Application to the Minnesota Public Utilities Commission for a Site Permit for a Large Wind Energy Conversion System

Lake Benton Wind II Repowering Project

Pipestone County, Minnesota

MPUC Docket Number: IP-6903/WS-18-179

May 3, 2018

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ACRONYM/TERM	DEFINITION
AADT	Average Annual Daily Traffic
AGL	Above Ground Level
ABPP	Avian Bat Protection Plan
AC	Alternating Current
ACSR	Aluminum Conductor Steel Reinforced
ANSI	American National Standards Institute
ASR	Antenna Structure Registration
Applicant or Lake Benton Wind II	Lake Benton Wind II, LLC
ASTM	American Society for Testing and Materials
BMPs	Best Management Practices; prevents soil erosion and sedimentation
Capacity	The capability of a system, circuit, or device for storing electronic charge
Phase Ia	Cultural Resources Literature Search – a large-scale review and compilation of known cultural resource data.
Phase I	Cultural Resources Reconnaissance Survey – physical inspection and identification of cultural resources within a specific area.
CON	Certificate of Need
CNHS	Community Noise and Health Study
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
dB	Decibels
DBS	Direct Broadcast Satellite
Distribution	Relatively low-voltage lines that deliver electricity to the retail customer's home or business
DNHs	Determinations of No Hazard

ACRONYM/TERM	DEFINITION
EF	Electric Fields
ELF	Extremely Low Frequencies
EMF	Electric and Magnetic Field
EWG	Exempt Wholesale Generator
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FPPA	Farmland Protection Policy Act
GE	General Electric
Generator	A machine by which mechanical energy is changed into electrical energy
GSU	Generator Step Up
Geotechnical	A science that deals with the application of geology to engineering
Hub	The central component of the wind turbine which connects the rotors to the generator.
Hz	Hertz
IEEE	Institute of Electrical and Electronic Engineers, Inc.
Interconnection	Location of project connection to the power grid.
IRAC	Interdepartment Radio Advisory Committee
kV	kilovolt
kV/m	Kilovolt per meter
kW	kilowatt
Leq	Equivalent Sound Level
LGU	Local Government Unit

ACRONYM/TERM	DEFINITION
LHVTL	Large High Voltage Transmission Line
LNTE	Low Noise Trailing Edge
LWECS	Large Wind Energy Conversion System
MBS	Minnesota Biological Survey
MERRA2	Modern-Era Retrospective Analysis for Research and Applications
MET	Meteorological Towers
MF	Magnetic Field
MG	MilliGauss
Micrositing	The process in which the wind resources, potential environmentally sensitive areas, soil conditions, and other site factors, as identified by local, state and federal agencies, are evaluated to locate wind turbines and associated facilities.
MISO	Midcontinent Independent Transmission System Operator
MN/DOT	Minnesota Department of Transportation
MMPA	Minnesota Municipal Power Authority
MPCA	Minnesota Pollution Control Agency
Commission	Minnesota Public Utilities Commission
MPH	Miles Per Hour
MSL	Mean Sea Level
MW	megawatt
Nacelle	A streamlined enclosure (as for an engine), which houses the gearbox, generator, brake, cooling system and other electrical and mechanical systems
NASA	National Aeronautics and Space Administration
NEC	National Electric Code

ACRONYM/TERM	DEFINITION
NEMA	National Electrical Manufactures Association
NESC	National Electric Safety Code
NHIS	Natural Heritage Inventory System
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NRHP	National Register of Historic Places
NSP	Northern States Power Company
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
O & M	Operations and maintenance facility
OPGW	Optical Ground Wire
OSA	Office of State Archaeologist
OSHA	Occupational Safety and Health Administration
POI	Point of Interconnection
PPA	Power Purchase Agreement
Project	Lake Benton Wind II Project
PTC	Production Tax Credit
PWI	Public Waters Inventory
RES	Renewable Energy Standard
RIM	Reinvest in Minnesota
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

ACRONYM/TERM	DEFINITION
RERL	Renewable Energy Research Laboratory
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisitions (communications technology)
SCS	Site Characterization Study
SHPO	Minnesota State Historic Preservation Office
SME	Subject Matter Expert
SMMPA	Southern Minnesota Municipal Power Agency
SNA	Scientific and Natural Area
SPCC	Spill Prevention, Control, and Countermeasure Plan
Step-up Transformer	A transformer that increases voltage
Stray Voltage	A voltage resulting from the normal delivery and/or use of electricity (usually smaller than 10 volts) that may be present between two conductive surfaces that can be simultaneously contacted by members of the general public and/or their animals
SWPPP	Storm Water Pollution Prevention Plan
TNW	Traditional Navigable Water
TV	Television
USACE	US Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
V	Volt
WCA	Wetland Conservation Act
WCFZ	Worst Case Fresnel Zone
Windlogics	Windlogics, Inc.
WMA	Wildlife Management Area

ACRONYM/TERM	DEFINITION
WNS	White Noise Syndrome
WOUS	Waters of the U.S.
WPA	Waterfowl Protection Area
WRP	Wetlands Reserve Program
Yaw	To deviate erratically from a course (as when struck by a heavy sea); especially to move from side to side: to turn by angular motion about the vertical axis
ZVRT	Zero Voltage Ride Through

Minnesota Rule	Required Information	Application Section(s)
7854.0500	**SITE PERMIT APPLICATION CONTENTS**	
Subpart 1	Applicant	
(A)	A letter of transmittal signed by an authorized representative or agent of the applicant	Under separate cover
(B)	The complete name, address, and telephone number of the applicant and any authorized representative	1.0
(C)	The signature of the preparer of the application if prepared by an agent or consultant of the applicant	Under separate cover
(D)	The role of the permit applicant in the construction and operation of the LWECS	1.0
(E)	The identity of any other LWECS located in Minnesota in which the applicant, or a principal of the applicant, has an ownership or other financial interest	1.0
(F)	The operator of the LWECS if different from the applicant	1.0
(G)	The name of the person or persons to be the permittees if a site permit is issued	1.0
Subpart 2	Certificate Of Need Or Other Commitment	
(A)	The applicant shall state in the application whether a certificate of need for the system is required from the commission and, if so, the anticipated schedule for obtaining the certificate of need. The commission shall not issue a site permit for an LWECS for which a certificate of need is required until the applicant obtains the certificate, although the commission may process the application while the certificate of need request is pending before the commission.	2.0
(B)	The commission may determine if a certificate of need is required for a particular LWECS for which the commission has received a site permit application	2.0

Minnesota Rule	Required Information	Application Section(s)
(C)	If a certificate of need is not required from the commission, the applicant shall include with the application a discussion of what the applicant intends to do with the power that is generated. If the applicant has a power purchase agreement or some other enforceable mechanism for sale of the power to be generated by the LWECS, the applicant shall, upon the request of the commission, provide the commission with a copy of the document.	2.0
Subpart 3	State policy. The applicant shall describe in the application how the proposed LWECS project furthers state policy to site such projects in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources.	3.0
Subpart 4	Proposed Site	
(A)	The boundaries of the site proposed for the LWECS, which must be delineated on a United States Geological Survey Map or other map as appropriate	4.1; Maps 1, 2, and 2a
(B)(1)	Characteristics of the Wind at the Proposed Site: interannual variation	9.1.1
(B)(2)	Characteristics of the Wind at the Proposed Site: seasonal variation	9.1.2
(B)(3)	Characteristics of the Wind at the Proposed Site: diurnal conditions	9.1.3
(B)(4)	Characteristics of the Wind at the Proposed Site: atmospheric stability, to the extent available	9.1.4
(B)(5)	Characteristics of the Wind at the Proposed Site: turbulence, to the extent available	9.1.5
(B)(6)	Characteristics of the Wind at the Proposed Site: extreme conditions	9.1.6

Minnesota Rule	Required Information	Application Section(s)
(B)(7)	Characteristics of the Wind at the Proposed Site: speed frequency distribution	9.1.7
(B)(8)	Characteristics of the Wind at the Proposed Site: variation with height	9.1.8
(B)(9)	Characteristics of the Wind at the Proposed Site: spatial variations	9.1.9
(B)(10)	Characteristics of the Wind at the Proposed Site: wind rose, in eight or more directions	9.1.10
(C)	Other meteorological conditions at the proposed site, including the temperature, rainfall, snowfall, and extreme weather conditions	9.1.11
(D)	The location of other wind turbines in the general area of the proposed LWECS	9.2; Map 14
Subpart 5	The applicant shall include in the application information describing the applicant's wind rights within the boundaries of the proposed site	7.0; Map 4
Subpart 6	Design of Project	
(A)	A project layout, including a map showing a proposed array spacing of the turbines	5.1; Map 3
(B)	A description of the turbines and towers and other equipment to be used in the project, including the name of the manufacturers of the equipment	5.2
(C)	A description of the LWECS electrical system, including transformers at both low voltage and medium voltage	5.3, 5.3.1-5.3.3
(D)	A description and location of associated facilities	6.0, 6.1-6.4

