistics. Additional factors that limit shadow flicker but have not been considered in the model result include operational availability/down time for maintenance, orientation of windows on structures and potential for tall vegetation to block potential flicker.

8.4.6 Shadow Flicker Mitigation Measures

Jeffers has been in continuous commercial operation since 2008. There have been no shadow flicker complaints filed with the Commission during its operational history.

Jeffers will evaluate any comments received regarding flicker. In coordination with the affected party, Jeffers will evaluate potential flicker minimization options in the unlikely event more flicker is present than was modeled.

Additional mitigation options the Repower Project may consider providing, where appropriate and reasonable, include exterior screening such as trees, shrubs and awnings, and interior screening such as curtains or blinds for windows.

Jeffers can also provide materials about shadow flicker to landowners that can help minimize the effect of shadow flicker such as turning on lights and using a different room for a short period of time.

8.5 Public Services and Infrastructure

The Repower Project is expected to have minimal effect on existing services and infrastructure of the area (**Map 8**). The Repower Project will be of much lower intensity and extent than building a new wind project of similar size, as much of the construction activity such as installing roads, foundations, towers, underground electrical systems, transmission interconnections data communication, O&M building, etc. will not occur. In addition, the duration of construction is approximately one-third that required to build a new project, or roughly 6-8 months. Once the repower is completed, O&M activity, and use of public services and infrastructure, would not increase from levels prior to the repower. The Repower Project is designed to have manageable temporary effects on the existing infrastructure during construction and operation. Because only minor impacts are expected, extensive mitigation measures are not anticipated. The following sections describe specific impacts that may occur to public services and infrastructure and how they will be mitigated.

8.5.1 Roads and Traffic

Existing roadway infrastructure in and around the Repower Project consists of county and township roads that generally follow section lines, with private gravel turbine access roads, private unpaved farmstead driveways and county farming access roads.

The major traffic routes to and from the project area includes Minnesota Trunk Highway 30. In addition, several county and township roads provide access to the site, including two-lane paved and gravel roads and minimum maintenance gravel roads. Annual Average Daily Traffic ("AADT") on area roads ranges from 45 to 1,050 (**Map 9**). Traffic during the repower will increase above current levels by roughly 100 trips per day due to construction personnel and deliveries of equipment, cranes, turbine blades, gearboxes, etc. Deliveries will be staged and spread out over the site as repowering activity moves across the project, so areas of concentrated traffic will be few and of short duration. Once the repower is complete, vehicle activity associated with the Repower Project will return to the low levels of activity currently experienced at the project site, comprised of approximately five trips to and from the project site daily.

8.5.2 Communication Systems

The Repower Project has undertaken an extensive analysis of federally-licensed ("FCC") microwave and fixed station radio frequency ("RF") facilities that may be adversely impacted as a result of the Repower Project. The study, completed by Evans Engineering Solutions in February 2019, is provided in **Appendix H**, and includes an analysis of microwave beam paths, land mobile and public safety facilities, television broadcast facilities, radio, cellular service, and government radar and communication systems.

On July 13, 2018, Evans Engineering Solutions contacted the National Telecommunications and Information Administration ("NTIA") in regard to the Repower Project. The NTIA provided plans to the federal agencies represented in the Interdepartment Radio Advisory Committee (IRAC) for the Repower Project. After a 45 plus day period of review, no federal agencies, including the Department of Defense ("DOD"), identified any concerns regarding blockage of their radio frequency transmissions, or construction of turbines on this site. A copy of the letter from the NTIA is provided in Appendix H.

Telephone and Cellular

Telephone service in the area is provided by CenturyLink, Frontier Communications, Midcontinent Communications, and Western Telephone. The nearest cell phone tower, according to the Evans study, is 1.25 miles from the nearest turbine. Jeffers is not aware of any complaints being made during operation of the Wind Farm.

Microwave Beam Paths

The Repower Project has undertaken an assessment of microwave beam pathways to ensure that the project does not interfere with microwave paths that have been established for communications systems in the vicinity of the project. Evans Engineering Solutions identified three unique licensed microwave paths from the FCC database that cross the project area; once licensed to Northern Border Pipeline Company, one to Affiniti, LLC, and another to Back 40

Wireless. Two turbines, 8 and 19, were found to be close to the beam paths. The study, which is provided in **Appendix H**, indicates no interference is anticipated.

AM/FM Radio
A search of the FCC's database by Evans revealed no AM facilities within the required notification distance of 1.86 miles from any turbine, and FM broadcast station signals (88 to 108 MHz) are fairly insensitive to wind turbines. Jeffers has received no complaints of AM or FM radio interference in 10 years of operation.

Fixed Land Mobile Stations
A search of the FCC's land mobile/public safety radio database revealed just one land mobile transmitter station that falls within the search area (about 500 m beyond the outermost turbines). The land mobile site is licensed to an individual, and has a call sign of WNZN424.

8.5.3 Television

Cottonwood County, where the Wind Farm is located, is in the Minneapolis-St. Paul, MN Designated Market Area ("DMA") as defined by Nielsen Media Research. However, based on this engineer's analysis, the project area and its environs are not predicted to receive a direct off-the-air signal from any TV stations licensed to Minneapolis-St. Paul market. The TV stations that have been determined to place a predicted FCC primary off-the-air service signal over at least a portion of the project area or its immediate environs are primarily from the Sioux Falls TV market. Also, the area is served by KEYC-TV in Mankato. The Evans report identified seven stations that have off-the-air service signals over a portion of the project area.

8.5.4 Other Local Services

Pipelines
No oil and gas pipelines are known to exist within the Repower Project site permit boundaries.

Electrical Services
There are currently no utility transmission lines within the project area. The Jeffers to Jefferson Tap 69kV transmission line runs along the northern project boundary parallel to County Road 53. The Storden Junction to South Storden 69kV transmission line runs north/south directly west of the project area. There are no substations located within the project area, but the project substation (Storden Junction Substation) is located approximately 0.5-mile west of the project boundary.

Jeffers will closely coordinate crane movements near electrical lines, substation wiring and project interconnection updates with electrical utilities so that no lengthy outages are experienced by local residents.

Water Supply and Sanitary Service
The final source of construction water is not yet determined. Obtaining and utilizing construction water for compaction and/or dust control will be scoped with the selected civil contractor, most likely from a public water source/meter or an existing source (permitted well, etc.). On a wind project, a majority of the water uses are for the concrete batch plant, turbine

foundation backfill/compaction, dust control, and the initial road building activities. Given a majority of this infrastructure is installed and will not be modified for the Repower Project, and the overall construction pace/staff/scope will be limited versus a new build, the overall quantity/daily rate of construction water needed is expected to be minimal. In addition, the Repower Project does not add new operations water uses. Operations water uses will be sourced from existing facilities, and the number of operations employees will not increase as described in Section 8.1.1. No impact to water supply is expected from continued operation of the Repower Project.

8.5.5 Potential Impacts

Traffic and Roads

During project repowering, temporary impacts are anticipated on some public roads within the Repower Project area. Roads will be affected by the normal wear and tear by vehicles required to deliver materials and equipment to and from the Repower Project. Some specific routes will also be impacted by the temporary expansion of road widths and/or intersections to facilitate the safe and efficient delivery of equipment.

In general, construction traffic for repowering is anticipated to be considerably less than when the Wind Farm was originally constructed in 2008, as most of the trips for wind farm construction in 2008 were related to activities not applicable to repowering, such as concrete work, foundations, road construction, tower installations, cabling, communication systems, and substation construction. Because the site deliveries will be mainly for turbine components and blades, the trips will be significantly less, and easily accommodated by the typical functional capacity of a two-lane paved rural highway (usually capable of 5,000 vehicles per day). Because many of the area roadways have AADTs currently well below capacity, the additional anticipated trips for component and equipment delivery will be perceptible, but similar to seasonal traffic increases such as observed during autumn crop harvest. Traffic control measures and coordination with local authorities will be implemented to ensure public health and safety is protected with respect to the Repower Project.

Once the Repower Project is completed, maintenance crews will periodically drive through the Repower Project area to monitor and maintain the wind turbines. Vehicle activity associated with the Repower Project will return to the low levels of activity currently experienced at the project site, estimated at approximately five trips per day. These low levels of wind project operation, maintenance and repair activities are not expected to adversely impact normal traffic in the Repower Project area.

In response to the pre-application notice submitted to agencies, MnDOT requested more information about minor upgrading to public roadways and intersections, as well as the project's intended laydown area and temporary crane paths (**Appendix E**). Jeffers intends to coordinate with MnDOT in regard to these requests once project plans and details are finalized.

In addition, the Cottonwood County Public Works Department requested that the Road Use Agreement ("RUA") for the project include designated haul roads and anticipated permits for the project. Jeffers will coordinate with Cottonwood County regarding an RUA for the Repower project.

Telephone
Repowering the operating Wind Farm is not expected to impact telephone, internet, or cellular service to the Repower Project area. Prior to any excavation, Gopher State One Call will be contacted to locate underground utilities so they can be avoided. Multidirectional signals emitted from any cellular tower that is not in the immediate area of the wind project (within 425 m of any turbine site) would not be expected to be adversely affected by wind turbines. As previously stated, there are no known towers registered with the FCC that are less than 1.25 miles from the nearest turbine. Therefore, the proposed Repower Project should not disrupt cell phone service in the area. Jeffers is not aware of complaints regarding telephone, internet, or cellular phone service during the past 10 years of project operation.

Microwave Beam Paths
Based on Evans Engineering's interference analysis, three unique licensed microwave paths were identified from the FCC database that cross the project area. The study indicated that no interference is anticipated. To assure the accuracy of the study, and to verify that turbines 8 and 19 will not cause interference, a land surveyor from Westwood Professional Services visited the antenna locations for the WQDT290/WQDT291 and WQGD818/WQGD822 microwave paths. The surveyed coordinates were incorporated into the microwave path impact study to confirm accurate locations and path avoidance. In addition to the Evan's analysis, Jeffers has received no complaints of interference from any operators during the 10 years of project operation.

AM/FM Radio
Real-world experience with wind farms has shown that FM broadcast station signals (88 to 108 MHz) are fairly insensitive to wind turbines, even in cases where the FM transmitting antenna is surrounded by turbines that are higher than the FM antenna. Because of the "capture effect" supported by the "discriminator" in FM receivers, significant disruptions to FM stations that are receivable in the area are not expected. Although the received signal may vary with the blade rotation at some receive locations in the immediate area, good quality FM receive radios will most likely factor out such time-varying signals. In those relatively few cases where significant impact is caused, home FM radios could be connected to a rooftop TV receive antennas to pull in a stronger direct signal.

Large metallic structures such as wind turbines can adversely affect the transmitted signals of AM broadcast stations up to 1.86 miles away. A search of the FCC's database revealed no AM facilities within the required notification distance of 1.86 miles from any turbine.

There should be no reasonable expectations of disruptions in transmitted signals on the AM band due to the presence of the repowered turbines. Occasionally, depending upon ground conditions, local AM receivers may experience slight signal changes due to local effects, but such anomalies are not recognized by the FCC as having an unduly adverse effect.

In addition, Jeffers is not aware of any radio signal interference during the past 10 years of facility operation. A change in coverage of radio stations associated with wind turbine

repowering is unlikely due to the nature of the repower changes, which do not increase radio interference.

Fixed Land Mobile Stations

Multi-directional transmitting facilities, including land mobile stations, which are within 425 m of a turbine site, customarily should be further evaluated for the possibility of transmitter interference caused by wind turbines. All operating wind turbines are more than 425 m from the nearest identified station (WNZN424).

Based on the current project layout, no adverse impact is expected to be caused to the transmissions of land mobile stations that are licensed by the FCC. In addition, Jeffers is not aware of fixed land mobile station signal interference during the past 10 years of facility operation and has received no complaints. A change in coverage of fixed land mobile stations associated with wind turbine repowering is unlikely due to the nature of the repower changes, which do not increase radio interference.

Television

The rotating blades of a wind turbine have the potential to disrupt over-the-air broadcast TV reception within a few miles of the turbine, especially when the direct path from the viewer's residence is obstructed by terrain. Interference is caused when signals reflected by the blades arrive at the viewer's TV antenna along with the direct signal. This is known as "multipath interference." However, as turbine manufacturers have replaced all-metal blades with blades constructed of mostly nonmetallic materials, this effect has been reduced.

Also, the new generation of HDTV receivers is better equipped to deal with minor multipath interference (which is manifested by "pixilating" or "freezing" of the digital picture) than analog TV sets, as special circuitry is employed to suppress the weaker reflected signal. Occasionally, however, multipath interference from one or more turbines can cause video failure in HDTV receivers, especially if the receiver location is in a valley or other place of low elevation.

There is some possibility of signal disruption for residences that have to point their outdoor antennas through the turbine area, or that utilize "rabbit ear" antennas and/or older HDTV receivers. Most of this effect should be dissipated for locations three or more miles from a turbine, but some residual problems could be noted for HDTV receivers that are located below the grade level at the turbine base. Usually, a rule of thumb is that approximately 10% of the receiver locations are affected to some extent within three miles of a large turbine when the turbine is between the TV station and the receiver. The usual effect is intermittent "pixilation" or freezing of the digital TV picture. This estimate is based upon Evans Engineering's experience with similar wind energy projects.

If the Wind Farm repowering should cause disruptions to over-the-air TV viewing, methods to resolve them are available, and are as follows:

1. Relocation of the household antenna to receive a better signal
2. Installation of a better outside antenna, or one with a higher gain
3. Installation of satellite or cable TV

According to Evans' calculations, there are approximately 360 households within an area likely to be affected (approximately 39 square miles). It is conservatively estimated that 45%, or 162, of the households receive TV programming primarily by satellite dish or cable. This leaves an estimated 198 households relying on transmitted off-the-air TV signals. Based on the 10% criteria described previously, up to 20 TV receiving locations may be affected in the worst-case scenario.

While repowering the turbines has the potential to impact television reception, during the past 10 years of project operation, there have been no documented complaints made to Jeffers and registered with the Commission regarding television interference from the project. It is the opinion of Evans Engineering that any disruptions to over-the-air TV broadcast signals that might occur, if they occur, can be resolved satisfactorily through high-gain antennas or other subscription means such as satellite or cable services.

Other Local Services

The Repower Project will be constructed and operated to avoid impacts to underground infrastructure such as drain tile, water, and electric. Should electrical service interruptions be necessary to facilitate movement of tall construction equipment around transmission or distribution lines, Jeffers and local service providers will work closely to ensure outages are planned and coordinated with local residents and other impacted users.

8.5.6 Mitigation Measures

Traffic and Roads

Prior to repowering, Jeffers will require its contractors to coordinate with the applicable local and state road authorities to ensure that the weights being introduced to area roads are acceptable, and to obtain all relevant permits for access. Jeffers and its contractors will work with MnDOT, as necessary, regarding roadway concerns and right-of-way work (if any) during repowering. Jeffers will also coordinate with the landowners and local road authorities in regards to the temporary widening of driveways and access roads to minimize land-use disruptions during repowering activities.

Road use agreements will be executed with applicable local governments where required, and will be used to identify suitable travel routes, traffic control measures, methods for evaluating, monitoring and restoring roads, and mitigation measures to ensure roads used for oversize/overweight loads are properly identified, monitored and stabilized.

Communication Systems

Because the Wind Farm has been operating for 10 years with no complaints, interference with communications systems is not expected. Should the addition of larger rotors trigger interference issues not previously experienced, Jeffers will work with those landowners to rectify the issue through the use of high-gain antennas, a low noise amplifier, a monetary contribution toward comparable satellite television services, or another mutually agreeable solution.

Telephone
At this time, no impacts are anticipated to telephone service. Should inadvertent impacts to these systems arise, Jeffers will work to remedy service interruptions on a case-by-case basis.

Microwave Beam Paths
No microwave beam paths currently interfere with Jeffers turbines, and therefore Jeffers does not anticipate impacts that would require mitigation. The Evans Engineering RF impact study concludes that no impact is anticipated even with the larger Vestas turbines.

AM/FM Radio
Jeffers is not aware that operating the Wind Farm during the past 10 years has caused any conflicts with AM/FM Radio transmission or reception. Should issues arise as a result of repowering, Jeffers will work closely with area stations in regard to mitigation options.

Fixed Land Mobile Stations
In the unlikely event a land mobile licensee believes their coverage has been compromised due to the Repower Project, there are options to improve signal coverage through optimization of a nearby base station or adding a repeater site. Utility towers, met towers or other structures within or near the Repower Project area can serve as the platform for a land mobile base station or repeater sites if necessary. Jeffers will work with the land mobile licensee towards a mutually agreeable solution.

Television
If interference to a residence's or business's television service is reported as a result of repowering, Jeffers will work with affected parties to determine the cause of interference and, when necessary, reestablish television reception and service. Jeffers plans to address post-construction television interference concerns on a case-by-case basis. If television interference is reported to Jeffers, project representatives will:

a. Review results of the report to assess whether impacts are likely wind project-related;

b. Meet with landowner and a local communication technician to determine the current status of their television reception infrastructure;

c. Discuss with the landowner the option of (1) installing a combination of high gain antenna and/or a low noise amplifier, or (2) entering into an agreement to provide a monetary contribution (equal to the cost of installing the recommended equipment) toward comparable satellite television services at the residence;

d. At the landowner's election, Jeffers will either install the necessary equipment or enter into an agreement to reimburse the landowner for the cost of comparable satellite television services;

e. If the landowner chooses satellite service, Jeffers will consider the matter closed upon installation of the satellite dish;

f. If the landowner chooses to have the antenna and/or amplifier installed and later complains of continued interference issues, Jeffers will send a technician to the site to assess whether the equipment is working properly and fix the equipment as needed and evaluate the reported interference issues;

g. If wind project-related interference remains an issue, Jeffers will propose an agreement that reimburses the landowner for the costs of comparable satellite television services and will remove the antenna and amplifier equipment, unless it was initially installed to serve multiple households;

h. If Jeffers and the landowner are unable to reach an agreement to resolve interference-related issues, Jeffers will report the concern as an unresolved complaint and defer to the MPUC's dispute resolution process to resolve the matter.

Other Local Services

Jeffers will coordinate with utility infrastructure owners before and during repowering to fully understand infrastructure and safety concerns and to prevent possible structural conflicts.

8.6 Cultural and Archaeological Resources

8.6.1 Description of Historic and Archeological Resources

On June 20, 2018, Westwood conducted a cultural resources literature search by examining files through the online Portal maintained by the Office of the State Archaeologist (OSA), and in-person at the Minnesota SHPO at the Department of Administration in St. Paul, MN (**Appendix I**). Archaeological site files and historic structure inventory files were used to obtain a list of previously recorded archaeological sites and historic structures within the proposed Repower Project area. Cultural resource reports were investigated to determine whether any portions of the Repower Project area had been previously surveyed for cultural resources.

A review of previous survey reports at SHPO revealed that "A Phase I Archaeological Resources Inventory for the Jeffers Wind Energy Center Project, Storden Township, Cottonwood County, Minnesota" conducted in 2006 by Summit Envirosolutions, Inc. constitutes the only archaeological field survey previously conducted within the Wind Farm area. While conducted in advance of construction, this survey only examined turbine locations in Sections 22 and 27 as it was suggested only those locations would have moderate to high potential for unrecorded cultural resources.

Two archaeological sites have been previously recorded within one mile of the project area, neither of which is within the project area boundaries. The sites, 21CO0019 and 21 CO0045, are both prehistoric lithic scatters.

No historic/architectural resources have been previously inventoried within one mile of the Wind Farm area (**Map 10**).

8.6.1 Potential Impacts

As the Repower Project consists of retrofitting existing turbines and most likely using existing infrastructure, it is anticipated that ground disturbance will be limited to crane paths and therefore archaeological resources will be avoided. If ground disturbance goes outside of existing infrastructure and crane path areas, there is the possibility that unrecorded archaeological resources could be impacted.

In an October 15, 2018 comment letter, SPHO staff requested additional information regarding the proposed disturbance from repowering, and information as to whether a Phase I survey was conducted (**Appendix E**). The letter also stated that a historic property which is listed in the National Register of Historic Places ("NRHP"), Jeffers Petroglyphs, is located several miles north-east of the project site. SHPO stated that it is unclear as to whether the wind turbines are currently visible form the historic property, or not, and that any significant change to the current viewshed may be considered an adverse effect.

In November 2018, Jeffers performed a Phase I Archaeological Reconnaissance Survey within the proposed crane paths and found no new archaeological resources. As existing infrastructure is being used, ground disturbance will be limited to crane paths and therefore no archaeological or historical resources will be impacted by the project.

On January 25, 2019, the Applicant visited the Jeffers Petroglyphs site (located approximately 8.5 miles east-northeast of the Repower Project) to assess the impact of the project upon the site, and determined that no turbines or portion of turbines can be seen. Consequently, the Repower Project will have no impact on the Jeffers Petroglyphs site. The Phase I survey report addressed the issue regarding the Jeffers Petroglyphs, which will be circulated to SHPO staff for review.

8.6.2 Mitigation Measures

No mitigation measures are warranted for the Repower Project. If previously unidentified archaeological or historic resources are found during repowering activities, the integrity and significance of such resources will be addressed in terms of the site's potential eligibility to the NRHP. Work in the area will be temporarily halted in the event unanticipated discoveries such as archaeological/historical resources or human remains are identified. Also, an assessment of the Repower Project's potential impacts upon the resource will be undertaken. If such resources are found to be eligible for the NRHP, adverse effects to the resource will be avoided by adjustment of the Repower Project's layout when possible. If avoidance is not possible, appropriate mitigation measures will need to be developed in consultation with Minnesota SHPO, the State Archaeologist, and consulting American Indian communities. While avoidance would be a preferred action, mitigation for the Repower Project related impacts on NRHP-eligible archaeological and historic resources may include additional documentation through data recovery.

Should previously unknown archaeological resources or human remains be inadvertently encountered during retrofitting and/or operation, the discoveries will be reported to the SHPO. With regard to a discovery of human remains, procedures would be followed to ensure that the

appropriate authorities would become involved quickly and in accordance with local and state guidelines.

8.7 Recreational Resources

8.7.1 Description of Resources

Information from USFWS, DNR, and Cottonwood County were reviewed to identify recreational resources within 10 miles of the Repower Project area. The recreational resources within this portion of Cottonwood, Murray, Redwood and Brown Counties identified within 10 miles included Wildlife Management Areas ("WMAs"), and Waterfowl Production Areas ("WPAs") (**Map 6**). Recreational opportunities in these counties include hunting, fishing, snowmobiling, camping, and hiking.