Subpart 7	Environmental Impacts	
(A)	Demographics, including people, homes, and businesses	8.1, 8.1.1, 8.1.2 , 8.2, 8.2.1-8.2.5
(B)	Noise	8.3, 8.3.1-8.3.3
(C)	Visual impacts	8.4.1-8.4.4
(D)	Public services and infrastructure	8.5, 8.5.1-8.5.6
(E)	Cultural and archaeological impacts	8.6.1-8.6.3
(F)	Recreational resources	8.7.1-8.7.3
(G)	Public health and safety, including air traffic, electromagnetic fields, and security and traffic	8.8.1-8.8.9
(H)	Hazardous materials	8.9.1-8.9.3
(I)	Land-based economics, including agriculture, forestry, and mining	8.10.1-8.10.7
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(O)	Wetlands	8.17.1-8.17.3
(P)	Vegetation	8.18.1-8.18.3
(Q)	Wildlife	8.19, 8.19.1-8.19.6

(R)	Rare and unique natural resources	8.19, 8.19.1-8.19.6
Subpart 8	Construction of project. The applicant shall describe the manner in which the project, including associated facilities, will be constructed	10.0-10.5
Subpart 9	Operation of project. The applicant shall describe how the project will be operated and maintained after construction, including a maintenance schedule	10.6
Subpart 10	Costs. The applicant shall describe the estimated costs of design and construction of the project and the expected operating costs.	10.7
Subpart 11	Schedule. The applicant shall include an anticipated schedule for completion of the project, including the time periods for land acquisition, obtaining a site permit, obtaining financing, procuring equipment, and completing construction. The applicant shall identify the expected date of commercial operation.	10.8
Subpart 12	Energy projections. The applicant shall identify the energy expected to be generated by the project.	10.9
Subpart 13	Decommissioning and Restoration	
(A)	The anticipated life of the project	10.10.1
(B)	The estimated decommissioning costs in current dollars	10.10.2
(C)	The method and schedule for updating the costs of decommissioning and restoration	10.10.4
(D)	The method of ensuring that funds will be available for decommissioning and restoration	10.10.3
(E)	The anticipated manner in which the project will be decommissioned and the site restored	10.10.5
Subpart 14	Identification of other permits. The applicant shall include in the application a list of all known federal, state, and local agencies or authorities, and titles of the permits they issue that are required for the proposed LWECS.	11.0

1.0 APPLICANT INFORMATION

Overview

Lake Benton Power Partners II, LLC (Lake Benton Wind II or Applicant) submits this Application for to the Minnesota Public Utilities Commission (Commission) for a Site Permit to construct and operate the 100.2 megawatt (MW) Lake Benton Wind II Repowering Project (Project). Lake Benton Wind II is an indirect, wholly-owned subsidiary of NextEra Energy Resources, LLC (NEER).[1] The Applicant will develop and construct the proposed Project. As explained in Docket No. E-002/M-16-777, Lake Benton Wind II is a build and transfer project, and, accordingly, the Site Permit will be transferred to Northern States Power Company (NSP) on the commercial operations date. Given the size of the Project, it is a large wind energy conversion system (LWECS) as defined in the Wind Siting Act, Minnesota Statues Chapter 216F. The Project is located in Pipestone County at the site of the existing Lake Benton wind facility in southwestern Minnesota, immediately southwest of the City of Ruthton and north of the City of Holland, Minnesota.

The Applicant, as a member of the NextEra Energy, Inc. family of companies, benefits from the capabilities developed within its network of affiliated companies, which combine to make NextEra Energy, Inc. the world's largest generator of renewable energy from the wind and sun. One such example is WindLogics, Inc. (WindLogics), which is a Minnesota-based affiliate of Lake Benton Wind II. WindLogics has decades of experience in providing engineering, technical analysis, and consulting services in the field of studying, modeling, and forecasting meteorological air flow, including scientific analysis of wind resources, wind-modeling services and climate-prediction services in support of wind-farm development. Among other contributions, WindLogics supported the development and optimization of the new Lake Benton Wind II array and provided inputs and data for Section 9 of the Application. Additional internal capacities, which also include engineering and construction, environmental, legal and regulatory, land acquisition services, and project management have been utilized to develop the Project, and this in-house expertise is supplemented by highly qualified external consultants.

Repower of Existing LWESC

The Lake Benton Wind II LWECS is a repowering of an existing wind facility consisting of 137 wind turbines, overhead and underground collection lines, access roads, four Point of Interconnect (POI) collector substations, ancillary equipment, and an operations and maintenance facility. The vast majority of the existing 137 wind turbines have a rotor swept area of 6,440 ft

[1] NEER is a global leader in development and operation of renewable energy resources, with a total generating capacity of 14,255 MW of wind generation in operation as of December 31, 2017.

(1,963 m) and several have a rotor swept area of 5,935 ft (1,809 m). The existing Lake Benton Power Partner II wind facility permitted on May 21, 1998 (Permit No. NSP & LBPP-LWECS-1-1998) will be decommissioned just prior to the start of construction of the proposed Project. The Applicant will make a separate filing on the decommissioning activities closer to the actual decommissioning of the existing turbines in 2019. Generally, however, decommissioning of the existing facilities will include the following activities:

- Lake Benton Power Partners II, LLC will identify components of the existing facility that will not be removed and will be used for development of the Project. It is anticipated that the use of several existing access roads and four POI substations will continue. It is generally anticipated that other components of the existing facility will not continue to be used and will be removed to a depth of four feet.
- For access roads that are not to be used for the proposed Project, Lake Benton Power Partners II, LLC will work with landowners regarding whether the landowner prefers to keep the access road in place. In the event landowners do not want the access road, or portions thereof, the access roads will be removed.
- Decommissioning will include the dismantling and removal of the existing wind towers, wind turbine generators, transformers, overhead cables, foundations, buildings, and ancillary equipment to a depth of four feet. Turbine tower sections will be dismantled utilizing cranes.
- Underground cables will be removed generally to a depth of four feet; however, in some cases, and in coordination with appropriate entities such as NSP, Minnesota Department of Natural Resources (MNDNR), Minnesota Board of Water and Soil Resources, the landowner, the Commission, and others, underground cables may remain in place to avoid surficial disturbance of sensitive features, such as prairies, habitat, or wetlands.
- After dismantling and excavating the facility, high value components will be removed for scrap value. The remaining materials will be reduced to transportable size and removed from the site for disposal. Materials will be disposed where disposal is permitted and where there is capacity for the disposal.
- Vacated areas, resulting from facility removal, will be filled with clean, compatible sub-grade material that will be compacted to a density similar to surrounding areas. These areas will then be covered with topsoil.
- Unexcavated areas compacted by equipment used in the decommissioning may be tilled in a manner adequate to restore the topsoil and subgrade material to a density consistent with the surrounding areas.
- Following the removal of the existing facility, the areas disturbed by the decommissioning activities will be restored. Lake Benton Power Partners II, LLC will restore and reclaim the areas disturbed by the decommissioning.

Other LWESCs

Although the Applicant does not own or have a direct financial interest in any other LWECS located in Minnesota, NEER has ownership and financial interests in: (1) the formerly operating 26.3 MW Buffalo Ridge Wind Energy Center in Lincoln County, which has been

decommissioned; (2) the 98.2 MW Mower County wind facilities in Mower County; and (3) the to-be-decommissioned 102.8 MW Lake Benton II project in Pipestone County.

Authorized Representatives

The authorized representatives for the Applicant are:

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2.0 CERTIFICATE OF NEED

On September 1, 2017, in Docket No. E002/M-16-777, the Commission issued an Order approving the Petition of Xcel Energy for Approval of the Acquisition of Wind Generation from the Company's 2016-2030 Integrated Resource Plan, which included the build and transfer of the Project to NSP. In that Order, the Commission also ruled that:

> The Commission also concurs that the four Minnesota projects (Blazing Star I and II, Freeborn, and Lake Benton) are exempt from the certificate of need process under Minn. Stat. § 216B.2422, subd. 5, because they were selected in a bidding process approved by the Commission.

Thus, Lake Benton Wind II does not require a certificate of need.

3.0 STATE POLICY

Pursuant to Minnesota Statutes § 216F.03, the Lake Benton Wind II Project is designed to further the state policy of siting a project in an orderly manner compatible with environmental preservation, sustainable development and the efficient use of resources. For example, the Project is designed to maximize the wind resource development, while minimizing impact on land resources and the environment. As required, the Application addresses the Site Permit criteria set forth in Minnesota Statutes § 216E.03, subd. 7 and Minnesota Rules Chapter 7854. Therefore, sufficient project design, wind resource, and technical information are provided herein for a thorough evaluation of the reasonableness of the proposed site and Project.

To facilitate the review of this Application, it has been organized and prepared following the *Minnesota Department of Commerce, Energy Facility Permitting Application Guidance for Site Permitting of Large Wind Energy Conversion Systems in Minnesota* (DOC, 2010).

4.0 PROJECT DESCRIPTION

4.1 Project Description and Location

The Project is located in Pipestone County in southwestern Minnesota, immediately southwest of the City of Ruthton and north of the City of Holland, Minnesota. Table 4.1 lists the Township, Range, and Sections in which the Project is located.