The 2005 Site Permit application identified one WMA (Highwater) and two WPAs (Lake Augusta and Storden) located near the Wind Farm. There were 10 additional WMAs, 9 WPAs, 3 snowmobile trails, and one DNR Designated Wildlife Lakes ("DWL") identified within 10 miles of the project area. The additional WMAs are as follows: Typhoon, Mountain Lake, Expandere, Pats Pasture, Hurricane Lake, Carpenter, Little Swan, Budolfson, Delft, and Arnolds Lake. The WPAs are as follows: Cottonwood Lake, Des Moines River, Dutch Creek, Harder Lake, Long Lake, Swan Lake, Watonwan River, Westbrook, and Lake Julia. The snowmobile trails are as follows: Cottonwood and Jackson County, Beaver Creek, and Brown County. Lake Augusta is also classified as a designated wildlife lake. Under the new proposed project boundary, there were no WMAs, WPAs, snowmobile trails or DNR DWL located within the project boundary. In addition, the Pats Pasture and Carpenter WMAs, the Cottonwood Lake WPA, and the Brown County snowmobile trail are not within 10 miles of the proposed project boundary.

There are no federal, state, county, or city parks, forests, Scientific and Natural Areas ("SNAs"), Aquatic Management Areas ("AMAs"), National Wildlife Refuges ("NWRs"), WPAs, or WMAs within the Repower Project boundary. There are no mapped state trails or snowmobile trails within the Repower Project boundary; however, a snowmobile trail exists along Co Road 53 (DNR, 2018a).

8.7.2 Potential Impacts

Repowering will avoid direct impacts to recreational resources. Total wind turbine height after repowering will increase by only 43.7 feet. Potential visual impacts to recreational resources within and around the Repower Project boundary related to adding slightly larger rotors to the turbines will be minimal.

8.7.3 Mitigation Measures

No direct impacts to recreational resources are anticipated as a result of repowering the project, and therefore no mitigation is proposed.

8.8 Public Health and Safety

8.8.1 Electromagnetic Fields

Electromagnetic fields ("EMF(s)") arise from the movement of an electrical charge on a conductor such as transmission lines, power collection (feeder) lines, substation transformers, house wiring, and electrical appliances (NIEHS, 2002). The intensity of the electric portion of EMF is related to the potential, or voltage, of the charge on a conductor, and the intensity of the magnetic portion of the EMF is related to the flow of charge, or current, through a conductor. EMF is commonly associated with power lines, but they occur only at close range because the magnetic field rapidly dissipates as the distance from the line increases (US EPA 2018).

8.8.1.1 Potential Impacts

Extensive research has been conducted by the National Institute of Environmental Health Sciences (NIEHS 1999). While there is no conclusive research evidence that EMFs from power lines and wind turbines pose a significant health impact, the turbines were originally installed beyond the minimum allowable distances from occupied residences (500-foot minimum setback), where EMF is expected to be at background levels unrelated to wind project proximity. EMFs from underground electrical collection and feeder lines dissipate very quickly and relatively close to the source because they are installed below ground to a depth of approximately 48 inches, and are heavily insulated and shielded. Consequently, the electrical fields that emanate from buried lines and transformers are generally considered negligible, and magnetic fields often decrease significantly within approximately three feet of stronger EMF sources (such as transmission lines and transformers) (NIOSH 2011). No changes to the Jeffers electrical system will occur except limited conductor size increases, testing of the system, and repairs to any deficient conductors. Consequently, no significant increase in EMF impact is expected from the repowering or operation of the project. Jeffers is not aware of any complaints or claims of impact from EMFs since the project became operational.

8.8.1.2 Mitigation Measures

Based upon current research regarding EMFs and the separation distances being maintained between transformers, turbines and collector lines from public access and occupied homes, EMFs associated with the Repower Project are not expected to have an impact on public health and safety. Because no changes to the electrical system with the repowering that could increase EMF are expected, no significant mitigations related to EMF are planned. Jeffers is committed to inspecting and maintaining the electrical infrastructure. Jeffers is committed to installing facilities in a manner that minimizes the potential for EMFs.

8.8.2 Aviation

Aviation resources surrounding the Repower Project were investigated. A review of the Ventyx database revealed one registered private use airport located within 10 miles of the Repower Project area. Ewen Landing Field is located just outside of the project area and approximately 1

mile south of Jeffers. According to AirNav.com, this is a private grass air strip that has been in operation since 1979 (AirNav 2018).

8.8.2.1 Potential Impacts

Jeffers received Determinations of No Hazard from the FAA for the increased rotor diameter of 110 m and tower heights on September 6, 2018. As such, no impacts from the Repower Project to aviation are anticipated.

8.8.2.2 Mitigation Measures

Jeffers will coordinate the lighting plan so that it is consistent with FAA standards and in accordance with the issued DNHs. Because no impacts are anticipated, no mitigation is planned beyond standard recommended turbine lighting and marking. All but four of the 20 currently operating turbines have FAA obstruction lighting. At this time, Jeffers is not considering the installation of an Aircraft Detection Lighting System ("ADLS") for the following reasons: 1) the Jeffers project is small with only 20 turbines, and 2) adding ADLS would require that an additional, lighted radar tower be added to the project area.

8.8.3 Safety and Security

Security measures will be taken during Repower Project repowering, O&M, including temporary and permanent fencing, warning signs, and locks on equipment and wind power plant facilities. All construction workers will be required to adhere to Longroad's corporate safety plan. The objective of Longroad's Emergency Preparedness and Emergency Action Plan is to outline the course of action associated with emergencies, evacuations, and fire prevention. This instruction applies to all personnel doing business at the Repower Project location, and includes activities in offices, in the field, as well as working within wind turbines. A copy of the safety plan will be available in a common location at the project location so each employee has access to the plan.

8.8.3.1 Potential Impacts

Potential safety and security impacts resulting from the Repower Project are a primary consideration to Jeffers because wind energy projects consist of complex, large electrical generating structures requiring specialized equipment, high voltages, and trained workers for installation and operations. This project is located on leased rural properties in a relatively remote area. No serious safety or security incidences have been reported at the Wind Farm during the past 10 years of operation.

8.8.3.2 Mitigation Measures

While no impact to the security of local residents is expected, Jeffers will use the following security measures to reduce the possibility of property damage or personal injury at the Repower Project area:

- Contractors and project personnel will be trained to use proper construction and maintenance methods to promote and protect workers and public health and safety;

- Jeffers and its contractors will use temporary and permanent safety fencing, warning signs, locks and other access control features on equipment and wind power facilities during repowering and ongoing operation of the Repower Project; and

- Jeffers will conduct regular O&M and inspections during the life of the Repower Project to minimize and address potential equipment failures and condition of safety equipment.

8.9 Hazardous Materials

8.9.1 Description of Resources

The wind turbines use synthetic oil as a lubricant in the gearboxes and hydraulic fluid for the blade pitch actuators. Waste oil will be collected from each repowered turbines will be properly handled and disposed of by qualified technicians in accordance with state and federal regulations.

Any hazardous materials generated by the Repower Project will be stored and disposed of in accordance with Minn. R. Ch. 7045. Wastes generated at the Repower Project site will be hauled off-site and disposed of under a U.S. EPA Small Quantity Hazardous Waste License.

8.9.2 Potential Impacts

Minimal amounts of hydraulic oil, lube oil, grease, antifreeze, and cleaning solvents will be used on the site to repower the wind turbines, and within construction equipment such as cranes, dump trucks, and graders. Materials will be transported, handled and disposed of by trained and qualified personnel utilizing established procedures and proper equipment. Lubricants, used oils, coolants, and waste products will be handled according to applicable regulations and disposed of through an approved waste disposal firm.

8.9.3 Mitigation Measures

Jeffers's contractor will prepare a plan for repowering the turbines to reduce the potential for spills and releases into the environment. Containment will be used to prevent fluids that might be spilled from being released into local soil and groundwater. Waste products will be handled and disposed of according to local, state and federal regulations through an approved waste firm by trained technicians.

8.10 Land-Based Economies

8.10.1 Agriculture

Land use within the Repower Project area is primarily agricultural (**Map 11**). As shown on **Map 12**, 48.11 percent of the soil within the Repower Project area is considered prime farmland, 41.33 percent is prime farmland when drained, and 8.87 percent is considered farmland of statewide importance. Approximately 43 percent of the project area is neither prime farmland nor farmland of statewide importance. During repowering, some cropped areas will be temporarily cleared to facilitate work at the turbine pads, crane pads, crane pathway, road widening locations, and staging areas. After repowering is completed, crops and vegetation will be re-established during the growing season.

8.10.1.1 Potential Impacts

To the extent possible, the Repower Project will avoid impacts to farmland and pasture. Because this is a repowering project, the only impacts to the landscape will be temporary for work around turbine pads, crane pads, crane pathway, staging areas and access road widening. Temporary impacts will total approximately 79 acres, with 40, 19, and 20 acres of impact from turbines work areas, access roads, and crane paths, respectively.

8.10.1.2 Mitigation Measures

To mitigate impacts resulting from compaction, the construction equipment used in the erection of wind turbine components, much like agricultural equipment, is designed with wide tires and tracks to distribute their weight over a larger area and provide stability. This minimizes the degree of soil compaction resulting from construction. Once repowering is complete, Jeffers will assess disturbed areas and determine whether excessive soil compaction has occurred in conjunction with the affected landowners. In areas where soil compaction has occurred from Repower Project activities, Jeffers will work with the landowner and establish appropriate corrective action measures (e.g., tilling or other methods). Sites used for temporary storage, material staging, and access areas typically experience significant amounts of traffic, which will likely require de-compacting prior to resuming agricultural use.

To the extent practicable, staging areas will be placed in previously disturbed locations to minimize the impact to agricultural production. While significant impacts to drain tiles and other existing facilities due to the Repower Project are not anticipated, Jeffers will promptly repair or replace drain tile that may be impacted. Prior to beginning site work, Jeffers will contact the landowner where the work will be conducted to properly identify and locate drain tiles or other drainage structures that may be present in the work area.

Overall, impacts to agriculture as a result of the Repower Project are anticipated to be short term, minimal and are not expected to significantly alter crop production. Once the repower is completed, Jeffers will restore disturbed areas as close as practicable to its original condition. Post-construction restoration will largely depend upon the amount of disturbance occurring on the site and the soil types at each location.

While in operation, it may occasionally be necessary for Jeffers to complete repairs, or clear vegetation around a turbine or facility, which could result in additional temporary impacts to agricultural operations. These interruptions are expected to be infrequent and short term, and landowners will be compensated in accordance with the terms of their agreements with Jeffers.

8.10.2 Forestry

There are no significant forestry resources within the Repower Project area.

8.10.2.1 Potential Impacts

Only negligible, if any, impacts to forestry resources are anticipated. Wooded areas near farmsteads and waterbodies will be avoided by the Repower Project. While significant tree removal is not anticipated, some trees and limbs may occasionally need to be removed for crane access, or trimmed to prevent damage to the Repower Project infrastructure from wind and ice, and to ensure reliable operation.

8.10.2.2 Mitigation Measures

Because economically important forestry resources are not found in the Repower Project area, and negligible or no impacts to forestry resources are anticipated, no mitigation has been proposed.

8.10.3 Mining

There are no significant mining resources within the Repower Project area (**Map 13**).

8.10.3.1 Potential Impacts

No impacts to mining resources or operations are anticipated to accommodate repowering or continuing project operation.

8.10.3.2 Mitigation

Because there are no significant mining resources within the Repower Project area, no mitigation has been proposed.

8.11 Tourism

Cottonwood County offers community-centered tourism and recreational opportunities throughout the year. In addition to the community events, county outdoor recreational opportunities include biking, camping, wildlife watching, hunting, fishing and snowmobiling.

8.11.1 Potential Impacts

No direct impacts to tourism are anticipated.

8.11.2 Mitigation Measures

No negative impacts to tourism are expected. Therefore, no mitigation measures are proposed.

8.12 Local Economies and Community Benefits

8.12.1 Potential Economic Impacts

The Repower Project is expected to positively impact the local economy by adding temporary jobs. Jobs are expected to be added for repowering the project; approximately 2 technicians will be needed for long-term servicing of the project. The communities near the Repower Project area are also expected to receive positive economic benefits. Short-term impacts to the socioeconomic resources of the area are expected to be minor. It is anticipated that some land will be temporarily removed from agricultural production for less than a year while the repowering work is accomplished, but landowners will be compensated for this loss under the terms of their landowner agreements. Repowering is anticipated to stimulate some local industries (e.g., hotels, restaurants, gas stations) and is not expected to have any negative impacts to local industries as a whole. Repowering is expected to extend the positive economic life of the Wind Farm by up to an additional 20 years, thereby extending the economic benefits as well.

Wages and salaries paid to contractors and workers in Cottonwood County will contribute to the overall personal income of the region. Additional personal income will be generated for residents in the counties and state by circulation and recirculation of dollars Jeffers pays for business expenditures and for state and local taxes. Equipment, fuel, operating supplies, lodging, and other product and service expenses will benefit businesses in the counties and the state.

8.12.2 Production Tax Payments Made to Counties

Construction and operation of the Repower Project will provide long-term beneficial impacts to the counties' tax bases and contribute to improving the local economy in this part of Minnesota. As described in other nearby wind project site permit applications, the development of wind energy in this area of Minnesota has been important in diversifying, supporting and strengthening the personal income and property tax base of southwestern Minnesota.

The wind energy production tax for the Wind Farm is assessed at $1.20 cents per megawatt-hour (MWh) of electricity produced. The Repower Project will result in increased tax payments of approximately 10 percent per year, compared to current tax payments, to Cottonwood County due to increased production. Based on energy production tax to the local counties of $1.20 per MWh of electricity produced, the annual wind energy production tax is projected to average approximately $220,000 per year without the repower and $255,000 each year with the repower. Total taxes going forward from 2020 until the end of the project's useful life is estimated at $4.1 million without the repower, and $6.3 million with the repower. It should be noted that realized production typically varies between 10 to 20 percent from year-to-year due to winds, outages, and other factors.

8.12.3 Mitigation Measures

The Repower Project is anticipated to result in positive socioeconomic impacts to the Repower Project area, and be beneficial to landowners, local governments, and communities. The Repower Project will result in increased wages to local businesses and landowners during construction, and an overall increase to Cottonwood County's tax base as a result of increased energy production. Participating landowners will also benefit economically through increased long-term lease payments. Landowners will be compensated directly for potential financial losses associated with removing small amounts of land from agricultural production during the less than one-year repower process and for potential drain tile damage per the terms of the lease agreements.

8.13 Topography

8.13.1 General Description

Topography within the project area is generally undulating consisting of rolling hills, stream networks, and wetlands. Digital elevations are provided on **Map 14**. Overall, the project area represents a high ridge that breaks to the northeast towards Jeffers, and to the west/southwest. The highest elevation on the site is approximately 1,517 feet above mean sea level (amsl), and the low is approximately 1,414 feet amsl.

8.13.2 Potential Impacts

No significant impacts to topography are anticipated, because only limited, if any, grading will be required to repower the project. Grading within steep slope areas will be avoided to the degree practicable. Minimizing cut and fill requirements will reduce erosion control potential as well as decrease overall construction costs. Laydown and staging areas will be sited in relatively flat locations to avoid excess grading.

8.13.3 Mitigation Measures

Construction Best Management Practices ("BMPs") will be implemented surrounding graded areas in accordance with state standards, the MPCA *Stormwater Best Management Practices Manual*, and the approved Stormwater Pollution Prevention Plan ("SWPPP") for the Repower Project area (see Section 10.2). Based on recommended and required mitigation measures and avoidance of areas with steep slopes (**Map 13**), there would be no adverse impact on topographic resources as a result of repowering the currently operational project.

8.14 Soils

8.14.1 General Description

The soils of Cottonwood County formed in several parent materials. They are glacial till, glacial lacustrine, and outwash sediments, post-glacial alluvium, and limnic material. The soils are dark colored because they formed under an original vegetation of tall and medium prairie. Glacial till

is the parent material of about 80 percent of soils in Cottonwood County. It is composed of older glacial till that was reworked by substages of the Wisconsin glaciation (DOA 1979).

The soil map (**Map 13**) illustrates the soils in the Repower Project area. The four main associations located within the project area are Delft-Clarion, Jeffers-Glencoe-Everly and Wilmonton-Letri-Everly (DOA 1979). To a lesser degree, the Mayer-Estherville-Biscay association occurs in the southwestern portion of the project area.

8.14.2 Potential Impacts

Repowering the project will likely result in minor short-term impacts to soils within the Repower Project area. Most of the impacts to soils will result from grading to accommodate temporary laydown areas. A temporary five-acre laydown yard will be constructed on agricultural lands to stage the turbine components prior to installation. No additional impacts are expected from continued operation of the Repower Project.

8.14.3 Mitigation Measures

The potential for construction-related soil erosion will be minimized by siting laydown areas so as to avoid highly erodible soils on steep slopes. Avoiding steep topography will also reduce the size of cut and fill areas. Jeffers will work with landowners in the Repower Project area to site laydown areas so as to minimize impacts to prime farmland to the extent practicable. Within work areas, topsoil will be separated form subsoils, protected from erosion and runoff using mulch, and then respread over disturbed areas once work is completed. Erosion control measures would also be implemented during construction to avoid or minimize soil erosion and off-site deposition. Erosion and sedimentation will be reduced through the use of BMPs such as mulching, hydroseeding, erosion control blankets, silt fence installation, jute matting, revegetation, and/or interim reclamation (see Section 10.2). After repowering is completed, soils will be planted with crops or revegetated to stabilize them long term. Based on the implementation of these recommended and required mitigation measures, no adverse impacts to soil resources are expected as a result of repowering the project.

8.15 Geologic and Groundwater Resources

8.15.1 General Description

Information on Cottonwood County geology is summarized from USDA, 1979, and Morey and Meints, 2000. The Coteau des Prairies ridge that extends across the County consists of a bedrock core that is overlain by glacial sediment. Sioux Quartzite is the oldest bedrock unit found in the county. It is of Pre-Cambrian age, and underlies most of the county. The depth to bedrock throughout the county is variable. In the western part of the county, the Sioux Quartzite underlies sandstone and shale of Cretaceous age. This sandstone and shale bedrock are overlain by thick deposits of glacial sediment except in river bottom lands, where the glacial sediment is thinner. In the central part of the county, the Sioux Quartzite is at a shallower depth, and in the northeastern part of the county, there are bedrock outcrops. The Sioux Quartzite is very hard, is interbedded with thin layers of Catlinite Shale, and does not fracture along planes. Weathered Sioux Quartzite and Catlinite shale have a dull red color and are known as “red rock.” Catlinite

shale is softer, and is also known as "Pipestone." Loamy glacial till, sandy and gravely to clayey glacial outwash, and lacustrine sediment cover most of the county. The glacial till is calcareous and of Wisconsin in age. It is a gently sloping to nearly level ground moraine in most of the county. Undulating lateral moraines formed along the main axis of glacial ice flow. Pre-glacial river channels formed along these lateral moraines. The channels entered the county on the west-central side, and ran in a southeasterly direction. Glacial action was not enough to entirely cover these channels, and the glacial meltwaters reopened some channels. Most of the lakes in the county formed in these channels. Glacial meltwaters sorted material from the glacial till. Silty and clayey sediments were deposited in glacial lakes in southwestern and south-central parts of the county. Glacial outwash of sand and gravel was deposited at glacial river terraces in the south-central and north-central parts of the county.

Geologic resources in the county include sand and gravel deposits. The types of aquifers in the county are varied. The unconsolidated glacial deposits yield water from the coarse-textured strata, which are generally sand and gravel lenses in glacial till. Sioux Quartzite also yields water obtained from the fissures of interbedded shale or fractures in the quartzite. Water yield from the quartzite is generally low. The best aquifer in the county is the Cretaceous sandstone, which yields large volumes of water. Glacial sediments may yield water, especially in lowlands where surface water bodies are present. These are typically low yield, and are not used as potable sources.

8.15.2 Potential Impacts

Impacts to geologic and groundwater resources from the Repower Project are not anticipated, as there will be only minimal surface disturbance for construction cranes.

8.15.3 Mitigation Measures

No impacts to geologic and groundwater resources are expected from repowering or continued operation of the project, therefore, no specific mitigation is proposed. Turbine components will be "switched out completely" rather than reconfiguring them on-site, and all gear oil and lubricants will be properly managed and disposed of in accordance with local, state and federal regulations. Any minor, accidental spills of petroleum or other coolants or lubricants that might occur from equipment (during construction or operation) will be immediately cleaned up by trained personnel, and absorbent and contaminated materials disposed of at an appropriate facility. Jeffers staff will report spills to the county and state as required.

8.16 Surface Water and Floodplain Resources

8.16.1 Lakes, Streams, and Ditches

Surface water and floodplain resources for the proposed project area were identified by reviewing the USGS Topographic Mapping and the Flood Insurance Rate Maps ("FIRMs") produced by the Federal Emergency Management Agency (FEMA, 1981a and b). According to the FIRM maps (Community Panel Numbers 270622-0100B and 270622-0125B; January 2, 1981) for the site, the entire project area is located outside established floodplains, within Zone C, which corresponds to areas of minimal flooding.

Several unnamed ditches, wetlands and watercourses exist within the project boundary as shown on **Map 15**. The MDNR Public Waters Inventory ("PWI") map for Cottonwood County shows no public waters, wetlands or watercourses within the project area.

8.16.2 Designated Wildlife Lakes and Special Waters

There are two DNR DWL within Cottonwood County (DNR, 2014). The designated wildlife lake nearest the Repower Project area is Lake Augusta located approximately 1.0 mile to the south. There are also no known outstanding resource value waters, sensitive lakeshores, or trout streams or lakes within the Repower Project area (DNR 2012). There is one trout stream in Cottonwood County that is located more than 3.0 miles southeast of the Repower Project area (DNR 2016). As the aforementioned resources are not located within or adjacent to the project area, it is unlikely that they will be negatively impacted.

8.16.3 Federal Emergency Management Agency ("FEMA") Floodplains

According to the FIRMs for Cottonwood County, the retrofitting areas are located within Zone C – areas determined to be outside of the 500-year floodplain and of minimal flooding, and Zone A – areas of 100-year flood; base flood elevations and flood hazard (FEMA 1981a, 1981b). No floodplain mitigation is anticipated at this time, as only temporary impacts to surface waters are anticipated, and no floodplains are mapped within the Repower Project area.