Table 4.1: Project Location

County Name	Township Name	Township	Range	Sections
Pipestone	Fountain Prairie	108	45	1,2, 11-14, 24
Pipestone	Aetna	108	44	5-9, 16-22, 26-36
Pipestone	Rock	107	44	1-4, 10-15

4.2 Size of the Project Area in Acres

Lake Benton Wind II plans to site the Project equipment and facilities within the Project Area as shown on **Map 1 (Project Location)**. The estimated size of the Project Area is 25,597 acres (10,359 hectares) (approximately 40.0 square miles or 104 square kilometers) of mostly agricultural land. The size of the Project Area allows some siting flexibility in the event turbine locations currently identified prove to be unsuitable and provides sufficient room for the required setbacks and buffering of sensitive features. The siting of the turbines, collector substations, collector lines, meteorological towers, and O&M facility will be within the Project Area.

The Project Area contains the existing Lake Benton II Project consisting of 137 Zond 0.75 MW turbines, which will be decommissioned just prior to the proposed construction of the Project. Also, there are turbines associated with several other wind energy projects, which are not associated with NEER or the Applicant, located within the Project Area.

4.3 Related Capacity

The rated capacity of the Project is up to 100.2 MWs.

The Lake Benton Wind II turbines will be grouped into three or four clusters of underground electrical collector cables into three or four existing 34.5kV POI substations owned by NSP (Delta, Echo, Foxtrot, and Golf). Specifically, the Project will either use all four POIs or the following three (Delta, Echo, and Golf), which will be determined upon acceptance/rejection by Midcontinent Independent Transmission System Operator (MISO) of the revised total MW

allocations to three stations rather than four. All attached maps that include collector circuits have been produced to show the use of 3 or all 4 POIs. Each of the POI collection substations contains protection relaying, metering, circuit breakers, and manual disconnects. These POI stations currently exist at the below addresses and will maintain their original boundaries; however, certain areas of fence may need to be temporarily removed to accommodate construction activities within the stations.

Delta
2299 150th Avenue
Ruthton, MN 56170

Echo
2164 150th Avenue
Ruthton, MN 56170

Foxtrot
1645 201st Street
Ruthton, MN 56170

Golf
1703 180th Avenue
Holland, MN 56139

Given the 34.5kV voltage level of the collector lines and POIs, Lake Benton Wind II is not required to submit a separate Transmission Route Permit application for a generation tie line.

4.4 Number of Turbine Sites

The Project's total capacity of 100.2 MW will be generated using 39 GE 2.3-116 wind turbines and 5 GE 2.1-116 wind turbines. The current turbine layout includes 44 primary turbines required for the Project with four alternative turbine locations identified. A maximum of 44 turbines are proposed for construction, with the inclusion of alternative locations to provide for flexibility in the event development or constructability issues are encountered. The current wind turbine array is set forth on **Map 2 (Four POI Project Area and Facilities)** and **Map 2a (Three POI Project Area and Facilities)**.

4.5 Meteorological Towers

The Project will include installation of up to two permanent MET towers. Consistent with Commission requirements, the MET towers will be no closer than 250 feet (76 meters) from the edge of road rights-of-way. The MET towers will be permanent and will remain for the duration of the Project's operations. Permanent MET towers will be free standing, made of galvanized steel with medium intensity dual LED day and night lights as required by the FAA, and will have

the capability to have acoustic recording equipment installed on them. Additional information on the permanent MET towers is provided in Section 6.3.2.

4.6 Percent of Wind Rights Secured

As of the date of this filing, the Project has land control agreements with landowners for approximately 9,600 acres (3,885 hectares) and approximately 38% of the land within the Project boundary. The Applicant continues to engage with landowners and expects to have sufficient land control to support this 100.2 MW Project.

5.0 PROJECT DESIGN

5.1 Description of Project Layout

The Project optimizes the wind resource while minimizing impacts to land use and the environment. The Project is sited in locations where landowners are willing to provide Lake Benton Wind II with wind rights. Many factors influence the best placement of project infrastructure including site topography, natural resources, cultural resources, land constraints, proximity to residences, turbine technology, engineering, landowner preferences, and siting criteria (including the setback requirements set forth in Table 5.1). Use of the access roads associated with the existing Lake Benton II project that is to be decommissioned is accounted for in the design of the Project. Some existing access roads will remain in place and will be reused for the purposes of the Project. At this time, while over 99% of the micrositing process for turbine placement has been completed, the precise turbine placement and project layouts have not been finalized and are subject to adjustment based upon pre-construction activities including, but not limited to geotechnical and environmental surveys, land acquisition, micrositing and field constructability reviews, and the identification and avoidance of siting constraints.

Preliminary site layouts are shown on **Map 3 (Turbine Layout and Constraints)**. The Project layout adheres to the wind energy conversion facility siting criteria outlined in the Commission's *Order Establishing General Wind Permit Standards*, Docket No. E, G999/M-07-1102 (MPUC, 2008) applicable regulations or agency guidance, and NEER's internal setback standards and avoidance of sensitive features. Table 5.1 summarizes the Commission's setback standards applicable to the Project, based on the 2007 standards as well as accounting for setbacks required in recent site permit conditions. The Project is designed to meet the setback standards summarized in Table 5.1. For example, consistent with the 3 rotor diameter by 5 rotor diameter LWECS setback requirement (*i.e.*, 3 RD X 5RD setback), properties not participating in the Project will have turbines set back from their property in non-prevailing wind directions by at least 1,147 feet (350 meters or 3 RD) and by at least 1,911 feet (583 meters or 5 RD) in the prevailing wind directions for both the GE 2.3 MW turbine model and the GE 2.1 MW turbine model.

Remnant grassland habitats, wetlands, streams, sites of biodiversity significance, and other sensitive features are present within the Project Area. As discussed in Section 8 of this Application, siting of project infrastructure largely avoids sensitive environmental features.

Table 5.1: Wind Turbine Setback Requirements

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Related to Setback Condition

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Related to Setback Condition
WIND ACCESS BUFFER –	Wind turbine towers shall not be placed less than five (5) rotor diameters (RD) on prevailing wind directions and three (3) RD on non-prevailing wind directions from the perimeter of the lands where the Permittee does not hold the wind rights, without the approval of the Commission. This section does not apply to public roads and trails.	
INTERNAL SPACING	The turbine towers shall be constructed within the site boundary as approved by the Commission. The turbine towers shall be spaced no closer than three (3) RD in non-prevailing wind directions and five (5) RD on prevailing wind directions. If required during final micrositing of the turbine towers to account for topographic conditions, up to 20 percent of the towers may be sited closer than the above spacing but the Permittee shall minimize the need to site the turbine towers closer.	
NOISE	Greater of 1000 feet (305 meters) for participating residents and for non-participating residents or Compliance with noise standards established as of the date of this permit by the Minnesota Pollution Control Agency (MPCA) at all times at all appropriate locations. The noise standards are found in Minnesota Rules chapter 7030. https://www.revisor.mn.gov/rules/?id=7030.0030 https://www.revisor.mn.gov/rules/?id=7030.0040 Turbine operation shall be modified or turbines shall be removed from service if necessary to comply with these noise standards. The Permittee or its contractor may install and operate turbines, as close as the minimum setback required in this permit, but in all cases shall comply with MPCA noise standards. The Permittee shall be required to comply with this condition with respect to all residences or other receptors in place as of the time of construction, but not with respect to such receptors built after construction of the towers.	A greater than 1,000 foot (305 meter) setback is necessary in certain cases to minimize noise and shadow flicker concerns.
ROADS	Wind turbine and MET towers shall not be located closer than 250 feet (76 meters) from the edge of the nearest public road (ROW) right-of-way.	
PUBLIC LANDS	Wind turbines and associated facilities including foundations, access roads, underground cable, and transformers, shall not be located in public lands, including Waterfowl Production Areas, Wildlife Management Areas, Scientific and Natural Areas, or in county parks, and wind turbine towers shall also comply with the	

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Related to Setback Condition
	setbacks of WIND BUFFER ACCESS.	
PUBLIC WATER WETLANDS	Wind turbines and associated facilities including foundations, access roads, underground cable, and transformers, shall not be placed in public waters wetlands, as defined in Minnesota Statutes section 103G.005, subdivision 15a, except that electric collector or feeder lines may cross or be placed in public waters or public waters wetlands subject to permits and approvals by the MNDNR, the United States Army Corps of Engineers (USACE), and local units of government as implementers of the Minnesota Wetland Conservation Act.	
METEOROLOGICAL TOWERS	Permanent towers for meteorological equipment shall be free standing. Permanent meteorological towers shall not be placed less than 250 feet (76 meters) from the edge of the nearest public road ROW and from the boundary of the Permittee's site control, or in compliance with the county ordinance regulating meteorological towers in the county the tower is built, whichever is more restrictive. Meteorological towers shall be placed on property the Permittee holds the wind or other development rights. Meteorological towers shall be marked as required by the FAA. There shall be no lights on the meteorological towers other than what is required by the FAA. This restriction shall not apply to infrared heating devices used to protect the wind monitoring equipment.	
AVIATION	The Permittee shall not place wind turbines or associated facilities in a location that could create an obstruction to navigable airspace of public and licensed private airports (as defined in Minnesota Rule 8800.0100, subparts 24a and 24b) in Minnesota, adjacent states, or provinces. https://www.revisor.mn.gov/rules/?id=8800.0100 The Permittee shall apply the minimum obstruction clearance for licensed private airports pursuant to Minnesota Rule 8800.1900, subpart 5. Setbacks or other limitations shall be followed in accordance with the Minnesota Department of Transportation (MnDOT), Department of Aviation, and FAA. The Permittee shall notify owners of all known airports within six (6) miles (10 kilometers) of the Project prior to construction. https://www.revisor.mn.gov/rules/?id=8800.1900	
FOOTPRINT MINIMIZATION	The Permittee shall design and construct the LWECS so as to minimize the amount of land that is impacted by the LWECS. Associated facilities in the vicinity of turbines such as electrical/electronic boxes, transformers, and monitoring systems shall, to the greatest extent feasible, be mounted on the foundations used for turbine towers or inside the towers unless otherwise negotiated with the affected landowner(s).	