8.16.4 Calcareous Fens

No calcareous fens are known to be located within the Repower Project area (DNR, 2015, 2017). During fall 2018 wetland delineation activities, Jeffers surveyed areas within 500 feet of areas to be disturbed by construction cranes for fens. No fens were identified during these field surveys, or supplemental desktop review for the project laydown area. There are two calcareous fens located within one mile of the project area. One fen is located west of the project area, and one is located to the south. The two known fens will not be disturbed. Consequently, no impacts to fens are anticipated from the repowering process. The Minnesota DNR has reviewed the project's crane path corridors and concurs that no impacts to calcareous fens are anticipated (**Appendix E**).

8.16.5 Potential Impacts and Mitigation Measures

Due to the presence wetlands and watercourses within the project area, permits may be required for temporary crane crossings. Potential temporary impacts will be closely coordinated with the DNR, Corps, and the Local Government Units administering the Minnesota Wetland Conservation Act (Cottonwood County), as appropriate.

Only minimal, if any, impacts to FEMA floodplains are anticipated during the repowering process for the project. It is possible that minor, temporary impacts to FEMA floodplains may occur as a result of crane crossings in areas where it is not possible to avoid. Any disturbed FEMA floodplain areas will be restored per local, state and federal regulations. Because impacts to other surface water resources are not anticipated, no mitigation is proposed.

8.17 Wetlands

Using the National Wetland Inventory dataset ("NWI"), a total of 13 potential wetlands were identified within the project boundaries. Of the 13 potential wetlands mapped by NWI, 11 were categorized as freshwater emergent wetlands (60 acres), and 2 were freshwater ponds (7 acres) (USFWS, 2018b). Using the PWI dataset, Jeffers identified no public waters wetland within the project boundaries.

An updated field delineation of the wetlands and watercourses within the Repower Project crane paths was completed during the week of November 5, 2018. The proposed crane paths were reviewed for the presence of wetlands and watercourses. Eleven wetlands and no watercourses were identified within 100 feet on either side of the crane path centerline. A wetland delineation report has been prepared and will be circulated to wetland agencies for review.

8.17.1 Potential Impacts and Mitigation Measures

Based on the current crane path layout, only minimal, if any, impacts to wetlands are anticipated. Minor, temporary impacts to wetlands may occur as a result of construction crane movements. Temporary placement of construction materials (e.g. timber mats, riprap, geotextile fabric, temporary stabilizing materials, culverts) into any waterbody or wetland for purposes of temporary stream crossings, cofferdams, or storage sites may require coordination with the Corps and Lincoln County, administering Section 404 of the Clean Water Act and the Minnesota Wetland Conservation Act ("WCA"), respectively. Because all proposed impacts are temporary, project fill placement activities are expected to qualify under Nationwide Permit 33, and be eligible for a "no-loss" determination under the WCA.

The MPCA administers the National Pollutant Discharge Elimination System ("NPDES") permit program in Minnesota and regulates construction activities that disturb more than one acre of land. As part of its NPDES permit application, a SWPPP will identify erosion and sedimentation control measures to prevent adverse water quality impacts to streams and wetlands during and after construction. Mitigation measures included in the SWPPP should be sufficient to ensure that streams and surface waters within the Repower Project area do not incur adverse construction-related stormwater impacts.

8.18 Vegetation

8.18.1 Description of Resources

Land cover mapping for the Repower Project area was obtained from the U.S. Geological Survey National Land Cover Database ("NLCD") (USGS 2011). The data is based on a 16-class land cover classification scheme that has been applied consistently across the United States at a spatial resolution of 30 m and is created through a decision-tree classification of Landsat satellite data (circa 2011) (Homer et al. 2015). Based on NLCD data, 91.18 percent of the proposed Repower Project area is cultivated cropland, 1.54 percent is herbaceous, and 0.05 percent is hay or pastureland. Emergent herbaceous wetlands, deciduous forest, barren land, and open water

account for less than one percent each. The NLCD data indicates the remaining area is composed of disturbed/developed land.

Pasture and grassland areas are mostly fragmented across the Repower Project area. Forested areas appear limited to areas along stream corridors, near lentic water features, and around homesteads.

8.18.2 Potential Impacts and Mitigation Measures

The 2005 Site Permit required a prairie protection plan to the extent there were prairie impacts (Site Permit Condition C.6). Because there were no impacts to native prairie when the Wind Farm was constructed, a prairie protection plan was not required or prepared. Similarly, impacts to native prairie will be avoided by Jeffers during the repowering process. Recent surveys completed in fall 2018 within the proposed crane path corridors did not identify native prairie, and therefore no impacts are anticipated. Proposed crane paths have been routed primarily on agricultural lands. The Repower Project will also avoid woodlands, shrublands, grasslands, and water resources to the degree practicable. However, some minor and temporary impacts to wetlands, grasslands and shrubland may occur as a result of crane path construction. It is possible that these areas may contain native vegetation (i.e., plant species living in the area where it is found naturally vs. being introduced). If disturbed, Jeffers is committed to restoring and seeding these areas with certified weed-free native mixes appropriate for the region. It is the goal of Jeffers to minimize impacts to non-cultivated and native plant communities within the project area.

8.19 Wildlife Resources

8.19.1 Wildlife

The wildlife found in the project area is typical of that found in agricultural-related habitats. The resident species are representative of Minnesota game and non-game wildlife that are associated with roadside ditches, fencerows, wetlands, streams, and grasslands. The majority of the migratory wildlife species are birds including waterfowl, raptors, and songbirds. Some common songbirds in the area include western meadowlark, song sparrow, American robin, red-winged blackbird, and killdeer. Waterfowl species include Canada geese, mallards, blue-winged teal, and wood ducks. Common raptors include red-tailed hawk, American kestrels, northern harriers and Swainson's hawks.

Mammal populations in the area include white-tailed deer, rabbit, red fox, badger, skunk, squirrel, and others. These species use the food and cover from agricultural fields, grasslands, farm woodlots, wetlands, and other wooded areas. Small mammals typical of the area include house and deer mice, weasels, and prairie and meadow voles. White-tailed deer have an affinity for agricultural crops, and use farm woodlots, wooded ravines, and intermittent stream bottoms for shelter. Primary bat species present in southwestern Minnesota include the hoary bat, the eastern red bat, the big brown bat, the silver-haired bat, and the little brown bat.

Reptiles and amphibians present in southwestern Minnesota include garter snakes, western hognose snakes, snapping turtles, western painted turtles, American toads, northern leopard frogs, and western chorus frogs.

The USFWS database indicates that the following species could potentially occur in Cottonwood County – (1) the threatened Northern long-eared bat, and (2) the threatened Prairie Bush-clover. Both species were added to the list since 2005. An updated Minnesota Natural Heritage Information System Database search revealed Henslow's sparrow, a state listed endangered birds species, as being documented in the vicinity of the project area.

The proposed crane paths have been sited primarily in agricultural row-cropland, therefore it is anticipated that repower activities will have minimal impact on resident wildlife. Jeffers has been in consultation with both the USFWS and the Minnesota DNR in regards to wildlife and habitat issues associated with the project. Aside from the species noted above, there are no known substantive changes to wildlife from those determined in the original site permit application.

Because repowering activities will be conducted primarily within agricultural landscapes, impacts from repowering are anticipated to be minimal. Wildlife-specific mitigation is described throughout this document.

8.19.2 Waterfowl Feeding and Resting Areas

According to the DNR's August 5, 2011 list of established Migratory Waterfowl Feeding and Resting Areas ("MWFRA"), there are no established MWFRA's within Cottonwood County or within neighboring counties (DNR, 2011).

8.19.3 Important Bird Areas

The permitted project area is approximately 9.0 miles north of the Heron Lake Important Bird Area ("IBA") (Audubon Society, 2015). The Heron Lake IBA encompasses a variety of lakes, wetlands, and grasslands, 11 WMAs, four WPAs, and two county parks. Seventy-seven bird species have been documented in the Heron Lake IBA. The project has been operating for the past 10 years with no know significant incidents of avian mortality.

No wildlife impacts have been observed or reported by operations staff since Jeffers took ownership, and no permanent impacts will occur to habitat within the IBA. Consequently, impacts are not anticipated to the Heron Lake IBA as a result of the Repower Project.

8.20 Rare and Unique Resources

The Repower Project area was evaluated for the presence of federal and state listed species, their habitat, and the potential for the proposed repowering efforts to affect said species. A review of the DNR Natural Heritage Information System ("NHIS") database licensed to Westwood (LA-876, June 2017) and endangered and threatened species lists from the USFWS was conducted to identify rare species known or likely to occur in the Repower Project area.

8.20.1 Review of Rare and Unique Natural Resources

In 2017, Jeffers requested updated information from the DNR's NHIS database to assess the potential presence of any new sensitive habitats or threatened or endangered species that might have been documented since the previous site permitting review process. The results of the 2017 NHIS evaluation for the Repower Project area are provided in **Appendix J**.

The USFWS Information Planning and Conservation ("IPaC") System identified two federally-listed threatened or endangered species as potentially occurring within the Repower Project area (USFWS, 2018a). The federally-listed species identified include the northern long-eared bat (*Myotis septentrionalis*) and the prairie bush-clover (*Lespedeza leptostachya*) (Coffin, 1988).

On September 14, 2018, Jeffers requested comments on the Repower Project from the USFWS. A response was received on October 4, 2018 indicating "The U.S. Fish and Wildlife Service has no comments or concerns with the proposed retrofit at this time. If either the scope or operational plan changes, please let us know." On February 1, 2019, Jeffers contacted USFWS staff to consult regarding any specific wildlife issues or concerns on the project; no specific concerns were raised by USFWS staff. Jeffers will continue to coordinate with the USFWS should the scope or operation plan for the project change.

Due to population-level declines caused by the fungus that results in white-nosed syndrome, the NLEB has been federally-listed as threatened since the Wind Farm was developed and constructed. Although the Repower Project area is located within the expected range of NLEB, no known NLEB hibernacula or maternity roost trees are located within Cottonwood County (DNR and USFWS 2018). Forested habitat is very limited within the Repower Project area and is unlikely to be suitable for roosting habitat and adequate foraging areas for NLEB. Regardless, incidental take resulting from wind energy development and operation is not prohibited under the final 4(d) rule; provided that the conservation measures set forth in the rule are followed to protect hibernacula and known, occupied maternity roost trees. Jeffers will implement feathering below cut-in speed ("FBCI") year-round to reduce risk of bat mortality when there is no energy production. FBCI will prevent free-wheeling at low wind speeds, when bats are most active.

Prairie bush-clover is an obligate of tallgrass prairie habitats (USFWS 2009). There are no prairie habitats mapped within the project area. There is one within one mile of the western project boundary. Prairie bush-clover may occur within the prairie habitats that were identified. However, no disturbance is planned within prairie habitats. Recent surveys completed in fall 2018 within the proposed crane path corridors did not identify native prairie, and therefore no impacts are anticipated. Additional information regarding the review for native prairies is provided in Section 8.20.2.

A search of the licensed NHIS database indicated a total of four records of sensitive species and two records of rare habitats within one mile of the boundary (**Appendix I**). Of the rare species and habitats identified, all are within one mile of the operational project boundary. The sensitive species records mapped within the area include one state-listed threatened plant, one nationally endangered invertebrate animal, one invertebrate species of special concern, and one bird species listed as endangered. A prior NHIS response (ERDB #20050821; June 1, 2005) for the original

permit application indicated that there were four known occurrences of rare species within the project area.

A current NHIS response (ERDB #20190079; September 20, 2018) indicated that if project-related activities will potentially impact any of the Minnesota Biological Survey ("MBS") identified in or near the project area, then the DNR should be contacted. MBS sites are ranked based on the level of biodiversity significance that they provide. Biodiversity significance includes occurrences of rare species or sensitive habitats. For example, some of the MBS sites near the project area include calcareous fens, a rare and specially-protected type of wetland that depend on groundwater hydrology and are sensitive to changes in hydrology, such as influxes in discharge or groundwater pumping. Provided this project will not alter the hydrology of the surrounding area, the DNR expressed that it will not have any concerns in reference to nearby calcareous fens.

The DNR also indicated that records of two state-listed species were documented in or near the project area. The two species identified include the state-listed as threatened hair-like beak rush (*Rynchospora capillacea*) and the state-listed as endangered Henslow's sparrow (*Ammodramus henslowii*). Hair-like beak rush is a plant that occurs in calcareous fens and the Henslow's sparrow is a ground-nesting bird species that breeds in grasslands and old-fields. Considering the conservation status of the two species that were documented in the area, protective measures will be employed during the construction and operation phases of the project to the extent practicable. As hair-like beak rush occur in calcareous fens, the same protective measures that are used to avoid disturbing fen habitat will also protect hair-like beak rush populations. Regarding the Henslow's sparrow, the DNR recommendations to minimize or avoid disturbance include avoiding ground disturbance in grassland habitat during their breeding season (mid-May to mid-July) and feathering turbine blade cut-in speeds. The DNR also recommended that Jeffers conduct a post-construction mortality monitoring study for the project.

Jeffers will adhere to the recommendations for avoiding and minimizing impacts to listed species and sensitive habitats (i.e., prairies) within or near the project area. Jeffers will also ensure that contractors are aware of the potential presence of sensitive species and habitats within the project area and measures to employ to minimize or avoid adversely affecting sensitive resources.

8.20.2 Native Prairie

In fall 2018, Westwood conducted a desktop review of native prairie habitat within the project area. A total of eleven suspect native prairie habitats were identified in the southern portion of the permitted project area. Ten of the eleven prairie habitats compose a prairie complex. No prairie habitat was mapped within the northern and central portions of the project area through the mapping exercise. The desktop mapping efforts took into consideration historical land use, publicly available undisturbed land mapping GIS data, and Minnesota Biological Survey information from the DNR, and Conservation Reserve Program data to identify suspect native prairie areas. Jeffers used the resulting desktop information to inform proposed crane path field surveys conducted in fall 2018. No native prairies were identified within the proposed crane paths during the field review, or supplemental desktop review of the project laydown area. Jeffers coordinated with the DNR by providing crane path shapefiles and the native prairie analysis for their review. On February 8, 2019, the DNR provided written confirmation that

based on the information provided in regards to native prairie, the agency concurs that no impacts are anticipated (**Appendix E**).

8.20.3 Minnesota County Biological Survey Sites

Jeffers conducted desktop review of Minnesota County Biological Survey Sites ("MCBS") within the project area (Map 15). One identified MCBS site is of high biological diversity significance and corresponds with the location of the Lake Augusta WMA in Section 1, over 2 miles southeast of the nearest turbine and outside of the project boundary. No MCBS sites were mapped within the project area. Crane walk paths will be re-evaluated for resources if moved.

8.20.4 Potential Impacts

The DNR's NHIS response letter dated September 20, 2018 recommended the following in regard to the project: (1) feathering turbine blades below cut-in speeds to minimize impacts to bat species, (2) preparation of an Avian and Bat Protection Plan, and (3) conduct post-construction fatality monitoring.

Jeffers will implement FBCI year-round to reduce risk of bat mortality when there is no energy production. In order to adequately document and describe measures to identify, avoid, and manage risks to avian and bat species that may result from wind turbine upgrades, Jeffers prepared a draft Bird and Bat Conservation Strategy ("BBCS") (**Appendix K**), and submitted the BBCS to DNR staff on January 22, 2019. A meeting to discuss the BBCS with the DNR occurred on February 7, 2019. BBCSs are based on recommendations provided in the USFWS's Land-Based Wind Energy Guidelines (USFWS, 2012). However, the original permitting effort pre-dated this guidance, so much of the current guidance was not applied at that time. Jeffers has been operating continuously since 2008, and there have not been any downed bats found during operations. Regardless, Jeffers will follow the DNR's recommendations and conduct a year of post-construction fatality monitoring.

Jeffers currently has a Downed Wildlife Observation Program ("DWOP") in place and has been operating under the plan since they took ownership. The DWOP is an ongoing program for operations staff to report all fatalities or injured wildlife discovered at the project. Information on fatalities or injured wildlife is immediately reported to the Operations Manager and DWOP staff through reporting and photography. No wildlife impacts have been observed or reported by operations staff to date at Jeffers.

Rare and Unique Natural Resources

No change from the original application concerning impacts to rare or unique natural resources is anticipated during the repowering process. Jeffers is familiar with the BMPs associated with avoiding and minimizing impacts to listed species and their habitats, and to prairie habitat that may be on-site or nearby, as demonstrated during construction of the original project in 2006. Jeffers intends to work closely with DNR and USFWS staff, as needed, to ensure rare and unique resources are avoided to the extent practicable.

8.20.5 Mitigation Measures

Areas indicated by the DNR as sensitive within the Repower Project area will be avoided to the extent practicable. Impacts to wildlife habitat will be mitigated by: (1) siting temporary crane walks, pads, and laydown areas on cultivated agricultural land when at all possible, (2) avoiding impacts to wetlands, streams, forested areas, shrublands, and native plant communities to the extent practicable; (3) applying FBCI as noted above; and (4) minimally lighting turbines and met towers while meeting FAA requirements.

9.0 SITE CHARACTERIZATION

9.1.1 Description of Resources

One 60-m tall tubular tilt-up met tower collected data at the project area from June 2006 to June 2008. It was instrumented with two anemometers to measure wind speed near the top of the mast at 59.8 m, plus additional anemometers at 50.2 m and 40 m. Two wind vanes to measure wind direction were installed at 58.9 m and 49.3 m. A temperature sensor was installed near the base of the met tower.

Temperature data from the met tower were correlated with an 18-year temperature dataset recorded at the Automated Surface Observing System ("ASOS") unit at the Redwood Falls, MN Municipal Airport. The long-term hub height temperature expected at the met tower is 6.5° C (43.7° F), with a maximum of 36° C (96.8° F) and minimum of -33.8° C (-28.8° F).

According to the Minnesota State Climatology Office, the average annual precipitation at the project is approximately 28-29 inches.

9.1.2 Interannual Variation

Interannual variation is the variation in wind speed from one year to the next. The inter-annual variability ("IAV") of wind speed at the project is estimated to be 3.3% by UL (formerly AWS Truepower, an independent consultant serving the wind energy industry). The IAV of 3.3%, applied to the project's estimated average hub height wind speed, is 0.3 m/s.

9.1.3 Seasonal Variation

Seasonal variation is represented by the change in wind speeds from one month to the next. Table 9.1.3 shows, at hub height at the project's met tower, the estimated average seasonal variation based on correlations between the on-site met data and a long-term reference dataset. Generally, the spring and autumn are expected to have the highest wind speeds, while the summer is expected to have the lowest wind speeds.

Table 9.1.3: Monthly Wind Speed	
Month	**Wind Speed (m/sec)**
January	8.7
February	8.9
March	8.9
April	9.5
May	8.8
June	7.8
July	7.1
August	7.1
September	8.0
October	9.1
November	9.5
December	8.8
Annual Average	8.5

9.1.4 Diurnal Conditions

As shown in Figure 9.1.4, the annual daily wind speed pattern at hub height at the project's met tower has an increase in wind speeds during the evening and overnight hours.

During the summer and late autumn/early winter the largest variations occur between daytime and nighttime wind speeds, whereas there is generally less variation in the diurnal pattern the remainder of the year.

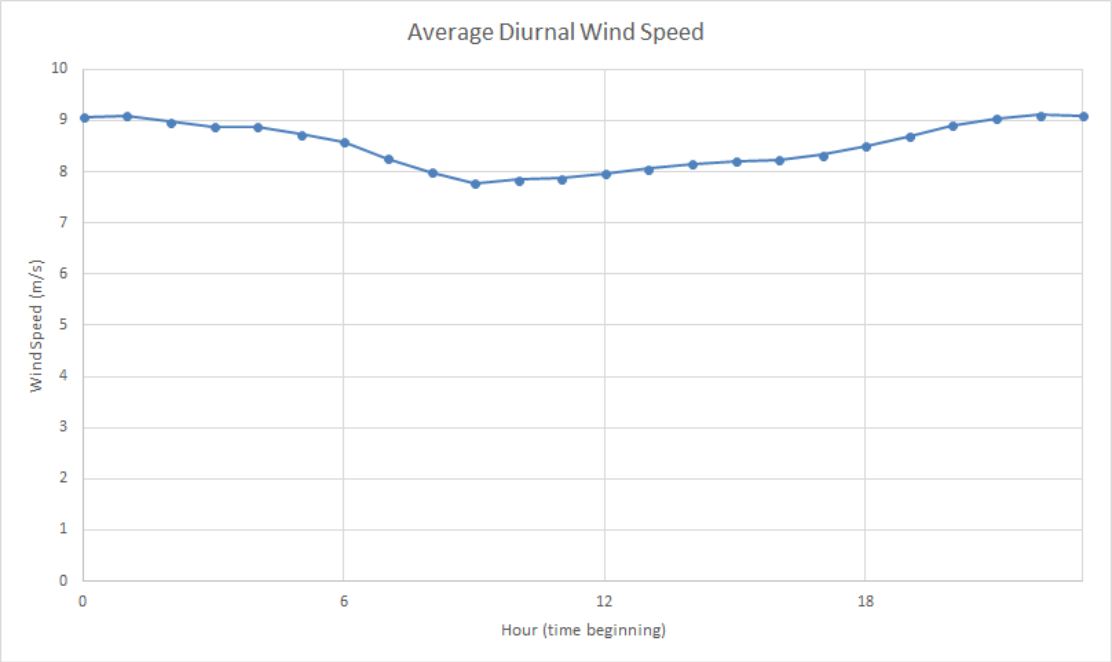


Figure 9.1.4. Average Diurnal Wind Speed

9.1.5 Atmospheric Stability

The stability of the atmosphere can be characterized based on temperature gradients. The estimated annual average of the thermal stability leads to near-neutral or weak to moderately stable conditions.

9.1.6 Hub Height Turbulence

Turbulence intensity ("TI") is an indicator of the variability of wind speed. Hub height TI at the met tower is on average 8 percent at 15 meters per second ("m/s"). Overall, the TI at the met tower is considered to be in the low to moderate range.

9.1.7 Extreme Wind Conditions

The hub height 50-year extreme 10-minute wind speed and 3-second gust estimated for the project area is 37.7 m/s and 45.7 m/s, respectively. The extreme wind speeds have been estimated by DNV GL (an independent consultant serving the wind energy industry) by employing an engineering standard (ASCE 7-16) used for identifying minimal design loads for buildings and other structures. In this strategy, data from the met tower are incorporated. The values estimated by DNV GL are conservative (i.e. higher) compared with alternative met tower-based estimates.