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Related to Setback Condition
COMMUNICATION CABLES	The Permittee shall place all supervisory control and data acquisition (SCADA) communication cables underground and within or adjacent to the land necessary for turbine access roads unless otherwise negotiated with the affected landowner(s).	
ELECTRICAL COLLECTOR AND FEEDER LINES	Collector lines that carry electrical power from each individual transformer associated with a wind turbine to an internal project interconnection point shall be buried underground. Collector lines shall be placed within or adjacent to the land necessary for turbine access roads unless otherwise negotiated with the affected landowner(s). Feeder lines that carry power from an internal project interconnection point to the Project substation or interconnection point on the electrical grid may be overhead or underground. Feeder line locations shall be negotiated with the affected landowner(s). Any feeder lines that parallel public roads shall be placed within the public ROW or on private land immediately adjacent to public roads. If feeder lines are located within public ROW, the Permittee shall obtain approval from the governmental unit responsible for the affected ROW. Collector and feeder line locations shall be located in such a manner to minimize interference with agricultural operations, including, but not limited to, existing drainage patterns, drain tile, future tiling plans, and ditches. Safety shields shall be placed on all guy wires associated with overhead feeder lines. The Permittee shall submit the engineering drawings of all collector and feeder lines in the site plan. The Permittee must fulfill, comply with, and satisfy all Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards applicable to this Project, including but not limited to, IEEE 776 [Recommended Practice for Inductive Coordination of Electric Supply and Communication Lines], IEEE 519 [Harmonic Specifications], IEEE 367 [Recommended Practice for Determining the Electric Power Station Ground Potential Rise and Induced Voltage from a Power Fault], and IEEE 820 [Standard Telephone Loop Performance Characteristics] provided the telephone service provider(s) have complied with any obligations imposed on it pursuant to these standards. Upon request by the Commission, the Permittee shall report to the Commission on compliance with these standards	

5.2 Description of Turbines and Towers

The Project will use 39 GE 2.3 wind turbines with 116.5-meter (382.2-foot) blade diameters and 90-meter (295-foot) hub height towers and 5 GE 2.1 wind turbines with 116.5-meter (382.2-foot) blade diameters and 80-meter (263-foot) hub height towers. The turbine characteristics for these

turbine models are summarized in Table 5.2. The selected turbines are each three-bladed, active yaw, and active aerodynamic control regulated wind turbine generators with generator/converter torque control capabilities (GE Renewable Energy 2017). The rotors utilize blade pitch regulation and other technologies to achieve optimum power output under various site conditions and wind speeds. Nine turbines will utilize LNTE serrations on the turbine blades to reduce sound impacts. LNTE serrations will be the same color as the turbine blades and will cover approximately 20-30% of the trailing edge of the outboard blade length.

Table 5.2: Wind Turbine Characteristics

Design Features	GE 2.3 Wind Turbine	GE 2.1 Wind Turbine
Nameplate Capacity	2.3MW	2.1MW
Hub Height	90 (m) (295 ft.)	80 (m) (263 ft.)
Rotor Swept Area	10,660 (sq. m) (114,743 sq. ft.)	10,660 (sq. m) (114,743 sq. ft.)
Total Height	148.3 (m) (486.6 ft.)	138.3 (m) (453.7 ft.)
Rotor Diameter	116.5 (m) (382.2 ft.)	116.5 (m) (382.2 ft.)
Cut in Wind Speed	3 m/s (10 ft./s)	3 m/s (10 ft./s)
IEC Wind Class	IIS	IIS
Cut Out Wind Speed	32 m/s (105 ft./s)	25 m/s (82 ft./s)
Rotor Speed	8-15.7 RPM	8-15.7 RPM
Tip Speed	191 MPH (307 km/hr)	191 MPH (307 km/hr)
Sound at Turbine	107.5 dBA	107.5 dBA
Power Regulation	Blade pitch controls power. Controls included for ZVRT and enhanced reactive power (0.9 power factor)	Blade pitch controls power. Controls included for ZVRT and enhanced reactive power (0.9 power factor)
Generation	2.3MW per turbine	2.1MW per turbine

Design Features	GE 2.3 Wind Turbine	GE 2.1 Wind Turbine
Tower	Multi-coated, conical tubular steel with safety ladder to the nacelle. Rest platforms each section.	Multi-coated, conical tubular steel with safety ladder to the nacelle. Rest platforms each section.
Supervisory Control and Data Acquisition	Each turbine equipped with SCADA controller hardware, software and database storage capability	Each turbine equipped with SCADA controller hardware, software and database storage capability
FAA Lighting	Yes, per FAA permitting	Yes, per FAA permitting
Foundation	Per Manufacturer specifications - Spread Foot or pier foundation-TBD	Per Manufacturer specifications -Spread Foot or pier foundation-TBD

Source: GE manufacturer specifications (GE Renewable Energy 2017).

Each turbine is comprised of a foundation, tower, nacelle, hub, and three blades (GE Renewable Energy 2017). The turbine towers are comprised of tapered steel cylinders consisting typically of three to four sections joined together via factory fabricated welds which are automatically controlled and ultrasonically inspected during manufacturing per American National Standards Institute (ANSI) specifications. Wind turbine surfaces are coated for protection against corrosion in generally non-glare white, off white, or gray. Each turbine can be accessed through a lockable steel door at the base of the tower, through which the nacelle and turbine blades can be accessed. Inside each tower, platforms are accessible via ladder or lift which are equipped with fall arresting safety systems.

Each turbine tower includes a control panel housing electronic and communication equipment. Each nacelle includes a wind speed and direction sensor that supports signaling when winds are sufficient for turbine operation. Each turbine is equipped with variable-speed control and independent blade pitch to enhance efficiency. An automated SCADA system located at the project substation provides local and remote supervision and control of turbine equipment and performance.

5.3 Description of Electrical System

Construction of the project will include 44 wind turbines, each with its own step-up transformer pad-mounted outside at the base of unit (stepping up to 34.5kV). Energy from the turbines will be routed through an underground electrical collection system that will deliver power to three or four of the existing POI stations (Delta, Echo, Foxtrot, and Golf) where it is delivered at 34.5kV to conductors owned and operated by NSP. See Section 6.1 and 6.2 for a more detailed

description of the proposed electrical system. The Project will have its electrical system designed under contract by a professional, experienced and qualified electrical system design firm. The entire collection system will be designed to meet NESC, NEC, ANSI, NEMA, and OSHA standards. The design work includes a load flow analysis for the Project to ensure the facility will meet the power factor and voltage control specifications. A coordination study will determine the appropriate protective relay settings for optimum protection and selectivity for the Project's electrical system. Preliminary electric collection layouts for both the use of a four or three POI are provided on **Map 2 (Four POI Project Area and Facilities)** and **Map 2a (Three POI Project Area and Facilities),** respectively.

5.3.1 Transformers

Power from the turbines is fed through a breaker panel at the turbine's base inside the tower and is interconnected to a pad-mounted step-up transformer, which steps the voltage up from 690 volt (V) to 34.5 kV. The transformer impedance will be optimized based on the facility power output requirements and feeder circuit-breaker interrupting ratings and internal fuses. Protection for the transformer and wind turbine is provided by a switch breaker at the turbine bus cabinet electrical panel, inside the tower. The pad-mounted transformers are interconnected on the 34.5 kV voltage side to underground cables to form an electrical collection system.

5.3.2 Electrical Collection System

The Project will utilize 34.5 kV electrical power lines to collect power from the turbines and transmit it to the Lake Benton II collector substation. The entire collection system will be direct buried underground cable. The underground cables are installed in a trench that is approximately three to four feet deep. Underground paths will typically take the shortest path to create less impact to the surrounding areas. Based on preliminary soil resistivity results within the Project Area, it is anticipated that native soil will be used as backfill material.

5.3.3 Collector Substation and Interconnection

The Project will interconnect into the existing 34.5kV POI collection substations owned by NSP (Delta, Echo, Foxtrot, and Golf).

6.0 DESCRIPTION AND LOCATION OF ASSOCIATED FACILITIES

Maps 2 and **2a** show the proposed locations of wind turbines, underground collection lines, crane walk paths, access roads, MET towers, the O&M facility, and other associated facilities.

6.1 Transmission and Project Substations

The Project turbines will be grouped into up to four underground collection circuits connecting into up to four existing 34.5kV POI collection substations owned by NSP (Delta, Echo, Foxtrot, and Golf). Each POI collection substation contains protection relaying, metering, circuit breakers, and manual disconnects within a fenced enclosure. The POI collection substations will maintain their original boundaries; however, minor modifications to these existing substations will be made to accommodate the Project. These modifications include breaker replacements, replacement/relocation of metering equipment, and the replacement of the existing control houses. No new transmission lines or substations are proposed for the Project.

6.2 Collector Lines and Feeder Lines

Power generated from each turbine will be fed down the turbine tower from the generator through the power conditioning equipment and breaker panel. The generator voltage will then be stepped up to the collector system voltage of 34.5 kV by means of a pad-mounted step-up transformer located outside the base of each tower. The power from each turbine will then be routed to up to four POI stations through the underground collection lines. Approximately 27 miles (44 kilometers) of underground collection line will be installed. The underground collection line cable installation will be trenched direct-buried and will include both a warning tape and tracer cable that will provide attention to the cables should any digging occur near the cables following their installation. **Map 2** and **2a** shows the preliminary design of the underground collection lines.

The power from the Delta and Echo POIs will be routed to the existing Buffalo Ridge Substation which is owned by Xcel Energy. The power from the Foxtrot and Golf POIs can be routed to either the existing Buffalo Ridge Substation or the existing Chanarambie Substation owned by Xcel Energy. Foxtrot and Golf POIs have a manual switch between them that allows the power to flow to either substation. In all cases, the power from the four POIs is transmitted via existing overhead 34.5 kV distribution lines.

6.3 Other Associated Facilities

6.3.1 O&M Facility

An O&M facility will be constructed within the Project Area to serve as a center for the Project's O&M efforts, provide Project access and storage, and house the SCADA system. The O&M

facility will be used by the operations staff for facility maintenance and operation. It provides office space for the crews, as well as a shop/storage area for spare parts and vehicles. It will also house the central monitoring equipment for the generating facility where the turbines are monitored and controlled. The footprint of the facility will be up to 5 acres (2 hectares) and will include a parking lot and O&M building. The O&M building will be approximately 7,500 square feet (697 square meters) and will house Project equipment. There will also be a parking lot adjacent to the building. A building permit will be obtained from Pipestone County for the O&M facility.

6.3.2 Permanent Meteorological Tower

Lake Benton Wind II proposes to construct up to two (2) MET towers that will remain operational for the duration of the Project's operations. The expected locations of the two (2) permanent meteorological towers are shown on **Map 2** and **Map 2a.** The precise location of MET towers in the Project Area have yet to be determined and will be based upon the final locations of the wind turbines and for proper operation of wind assessment equipment. All towers will be no closer than 250 feet (76 meters) from the edge of road ROW and from the boundaries of Lake Benton Wind II's site control. Consistent with the typical Commission site permit requirements, the permanent met towers will be free-standing and will not use guy wires. The MET towers will be approximately 295 feet tall (90 meters).

The MET towers will contain instruments such as anemometers, data loggers, wind direction sensors, temperature probes that can be configured at various elevations, and a communication system for providing remote reporting of the data being collected. The temporary area required to construct the meteorological towers is expected to be approximately 400 by 400 feet (122 by 122 meters) and includes equipment storage, material lay down, and construction staging. The permanently impacted area of the MET tower, once installed, will be less than 0.1 acre (0.04 hectares) since they will be self-supporting monopole structures.

FAA Determinations of No Hazard will be obtained for each tower location prior to installation and each location will have appropriate lighting and marking as required by FAA.

6.3.3 Turbine Access Roads, Temporary Laydown/Staging Areas, and Other Associated Facilities

Each turbine will have a low-profile, gravel access road that will connect the turbine from the public road network or private access roads to the turbine location. In some cases, existing access roads that are in place from the existing Lake Benton II project will be re-used as access roads for the proposed Project. These existing access roads may be widened or re-surfaced as appropriate. All access road networks for the project will be designed to serve the Project in an

efficient manner, with the needs of landowners and comments from local authorities considered. The roads will be all-weather gravel construction and approximately 16 feet (5 meters) wide once the wind project is operational. The approximate length of permanent access roads to be installed is 13 miles (21 kilometers) with final length determined by final layout.

During construction, temporary access roadways will be prepared to facilitate crane movement and equipment delivery during construction. These temporary access roadways will be constructed to a width of up to 40 feet (12 meters). Drainage culverts will be installed as appropriate.

The Project will also require grading of a primary temporary laydown area of approximately 10 acres (4 hectares). The temporary laydown area will serve as a location for: (i) parking during construction; (ii) situating office trailers; and (iii) situating a storage and staging area for materials and equipment during construction. The temporary laydown area will be located in cropland or pastureland where land use rights have been acquired and environmental surveys have been conducted.

Additionally, a concrete batch plant may be temporarily established at the laydown area or O&M building, if necessary, to provide concrete production during construction.

6.4 Associated Facilities Permitting

Following the issuance of the LWECS Site Permit from the Commission, Lake Benton Wind II will be responsible for obtaining all other applicable permits, approvals, and licenses associated with the construction of the Project. Table 11 provides a summary of the permits and approvals that may be required.

7.0 WIND RIGHTS

Lake Benton has substantially completed securing landowner agreements for wind rights and property easements necessary to support the Project. The overall area within the project boundary consists of approximately 25,597 acres (approximately 10,359 hectares). The Project has executed and recorded landowner agreements for 9,600 acres (3,885 hectares) of private land within the Project Area which is roughly 37.5 % of the land within the overall project boundary. Current participating and non-participating parcels and landowners are shown on **Map 4 (Parcel Land Status).** The secured easement agreements will ensure access for construction and operation of the Project and identifies landowner and Lake Benton's obligations and responsibilities during the implementation and operation of the wind project. Project facilities have been sited on leased land, and the current leasehold is sufficient to accommodate the proposed 100.2 MW project in compliance with the setback requirements identified in Table 5.1, above.

8.0 ENVIRONMENTAL IMPACTS

In accordance with Minnesota Rule 7854.0500, Subp. 7, Section 8 provides an analysis of the potential impacts of the Project, proposed mitigation measures, and any adverse environmental effects that cannot be avoided. The Applicant has consulted with various entities, including MNDNR, USFWS, USACE, the Minnesota Board of Water, the Soil Resources Local Government Unit Pipestone County Soil and Water Conservation District, Pipestone County.

Coordination with MNDNR and USFWS included the receipt of an initial MNDNR Natural Heritage Review letter, an in-person kickoff meeting, and on-going coordination throughout project development. Per MNDNR's request, a second Natural Heritage Review will be requested following development and refinement the complete infrastructure layout. Further, the Applicant has coordinated with the USACE and Pipestone County Soil and Water Conservation District through in-person meetings. A more detailed list of agencies and entities contacted and coordinated with is set forth in **Appendix A (Agencies Contacted Regarding Project)** and the correspondence received from the agencies is included in **Appendix B (Agency Correspondence and Responses)**.

8.1 Demographics

The Project is located in southwestern Minnesota in an agricultural/rural region within Pipestone County. The 2010 census population for Pipestone County was 9,596 (U.S. Census Bureau 2010), while the U.S. Census 2015 American Community Survey (ACS) population estimate for Pipestone County was 9,354, representing a population decrease of approximately 2.5% (U.S. Census Bureau 2015). The county seat of Pipestone County is the city of Pipestone, located approximately nine miles southwest of the Project Area.

Table 8.1 shows the U.S. Census Bureau 2011-2015 ACS demographic profile data for the state of Minnesota, Pipestone County, and townships within the Project Area including: Fountain Prairie, Aetna, Rock, and Grange (U.S. Census Bureau 2015). The demographic profile summarizes some of the population and economic characteristics of Minnesota, Pipestone County, and the townships in which the project is located.

Table 8.1: Population and Economic Characteristics

Location	Population	Housing Units (Occupied)	Per Capita Income	Families Below Poverty Line (%)
Minnesota	5,419,171	2,124,745	$32,157	7.3%
Pipestone County	9,354	3,980	$26,842	9.2%
Fountain Prairie Township	168	60	$32,802	12%
Aetna Township	177	66	$29,765	1.9%

Location	Population	Housing Units (Occupied)	Per Capita Income	Families Below Poverty Line (%)
Rock Township	155	68	$49,188	0.0%
Grange Township	195	79	$34,874	1.5%

U.S. Census Bureau, 2011-2015 American Community Survey 5-Year Estimates

According to the ACS 2011-2015 estimates, educational services, health care, and social assistance accounted for 24.7% of jobs statewide in Minnesota, followed by manufacturing at 13.5% and retail trade at 11.2% (U.S. Census Bureau 2015). According to the ACS 2011-2015 estimates, educational services, health care and social assistance accounted for 22.3% of jobs in Pipestone County, followed by retail trade at 12.8% and agriculture, forestry, fishing and hunting at 11.8% (U.S. Census Bureau 2015).