9.1.8 Wind Speed Frequency Distribution

Figure 9.1.8 shows the anticipated long-term annual wind speed frequency distribution at the met tower at hub height.

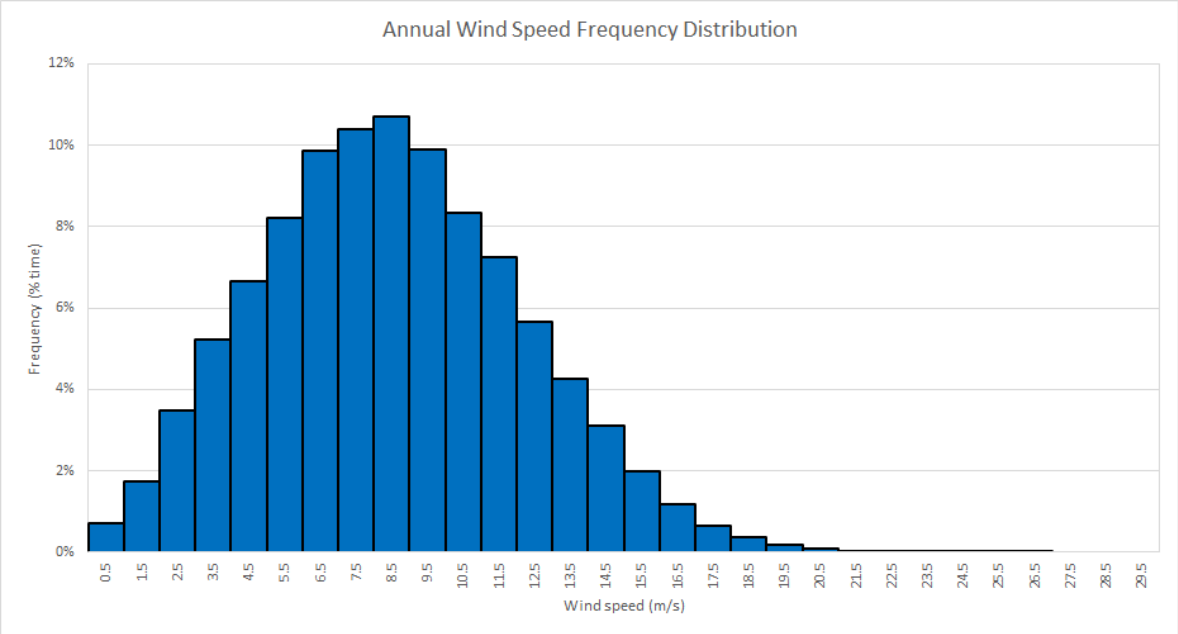


Figure 9.1.8. Annual Wind Speed Frequency Distribution

9.1.9 Wind Variation with Height

The wind shear exponent describes how quickly the wind speed changes as a function of height. It can vary greatly due to terrain, surface roughness, and atmospheric stability. The annual wind shear exponent at the met tower up to hub height is 0.21.

9.1.10 Spatial Wind Variation

DNV GL has estimated the annual average hub height wind speeds among the project's 20 turbines to range from approximately 8.4 to 8.8 m/s, averaging approximately 8.7 m/s. These estimates result from a combination of wind flow modeling (using the WAsP model) and analysis of the project's historical operational data.

9.1.11 Wind Rose

The frequency with which the wind blows from each direction during the year is best represented by a wind rose. Figure 9.1.11 shows the met tower's annual wind rose. Prevailing winds blow from the north/northwest at the Wind Farm.

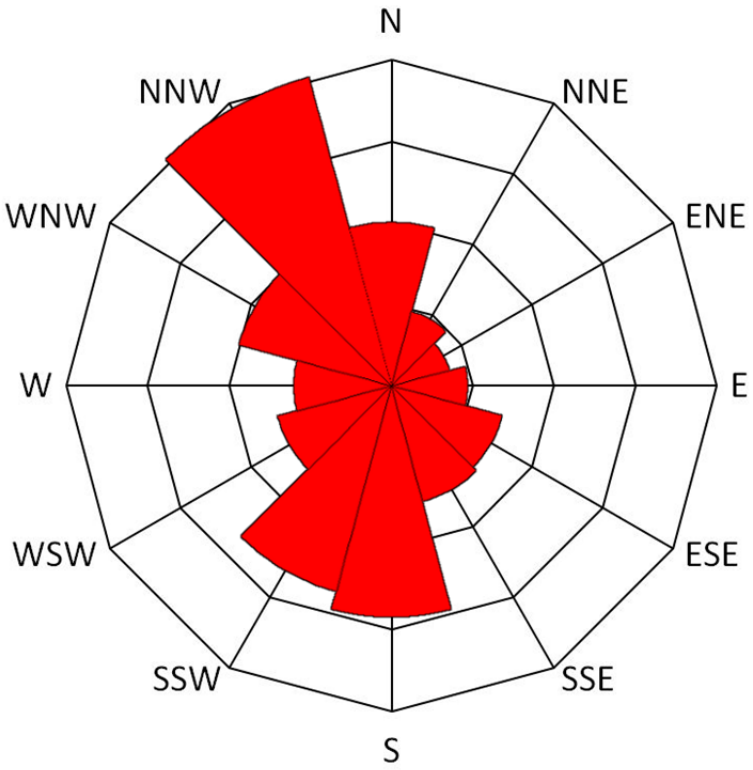


Figure 9.1.11. Wind Rose

9.1.12 Other Meteorological Conditions

Minnesota has a continental-type climate characterized by frequent occurrences of continental polar air throughout the year, with occasional Arctic outbreaks during winter and occasional periods of prolonged heat during the summer, especially in southern Minnesota when warm air moves in from the Gulf of Mexico and southwestern United States. Pacific Ocean air masses moving across the western United States allow for mild and dry weather conditions during all seasons. While the climate within the project area is fairly uniform due to relatively little topographic relief and lack of large water bodies, extreme weather events, such as tornadoes, thunderstorms, high winds and blizzard conditions, do occur. Extreme weather events in the Repower Project retrofit area have been recorded by the National Oceanic and Atmospheric Administration (NOAA, 2019) ("NOAA") in the U.S. Storm Events Database for the period of time from January 1950 through December 2018. Extreme weather events during this period include tornadoes, hail, thunderstorm winds, high wind, winter storms, blizzards, extreme cold, heavy snow, excessive heat, dense fog, floods, and flash floods (among others). NOAA recorded 464 extreme weather events in Cottonwood County during this time period. Typically, such storms are local in extent, short in duration, and result in damage to relatively small geographic areas. There were 50 event days with property damage reported during this period (NOAA, 2019).

9.1.13 Other Nearby Wind Turbines

Other wind projects located in the vicinity of the Repower Project retrofit according to the American Wind Energy Association U.S. Wind Industry Map and USGS sources include: Bingham Lake Wind (12 turbine; 15 MW capacity), Mountain Lake Wind (1 turbine; 1.25 MW capacity), Odell Wind Farm (100 turbine; 200 MW capacity), and Odin Wind Farm (10 turbine; 20 MW capacity) (USGS, 2018).

10.0 CONSTRUCTION

Repowering will consist of the following general construction steps: completing improvements to existing gravel roads to accommodate truck deliveries, preparing laydown and staging areas, installing temporary crane crossings over streams, offloading new turbine components near operating turbines, removing and replacing existing blades and nacelles with a construction crane, removal of existing met towers, performing engineering inspections on new components, returning turbines to operation, and restoring temporarily disturbed areas to pre-construction conditions.

Because this is a repowering project, earthmoving will be fairly minimal and generally limited to laydown, staging and crossing areas. Land will be graded only where needed to allow for crane and delivery truck access. Detailed descriptions of construction processes are described within sections below for primary grading and preparation areas. Prior to any earthwork being performed, Gopher State One Call will be contacted to mark utility locations, right-of-ways will be identified as needed, and construction stakes placed. Limited access road widening and temporary storage area construction will be completed as necessary to accommodate the repower.

Professional design engineering firms and experienced pre-qualified trade contractors will be hired and managed by the primary contractor for component dismantling and installation. Jeffers will have overall project management responsibilities. The repowering team will be on-site to handle materials, deliveries, staging, repowering, and quality assurance. An on-site construction manager will coordinate all aspects of the work, including ongoing communication with local officials, citizens groups, and landowners.

The construction manager will also oversee the temporary widening of access roads, crane routes, gear box and blade installations, electrical infrastructure, as well as the coordination of materials receiving, inventory, and distribution.

10.1 Roads and Infrastructure

Area roadways will be accessed by a variety of small (standard pickup trucks) to large (semi-tractor delivery trucks) construction vehicles during project repowering. Once the repower is completed, only small-to-medium sized vehicles will access local roadways to perform routine maintenance on turbines and associated facilities as they do currently. The Applicant estimates that the maximum traffic the Repower Project will create is approximately 100 additional trips per day on local roadways during peak repowering when turbine components and equipment are

being delivered. It is anticipated that total trips per day will decrease to approximately five vehicle trips to and from the site per day following repowering.

Because of the size of the equipment to be installed, and the turning radii of the delivery trucks, some local roadways may require upgrades to improve drivability and access. This typically includes widening select intersections to allow for the long delivery trucks to turn, and upgrading road surfaces (grading and/or the addition of gravel). The degree to which existing roadways will require upgrading for the Repower Project remains under evaluation. However, due to the short-term nature of the repower work, gravel road improvements will generally consist of placement of additional gravel, as needed, and compacting the surface. All proposed upgrades will be coordinated through agreements in advance with county and township personnel.

10.2 Access Roads and Crane Crossings

The Repower Project will not require construction of new, permanent access roads. Some access roads will be temporarily widened to allow for crane movement and delivery of equipment to the base of each turbine, which will be detailed on site plans prior to construction. Temporary crane pads will be constructed along the access roads to enable removing and replacing turbine components. Jeffers will coordinate with landowners throughout the repowering process to minimize disturbances to active agricultural lands. Upon completion of repowering, temporary materials will be removed, and access roads will be returned to their standard 16-foot widths.

No stream crossings are anticipated for Jeffers; however, wetlands will be crossed in several locations with cranes. Wetland crossings will generally be installed and restored in accordance with the following steps, and the site SWPPP:

a. Plan crane walks according to unique area conditions where crane walk will occur;
b. Install down grade perimeter controls such as fiber rolls, silt fence and erosion control blanket to protect conveyances as field conditions dictate;
c. Install geotextile fabric, timber mats;
d. Walk cranes across wetlands during dry conditions;
e. Restore all disturbed areas to pre-construction conditions following crane walk activity by removing timber mats and geotextile fabric, seeding all disturbed areas, installing erosion control blankets on all ditch bottoms and disturbed slopes greater than 3:1, and then removing erosion control measures once final stabilization has occurred.

10.3 Associated Facilities

10.3.1 Operation and Maintenance Facility

The project currently does not have an on-site O&M facility, and one is not proposed with repowering. Vestas will continue to utilize the existing, off-site O&M building (the O&M is described further in Section 6.3.1).