8.1.1 Potential Impacts

The Project is not anticipated to significantly change the demographics of the Project Area or Pipestone County.

8.1.2 Mitigation Measures

No mitigation measures are proposed as the Project is not expected to impact the demographics of the local community.

8.2 Land Use

8.2.1 Local Zoning and Comprehensive Plans

Local municipalities develop comprehensive plans as community planning tools to guide the future and direction of land use and development within a county or municipality. Comprehensive plans generally include goals and objectives regarding current and future land use, demographics, housing trends, economic development, and natural resources. In preparing this Application, Lake Benton Wind II has reviewed Pipestone County's most recently adopted comprehensive plan, which includes land use planning for the cities and townships within and adjacent to the proposed Project Area. Table 8.2.1 provides an inventory of governing bodies within and adjacent to the Project Area, along with their respective comprehensive plans, if available.

Table 8.2.1: Comprehensive Plan Inventory for Local Governments

Governing Body	Name of Plan	Year Adopted	Associated Development Plan(s)
Pipestone County	Pipestone County Comprehensive Plan *Including the County's Water Plan*	2004	Pipestone County Zoning Ordinance Adopted December 13, 2005 Amended June 8, 2010, February 12, 2013, December 9, 2015, July 26, 2016, June 13 2017, and October 24, 2017.
City of Ruthton	None Adopted*	NA	2004 Pipestone County Comprehensive Plan *Including the County's Water Plan*
City of Holland	None Adopted*	NA	2004 Pipestone County Comprehensive Plan *Including the County's Water Plan*
Aetna Township	None Adopted*	NA	2004 Pipestone County Comprehensive Plan *Including the County's Water Plan*
Fountain Prairie Township	None Adopted*	NA	2004 Pipestone County Comprehensive Plan *Including the County's Water Plan*

Governing Body	Name of Plan	Year Adopted	Associated Development Plan(s)
Grange Township	None Adopted*	NA	2004 Pipestone County Comprehensive Plan *Including the County's Water Plan*
Rock Township	None Adopted*	NA	2004 Pipestone County Comprehensive Plan *Including the County's Water Plan*

**Government body is included in the 2004 Pipestone County Comprehensive Plan Including the County's Water Plan.*

Pipestone County's Comprehensive Plan (including the County's Water Plan) (Pipestone County et al. 2015) serves as a land use planning tool with the intent to guide the direction of community future growth. It includes an overview of existing county-wide land use, cities, and townships as well as future land use, population and housing trends, economic development, and environmental characteristics. It also includes two appendices with detailed Census Profiles from the year 2000 and Wellhead Protection Areas.

The overall vision or focus of the Comprehensive Plan is a continued high quality of life for all residents with long term goals of promoting citizen participation, public awareness, and intergovernmental and agency cooperation. The Plan provides context for creating sustainable economic development strategies; protecting and preserving the area's natural, scenic, historic, and agricultural resources; maintaining an adequate supply of affordable housing; establishing community-based land use processes to help shape good land use decisions; maintaining a balanced mix of transportation options; and supporting research and providing information on the County's fiscal, environmental, and social issues (Pipestone County et al. 2015).

Lake Benton Wind II believes the Project is consistent with Pipestone County's Comprehensive Plan's goals to conserve farmland and natural resources, support economic and sustainable development, and provide a positive benefit to its citizens. Lake Benton Wind II also believes the proposed Project will be compatible with the rural, agricultural character of the county.

8.2.2 County or Local Ordinances

Under Minnesota Statute Section 216F.081, "The commission, in considering a permit application for LWECS in a county that has adopted more stringent standards, shall consider and apply those more stringent standards, unless the commission finds good cause not to apply the

standards." Pipestone County's Ordinance Section 5-10: Wind Energy Conversion Systems, subsection E related to setbacks is not intended to apply to the Project per Minnesota Statute Section 216F.081. As set forth in Pipestone County's Ordinance Section 5-10, subsection A, the application of Section 5-10, including subsection E, is limited to:

> . . . Wind Energy Conversion Systems (WECS) with a rated capacity of less than 25,000 kilowatts (kW) or 25 megawatts (MW), and to regulate the installation and operation of WECS not otherwise subject to siting and oversight by the State of Minnesota pursuant to Minnesota Statutes, Chapter 216F, Wind Energy Conversion Systems, as amended.

Thus, since the Project is subject to siting and oversight by the Commission pursuant to Minnesota Statues, Chapter 216F, the entirety of Ordinance Section 5-10 does not apply to the Project. Therefore, the setbacks in Section 5-10, subsection E should not be considered by the Commission as more stringent standards under Minnesota Statute Section 216F.081. Should the Commission nevertheless determine that it must consider the County's standards under Minnesota Statute Section 216F.081, Pipestone County has provided a letter on January 9, 2018 indicating that the County supports a finding that there is good cause not to apply the County's standards to the Project. See **Appendix B** for a copy of the letter from Pipestone County. Specifically, the letter from Pipestone County stated: "Should the Commission nevertheless determine that it must consider the County's standards under Minnesota Statute Section 216F.081, the County supports a finding that there is good cause not to apply the County's specific standards as stated."

The following table provides a comparison of the Pipestone County setbacks to the Commission's setbacks.

Table 8.2.2 Comparison of Local Government and Commission Setbacks

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Pipestone County (Section 5-10, Subsections E, F and G) Wind Turbine	Pipestone County (Section 5-10, Subsections E, F and G) Met Tower
WIND ACCESS BUFFER	Wind turbine towers shall not be placed less than five (5) RD on prevailing wind directions and three (3) RD on non-prevailing wind directions from the perimeter of the lands where the Permittee does not hold the wind rights, without the approval of the Commission. This section does not apply to public roads and trails.	3 RD on east-west axis and 5 RD on north-south axis	The fall zone, as certified by a professional engineer + 10 feet (3 meters) or 1.1 times the total height, Minimum 250 feet (76 meters)
NOISE	Greater of 1000 feet (305 meters) for participating residents and non-participating residents or Compliance with noise standards established as of the date of this permit by the MPCA at all times at all appropriate locations. The noise standards are found in Minnesota Rules chapter 7030. https://www.revisor.mn.gov/rules/?id=7030.0030 https://www.revisor.mn.gov/rules/?id=7030.0040 Turbine operation shall be modified or turbines shall be removed from service if necessary to comply with these noise standards. The Permittee or its contractor may install and operate turbines, as close as the minimum setback required in this permit, but in all cases shall comply with MPCA noise standards. The Permittee shall be required to comply with this condition with respect to all homes or other receptors in place as of the time of construction, but not with respect to such receptors built after construction of the towers.	All WECS shall comply with Minnesota Rules 7030	
ROADS[2]	Wind turbine and meteorological towers shall not be located closer than 250 feet (76 meters) from the edge of the nearest public road ROW.	1.1 times the height, may be reduced for minimum maintenance roads or a road with an Average Daily Traffic Count of less than 10.	The fall zone, as certified by a professional engineer + 10 feet (3 meters) or 1.1 times the total height. Minimum 250 feet (76 meters).
PUBLIC LANDS	Wind turbines and associated facilities including foundations, access roads, underground cable, and transformers, shall not be located in public lands, including Waterfowl Production Areas, Wildlife Management Areas, Scientific and Natural Areas, or in county parks, and wind turbine towers shall also comply with the setbacks of WIND BUFFER ACCESS REQUIREMENT.	3 RD on east-west axis and 5 RD on north-south axis.	600 feet (183 meters)

[2] Pipestone County requires the setback shall be measured from future rights-of-way if a planned changed or expanded ROW is known.

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Pipestone County (Section 5-10, Subsections E, F and G) Wind Turbine	Pipestone County (Section 5-10, Subsections E, F and G) Met Tower
WETLANDS	Wind turbines and associated facilities including foundations, access roads, underground cable, and transformers, shall not be placed in public waters wetlands, as defined in Minnesota Statutes section 103G.005, subdivision 15a, except that electric collector or feeder lines may cross or be placed in public waters or public waters wetlands subject to permits and approvals by the MNDNR, USACE, and local units of government as implementers of the Minnesota Wetland Conservation Act.	3 RD on east-west axis and 5 RD on north-south axis.	600 feet (182 meters)
TURBINE SPACING	The turbine towers shall be constructed within the site boundary as shown in the official site maps. The turbine towers shall be spaced no closer than three rotor diameters in the non-prevailing wind directions and five rotor diameters on the prevailing wind directions. If required during final micrositing of the turbine towers to account for topographic conditions, up to 20 percent of the towers may be sited closer than the above spacing but the Permittee shall minimize the need to site the turbine towers closer.	3 RD on east-west axis and 5 RD on north-south axis.	N/A
METEOROLOGICAL TOWERS	Permanent towers for meteorological equipment shall be free standing. Permanent meteorological towers shall not be placed less than 250 feet (76 meters) from the edge of the nearest public road ROW and from the boundary of the Permittee's site control, or in compliance with the county ordinance regulating meteorological towers in the county the tower is built, whichever is more restrictive. Meteorological towers shall be placed on property the Permittee holds the wind or other development rights. Meteorological towers shall be marked as required by the FAA. There shall be no lights on the meteorological towers other than what is required by the FAA. This restriction shall not apply to infrared heating devices used to protect the wind monitoring equipment. (All meteorological towers shall be fitted with the necessary equipment to install or attach acoustic recording devices to monitor wildlife activity.)		The fall zone, as certified by a professional engineer +10 feet (3 meters) or 1.1 times the total height, Minimum 250 feet (76 meters).