10.3.2 Electrical Substation

The Wind Farm's cable system routes to a nominally rated 60 MVA 34.5 kV/69 kV transformer at a site switchyard located adjacent to the Storden Junction Substation, then to the point of grid interconnection at the Storden Junction Substation, located just west of the project area. No changes to the existing step-up substation are proposed, or needed, to accomplish repowering. The substations will stay intact and substantially unchanged; no work will be required outside of the substation fencing.

10.3.3 Laydown and Staging Areas

A secure laydown yard and staging area will be prepared where wind turbine components are temporarily stored, assembled, or processed, as part of the wind turbine repowering operation. The parcel will be approximately five acres in size, may house temporary construction offices and facilities, and will be sited on agricultural lands outside of native landscapes. The laydown yard will be relatively flat, near the site access point, and central to the proposed turbine sites. The area will be a gravel pads and will have geotextile fabric or something similar placed in between the gravel and the soil on the site to increase the ease of site restoration. The laydown area will be in place for 6-8 months and then restored. In addition, a one-acre working area around each turbine is anticipated for installing the new wind turbine components. Laydown and staging areas will be in place for 6-8 months and then restored. In addition, a two-acre working area around each turbine is anticipated for installing the new wind turbine components. These working areas will be prepared using compacted native soils or gravel over geotextile fabric, or something similar, for ease of restoration. General laydown, staging and work area preparation and restoration steps are provided below, and will be installed in accordance with the site SWPPP.

a. Install perimeter sediment controls and provide stable accesses to area; install culverts as necessary and according to the plan for the accesses;
b. Install additional silt fence and other sediment controls as necessary and as detailed in the plan;
c. Strip and stockpile topsoil around the up-gradient perimeter of the lay down yard, staging area or work area for a diversion of water, or downgrade perimeter of the yard for runoff control;
d. Apply geotextile fabric, or something similar, and then rock base to designed thickness for laydown/staging areas or compact native materials for working areas;
e. Temporarily cover the stockpiles with hydro-mulch or wood-fiber blanket after seeding with temporary seed mix;
f. Provide necessary secondary containment, secure storage and maintenance activities during operation;
g. Remove rock, if present;
h. Decompact and then reapply topsoil to the area after the areas are no longer needed; and
i. Return disturbed areas to preconstruction condition, which may include applying seed and mulch cover for restoration in non-agricultural areas.

10.3.4 Met Towers

No new permanent met towers are required for repowering. The existing permanent met tower at Jeffers is free-standing and 81 m tall, excluding the lightning rod. As described in Section 6.3.2, the existing permanent met towers will be dismantled and re-used, recycled or properly disposed.

10.4 Turbine Site Selection

No new turbine sites are proposed.

10.4.1 Foundation Design

According to the Wind Turbine Foundation Evaluation Report prepared by Barr Engineering in May 2018 (**Appendix C**), the existing wind turbines have a spread footing style foundation. Foundations were designed by Barr for Carstensen Contracting, Inc.. The foundation has an octagonal (8 sided) shape with a plan width of 56 feet, and a footing thickness of 12 inches at the edge and 72 inches in the middle. The foundation pedestal has a 19-foot diameter plan dimension and is 54 inches high. The footing is embedded to a depth of 10 feet. There are approximately 417 cubic yards of concrete and 37 tons of reinforcing steel in the existing foundations.

A desktop comparison of load documents for the Clipper C96 and the Vestas V110 wind turbines found that the extreme loads for the Vestas V110 were lower than the Clipper C96. The operating loads for the Clipper C96 were also higher than the Vestas V110. When comparing damage equivalent loads, the fatigue loads for the Clipper C96 also appear somewhat higher than the Vestas V110. Using 2017 standards, the foundations passed all design checks for stability, bearing capacity, stiffness, strength and fatigue.

10.4.2 Tower

The existing towers are conical tubular steel with a hub height of 80 m (262.5 feet). Changes to towers include replacement of turbine tower internals, nacelles, hubs, and blades. The hub height of the repowered turbines will be increased to 86.3 m (283.1 feet) because of the addition of an adapter for the new Vestas turbines. The 6.3-meter adapter, which is warranted by Vestas for the life of the repower, will be bolted on to the top of the existing 80-meter towers.

A tower design life analysis has been prepared that analyzes the structural requirements of the repower turbines and suitability of the towers (**Appendix L**). As described in the analysis, the integrity of the existing towers will be more than adequate to support the new turbine components.

10.5 Post-Construction Cleanup and Site Restoration

During repowering, some areas will be temporarily impacted. Activities causing temporary impacts are associated with the widening of existing access roads for equipment transport, crane pads, crane walk path, and laydown areas. At the completion of repowering activities, temporary impact areas will be graded back to natural contours with soil loosened and seeded as needed with certified weed-free native seed mixes, planted with crops, or seeded with temporary

transition grasses until crops are planted. Erosion control practices will be kept in operating condition until seeded areas are stabilized. Jeffers anticipates that cleanup and restoration will take no longer than 30 days. Jeffers is committed to cleaning up construction debris and restoring temporarily impacted areas, and to the satisfaction of landowners, following project repowering.

10.6 Operation and Maintenance of Project

Jeffers will enter into a contractual agreement with the turbine vendor, Vestas, to provide service and maintenance for the project at least through the 30-year warranty period given by the turbine vendor. Thereafter, Jeffers will contract with a qualified contractor for service and maintenance for the project. The service and maintenance activities will be performed by qualified technicians, trained specifically on the applicable wind turbines.

Jeffers owns an operations and maintenance building located at 308 South County Road 52, Jeffers, MN 56145. Turbine maintenance will be accomplished as an ongoing cyclical function during the life of the project, so as to minimize downtime. Transformer maintenance will be accomplished on an annual basis and will be scheduled and performed during non- or low-wind periods.

The project includes a computer-controlled communications system that permits automatic, independent operation and remote supervision of each turbine and the facility collectively, thus allowing the simultaneous control of all wind turbines. The SCADA system collects data on wind turbine generation, availability, alarms, turbine conditions, communication system status, and meteorological data. Performance data and parameters for each machine can also be viewed in real time, and machine status can be changed. The SCADA system also reports and archives generation data.

10.7 Costs

The capital cost of the Repower Project is estimated at approximately $40.5 million; the actual cost will be finalized after component procurement, construction, and contractual arrangements are complete. The bulk of Repower Project costs are attributed to the wind turbine components required for repowering.

10.8 Schedule

Repowering is expected to begin during the 2020 construction season and is anticipated to take up to 8 months to complete.

10.9 Energy Projections and Wake Loss

Jeffers is currently engaging an independent third party to conduct wake loss and energy projection calculations for the Repower Project. An initial draft report estimating the repowered project's energy production and wake loss is expected to be completed in Q2 2019, at which time it can be shared with the Commission. Wake loss studies are project specific, so a study

completed for the existing Wind Farm would not be applicable to the Repower Project. Details such as tower height and blade length can dramatically change the results from a wake loss study; thus, a new study is being completed for the proposed project.

10.10 Decommissioning and Restoration

10.10.1 Anticipated Life of the Project

Jeffers estimates the service life of the Repower Project to be approximately 30 additional years.

10.10.2 Estimated Decommissioning Costs in Current Dollars

Jeffers estimates that net decommissioning cost (estimated cost of dismantling and removal less the salvage value) for the Wind Farm after the Repower Project is complete at between $50,000 and $70,000 per turbine.

10.10.3 Method for Ensuring that Funds are Available for Decommissioning

Jeffers proposes to establish a separate Decommissioning Fund Balance as a regular expense item within the Repower Project budget beginning in the 16th year of operation. An annual "set-aside" of $5,000 per turbine is scheduled for each year of operation. This will provide a fund in the amount of at least $1,500,000 (plus earned interest) to pay for decommissioning and site restoration costs after operations cease, to the extent that the salvage value does not cover decommissioning. However, the salvage value of the turbines and other components should ensure that sufficient funds will be available to pay for decommissioning and restoration costs.

10.10.4 Method for Updating that Funds are Available and Updating Decommissioning Costs

Over the life of the Repower Project, Jeffers will budget and maintain funds to cover decommissioning costs. Jeffers will be responsible for costs to decommission the project and associated facilities. Jeffers anticipates updating the budget roughly mid-way through the project life-cycle to ensure adequate funds are available.

10.10.5 Anticipated Methods of Site Decommissioning and Restoration

Decommissioning of the site will include: (1) removal of all turbines and towers; (2) removal of all pad mounted transformers; (3) removal of all above-ground distribution facilities; (4) removal of foundations to a depth of four feet below grade; and (5) removal of surface road material and restoration of the roads and turbine sites to previous conditions to the extent feasible, consistent with the landowner's desires. Removed components will either be scrapped by the project EPC contractor or sold to another Clipper project owner. The determination will be made based on the expected market for the used components.

Removal and restoration obligations shall be completed within eighteen (18) months, and in general accordance with the requirements of Minnesota Rules 7854.0500, subp. 13, and applicable county requirements.

Jeffers requests the right to re-evaluate decommissioning alternatives prior to the end of the LWECS Site Permit term and to update decommissioning costs. Jeffers also requests the right to re-apply for a LWECS Site Permit to continue operation of the Repower Project upon expiration of the LWECS Site Permit, and to retrofit, repower or replace the turbines and power system with upgrades based on new or available technology to continue to operate the project.

11.0 IDENTIFICATION OF OTHER POTENTIAL PERMITS

The federal, state and local permits or approvals that have been identified as potentially being required for the construction and operation of the Repower Project are provided in Table 11. Permits dependent on the final site layout will be applied for after receiving Commission approval, but prior to construction.

Table 11.0: Potential Permits and Approvals Required for Repowering and Operation of the Facility

Agency		Name and Type of Permit/Approval
Federal	Federal Aviation Administration	Form 7460-1 Notice of Proposed Construction or Alteration (Determination of No Hazard)
		Notice of Actual Construction or Alteration (Form 7460-2)
	U.S. Army Corps of Engineers	Federal Clean Water Act Section 404 Nationwide Permit; Wetland Delineation Approvals; Jurisdictional Determinations
	U.S. Fish and Wildlife Service	Review for Threatened and Endangered Species
	Environmental Protection Agency ("EPA")/("MPCA")	Spill Prevention Control and Countermeasure ("SPCC") Plan
State of Minnesota	Minnesota Public Utilities Commission	Large Wind Energy Conversion System (LWECS) Site Permit Amendment
	Minnesota State Historic Preservation Office	Cultural and Historical resources review; State and National Register of Historic Sites review
	Minnesota Department of Natural Resources	Potential Native Prairie Review
	Minnesota Pollution Control Agency	NPDES Permit for Construction Activities and Storm Water Pollution Prevention Plan
		License for Very Small-Quantity Generator of Hazardous Waste
		Section 401 Water Quality Certification, or waiver
	Minnesota Department of Transportation	Utility Access Permit
		Aviation clearance from Office of Aeronautics
		Oversize and Overweight Permit
Local	Cottonwood County	Roadway Access Permit
		Drainage Permit
		Working in the Right-of-Way Permit
		Overweight/Over-Dimension Permit
		Utility Permit

Table 11.0: Potential Permits and Approvals Required for Repowering and Operation of the Facility		
Agency		**Name and Type of Permit/Approval**
	County Soil and Water Conservation District	Wetland Conservation Act "No-Loss" Confirmation
	Storden Township	Right-of-Way permits, crossing permits, road access permits, and driveway permits for access roads and electrical collection system, as needed.

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