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Pipestone County (Section 5-10, Subsections E, F and G) Wind Turbine	Pipestone County (Section 5-10, Subsections E, F and G) Met Tower
AVIATION	The Permittee shall not place wind turbines or associated facilities in a location that could create an obstruction to navigable airspace of public and licensed private airports (as defined in Minnesota Rule 8800.0100, subparts 24a and 24b) in Minnesota, adjacent states, or provinces. https://www.revisor.mn.gov/rules/?id=8800.0100 The Permittee shall apply the minimum obstruction clearance for licensed private airports pursuant to Minnesota Rule 8800.1900, subpart 5. Setbacks or other limitations shall be followed in accordance with the MN/DOT, Department of Aviation, and FAA. The Permittee shall notify owners of all known airports within six (6) miles (10 kilometers) of the Project prior to construction. https://www.revisor.mn.gov/rules/?id=8800.1900	No turbines, tower or associated facilities shall be located so as to create an obstruction to navigable airspace of public and private airports in Pipestone County. Setbacks or other limitations determined in accordance with MN/DOT Department of Aviation and FAA requirements.	Same as Pipestone County Wind Turbine setback.
FOOTPRINT MINIMIZATION	The Permittee shall design and construct the LWECS so as to minimize the amount of land that is impacted by the LWECS. Associated facilities in the vicinity of turbines such as electrical/electronic boxes, transformers, and monitoring systems shall, to the greatest extent feasible, be mounted on the foundations used for turbine towers or inside the towers unless otherwise negotiated with the affected landowner(s).		
COMMUNICATION CABLES	The Permittee shall place all SCADA communication cables underground and within or adjacent to the land necessary for turbine access roads unless otherwise negotiated with the affected landowner(s).	All communications equal to or less than 34.5 kV in capacity, installed as part of a WECS shall be buried where reasonably feasible.	

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Pipestone County (Section 5-10, Subsections E, F and G) Wind Turbine	Pipestone County (Section 5-10, Subsections E, F and G) Met Tower
ELECTRICAL COLLECTOR AND FEEDER LINES	Collector lines that carry electrical power from each individual transformer associated with a wind turbine to an internal project interconnection point shall be buried underground. Collector lines shall be placed within or adjacent to the land necessary for turbine access roads unless otherwise negotiated with the affected landowner(s). Feeder lines that carry power from an internal project interconnection point to the Project substation or interconnection point on the electrical grid may be overhead or underground. Feeder line locations shall be negotiated with the affected landowner(s). Any feeder lines that parallel public roads shall be placed within the public ROW or on private land immediately adjacent to public roads. If feeder lines are located within public ROW, the Permittee shall obtain approval from the governmental unit responsible for the affected ROW. Collector and feeder line locations shall be located in such a manner to minimize interference with agricultural operations, including, but not limited to, existing drainage patterns, drain tile, future tiling plans, and ditches. Safety shields shall be placed on all guy wires associated with overhead feeder lines. The Permittee shall submit the engineering drawings of all collector and feeder lines in the site plan. The Permittee must fulfill, comply with, and satisfy all IEEE standards applicable to this Project, including but not limited to, IEEE 776 [Recommended Practice for Inductive Coordination of Electric Supply and Communication Lines], IEEE 519 [Harmonic Specifications], IEEE 367 [Recommended Practice for Determining the Electric Power Station Ground Potential Rise and Induced Voltage from a Power Fault], and IEEE 820 [Standard Telephone Loop Performance Characteristics] provided the telephone service provider(s) have complied with any obligations imposed on it pursuant to these standards. Upon request by the Commission, the Permittee shall report to the Commission on compliance with these standards	All communications and feeder lines, equal to or less than 34.5 kV in capacity, installed as part of a WECS shall be buried where reasonably feasible. Feeder lines installed as part of a WECS shall not be considered an essential service. This standard applies to all feeder lines subject to Pipestone County authority.	
OTHER RIGHTS-OF-WAY (RAILROADS, POWER LINES, ETC)		1.1 times total height.	The fall zone, as certified by a professional engineer + 10 feet (3 meters) or 1.1 times the total height. Minimum 250 feet (76 meters).

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Pipestone County (Section 5-10, Subsections E, F and G) Wind Turbine	Pipestone County (Section 5-10, Subsections E, F and G) Met Tower
NEIGHBORING DWELLINGS[3]		750 feet (229 meters) and/or sufficient distance to meet state noise standards, whichever is greater.	The fall zone, as certified by a professional engineer + 10 feet (3 meters) or 1.1 times the total height. Minimum 250 feet (76 meters).
OTHER EXISTING WECS[4]		3 RD on east-west axis and 5 RD on north-south axis.	N/A
PROPERTY LINES		3 RD on east-west axis and 5 RD on north-south axis.	The fall zone, as certified by a professional engineer + 10 feet (3 meters) or 1.1 times the total height. Minimum 250 feet (76 meters).
BLADES		Rotor blades or airfoils must maintain at least 30 feet (9 meters) of clearance between their lowest point and the ground.	

[3] The setback for dwellings shall be reciprocal in that no dwelling shall be constructed within 750 feet (229 meters) of a commercial wind turbine.
[4] Waived for internal setbacks in multiple turbine projects, including aggregated projects.

Wind Facility and Collector Lines Setback Categories	Setback Conditions as Represented in Recent Site Permits	Pipestone County (Section 5-10, Subsections E, F and G) Wind Turbine	Pipestone County (Section 5-10, Subsections E, F and G) Met Tower
INTERFERENCE	The Permittee shall not operate the project so as to cause microwave, television, radio, telecommunications, or navigation interference in violation of Federal Communications Commission regulations or other law. In the event the project or its operations cause such interference, the Permittee shall take timely measures necessary to correct the problem.	The applicant shall minimize or mitigate interference with electromagnetic communications, such as radio, telephone, microwaves, or television signals cause by any WECS. The applicant shall notify all communication tower operators within five miles of the proposed WECS location upon application to the county for permits. No WECS shall be constructed so as to interfere with County or Minnesota Department of Transportation microwave transmissions.	Same as Pipestone County Wind Turbine.
ELECTRICAL CODES AND STANDARDS	The Project and associated facilities shall be designed to meet or exceed all relevant local and state codes, Institute of Electrical and Electronics Engineers, Inc. standards the National Electric Code, the National Electric Safety Code, and North American Electric Reliability Corporation requirements. The Permittee shall report to the Commission on compliance with these standards upon request.	All WECS and accessory equipment and facilities shall comply with the National Electrical Code and other applicable standards.	Same as Pipestone County Wind Turbine.

8.2.3 Current and Future Zoning

The Pipestone County Zoning Ordinance applies only to unincorporated areas of Pipestone County. Each nearby city (Ruthton and Holland) has its own ordinance, however, the entire Project Area occurs outside of these incorporated areas and all project infrastructure will be sited at least one mile from incorporated areas. Urban expansion areas, depicted on **Map 5 (Zoning Map),** are designated to the north and south of Holland and these expansion areas are outside of the Project Area.

To regulate land use, the Pipestone County Zoning Ordinance establishes nine separate zoning districts. Table 8.2.1.1, below, defines the nine zoning districts and indicates the two of those that fall within the Project Area (the Agricultural District and the Special Protection Shoreland District).

Table 8.2.3 Pipestone County Zoning Districts, Zoning Intent, and Zoning Districts

ZONING DISTRICT	DESCRIPTION OF ZONING INTENT	ZONING DISTRICTS WITHIN LAKE BENTON WIND II PROJECT AREA
Flood Plain District (F)	The intent of this district is to encompass all of the properties within Pipestone County that lie within areas prone to flooding. These areas require special regulations, as they are necessary for the minimum protection of the public health and safety, and of property and improvements from hazards and damage resulting from floodwaters.	
Agriculture District (A)	The purpose of this district is to maintain, conserve and enhance agriculture land within the County. This land has a history of being tilled and used for agricultural purposes. The Agriculture District protects this land from unnecessary urban encroachment.	**X**
Urban Expansion District (A-1)	The primary purpose of this district is to conserve for a period of time, land for farming and other open space land uses located adjacent to or within close proximity of existing incorporated urban centers within Pipestone County. It is the intention of this district to defer urban development in such areas until public utilities and services can be economically and financially reasonable to install. It is also intended that the appropriate planning bodies jointly review the status of all areas within this district once per calendar year. At this time, it shall be determined whether or not any or all of any part of these areas should be transferred to some other appropriate land use.	
Rural Residential District (R-A)	It is the intent of this district to provide suitable areas of low density residential development in areas of existing development which occurs in unincorporated areas and where municipal (sewer and water) utilities or an approved community utility system is available or as substantially relates to the urban development pattern set forth in the Land Use Plan for Pipestone County.	

ZONING DISTRICT	DESCRIPTION OF ZONING INTENT	ZONING DISTRICTS WITHIN LAKE BENTON WIND II PROJECT AREA
Natural Environment Shoreland (NES)	The purpose of this district is to preserve and enhance shoreland areas, retain high quality water standards, protect these areas from pollution, to protect shorelands which are unsuitable for development, to maintain a low density of development, and to maintain high standards of quality for permitted development.	
Special Protection Shoreland District (SP)	The intent of this district is to guide the development and utilization of shorelands of public waters for the preservation of water quality, natural characteristics, economic values, and the general health, safety, and welfare of all public waters in the unincorporated areas of the County. Further, the purpose of this district is to manage areas unsuitable for development due to wet soils, steep slopes, or large areas of exposed bedrock; and to manage areas of unique natural and biological characteristics in accordance with compatible uses.	**X**
Recreation Commercial District (RC)	This district is intended to provide suitable locations for, and to encourage the development of commercial recreation facilities in these areas of the County which benefit the recreational needs of both residents and tourists, will avoid land use conflicts with residential areas, and restrict incompatible commercial and industrial uses.	
Highway Commercial District (HC)	The purpose of this district is to provide a district that allows for a wide range of services and goods in a compact and convenient limited highway-oriented business closely related to existing urban areas or major transportation routes. Such developments are to be developed at standards that will not impair the traffic-carrying capabilities of abutting roads and highways.	
Industry District (I)	The intent of this district is to provide a district that will allow compact, convenient industry adjacent to existing urban areas in the County and will do so at standards that will not impair traffic-carrying capabilities of abutting roads and highways. This district will provide locations for industry that provide both adequate and essential utilities and insure a functional relationship among various types of land use.	

Source: Pipestone County Zoning Ordinance (Pipestone County 2017)

As indicated above, of the nine zoning designations, two occur within the Lake Benton Wind II Project Area: Agricultural District (A) and Special Protection Shoreland District (SP). The SP Districts within the Project Area are associated with Redwood River, North Branch Pipestone

Creek, Rock River, and East Branch Rock River. In order to comply with the Pipestone County Zoning Ordinance, Lake Benton Wind II has sited all turbines within the Agricultural District, avoiding SP locations. If SP locations need to be crossed by the collection system, Lake Benton Wind II will coordinate with Pipestone County to ensure compliance with all zoning regulations and acquire all appropriate permits, if applicable. Refer to **Map 5 (Zoning Map)** for the location of all zoning districts within the Project Area.

Lake Benton Wind II has sited all Project infrastructure at least one mile from incorporated areas and Urban Expansion Districts to minimize potential impacts on future urban growth. The proposed Project will be compatible with the rural, agricultural character of Pipestone County and the goals and policies regarding urban growth set forth in the County's comprehensive plan.

8.2.4 Conservation Easements

A variety of programs exist whereby landowners can sell or donate an easement to state, federal or non-governmental organizations to meet conservation objectives. Some of these programs include the Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Reinvest in Minnesota (RIM) program, Wetlands Reserve Program (WRP) and Permanent Wetland Preserves (PWP) Program. These programs have varying requirements including length of time parcels are protected, annual lease rate, and type of habitat protected.

Review of the Project Area identified five CREP easements and two PWP easements (Minnesota Board of Water and Soil Resources 2017). Refer to table 8.2.2 below for additional details on these parcels.

Table 8.2.4 Conservation Easements

Conservation Program	Acreage within Project Area	Location	Expiration Year
CREP	22 acres (9 hectares)	Northern half of Project Area, near the eastern boundary.	Not Indicated
CREP	4.6 acres (1.9 hectares)	Northern half of Project Area, near the eastern boundary.	2052

Conservation Program	Acreage within Project Area	Location	Expiration Year
CREP	20.8 (8.4 hectares)	Northeast corner of Project Area, adjacent to eastern boundary.	Not Indicated
CREP	69.6 (28.2 hectares)	Northern half of Project Area, near the eastern boundary.	Not Indicated
CREP	77.9 (31.5 hectares)	Northern half of Project Area, near the eastern boundary.	Not Indicated
PWP	0.7 (0.3 hectares)	Within the western portion of the Project Area, adjacent to the western boundary.	Not Indicated
PWP	2.5 (1.0 hectares)	Within the western portion of the Project Area, adjacent to the western boundary.	Not Indicated

The two PWP properties within the western portion of the Project Area cover a total of 3.2 acres (1.3 hectares), with an additional 151.8 acres (61.4 hectares) extending outside of the Project Area to the west. No RIM properties are present in the Project Area.

Lake Benton Wind II will continue to work to obtain information on any CRP easements that may exist within the Project Area. Further, Lake Benton Wind II will attempt to avoid and preserve CRP easements to the maximum extent practicable if a landowner is found to have such an easement on their property.

8.2.5 Potential Impacts

The Lake Benton Wind II Project is consistent with Pipestone County's zoning requirements and comprehensive plan. The Pipestone County Zoning Ordinance Section 5-10 (D) allows for the construction and operation of commercial scale wind energy facilities within the Agricultural District. Thus, the Project is consistent with Pipestone County zoning. Additionally, while the SP District is present within the Project Area, no turbines or associated facilities are proposed within this district. No Project infrastructure is planned within the SP District; however, if at a later date infrastructure is proposed to be placed with the SP District, Lake Benton Wind II would request permission to place infrastructure in the SP District from Pipestone County and obtain required permits.

Lake Benton Wind II is not likely to impact future zoning and expansion of incorporated areas near the Project Area. Lake Benton Wind II has sited all Project infrastructure at least one mile from incorporated areas and Urban Expansion Districts to minimize potential impacts on future urban growth. Development of the Project will allow continued agricultural use of the Project Area, while helping to strengthen the local economy through annual payments to landowners with Project infrastructure on their property, potential use of local contractors and suppliers, potential temporary jobs for local workers and tax benefits to local governments.

Temporary and permanent impacts to current land use are anticipated to occur from the construction of the Project. As the Project is primarily located within the Agricultural District of Pipestone County, land use primarily consists of agricultural activity, including row cropping and livestock production. Temporary and permanent impacts to agricultural activities will include the removal of land from row crop production and pasture during the construction and operation of the Project. Additionally, temporary and permanent impacts to pastureland are expected to be minimal and restricted to removing small amounts of land from use.

The locations of the CREP and PWP easements have been incorporated into Project planning so that these locations will be avoided and not disturbed by Project activities. No Project infrastructure or construction easements will be located in CREP or PWP areas. Refer to **Map 6 (Public Land Ownership & Recreation)**. CRP easements will be located in coordination with participating landowners. If CRP easements are determined to be present, the locations will be incorporated into Project planning as it relates to turbine and road layout, and any other associated construction activities and these lands will be avoided to the maximum extent practicable. If the Project requires the placement of permanent infrastructure within CRP land, the Applicant will work with the landowner to remove the land from the CRP program and will cover the costs of any penalties incurred due to the removal of the easement from the program.

8.2.6 Mitigation Measures

Lake Benton Wind II does not propose any mitigation measures based on the comprehensive plans, land use planning and local zoning as negative impacts are not anticipated. Impacts to

conservation easements are not expected. CREP and PWP lands will be avoided and Lake Benton Wind II will verify whether any CRP easements are located within areas where infrastructure is planned. If CRP easements are unavoidable, Lake Benton Wind II will collaboratively work with the appropriate agency, as well as the landowner, to remove the impacted portion of the parcel from the conservation program and Lake Benton Wind II will cover the costs of any penalties incurred due to the removal of the parcel from the conservation program.

Additional mitigation for impacts to existing land use are further described in Sections 8.16, 8.17, 8.18, 10.2, 10.3, and 10.5.

8.3 Sound

Sound levels are measured and quantified using the logarithmic decibel (dB) scale. The decibel scale is logarithmic to accommodate the wide range of sound intensities found in the environment. Every 3-dB change in sound level represents a doubling or halving of sound energy and a change in sound levels of less than 3 dB is imperceptible to the human ear.

A sound level meter (SLM) that is used to measure sound is a standardized instrument per ANSI S1.4-1983 (R2006). It contains "weighting networks" (*e.g.*, A-, C-, Z-weightings) to adjust the frequency response of the instrument. Frequencies, reported in Hertz (Hz), are detailed characterizations of sounds, often addressed in musical terms as "pitch" or "tone". The most commonly used weighting network is the A-weighting because it most closely approximates how the human ear responds to sound at various frequencies. The A-weighting network is the accepted scale used for community sound level measurements; therefore, sounds are frequently reported as detected with a sound level meter using this weighting. These sound levels are reported in decibels designated as "dBA". Z-weighted sound levels are measured sound levels without any weighting curve and are otherwise referred to as "unweighted".

Because the sounds in our environment vary with time they cannot simply be described with a single number. Two methods are used for describing variable sounds. These are exceedance levels and the equivalent level, both of which are derived from a large number of moment-to-moment A-weighted sound level measurements. Exceedance levels are values from the cumulative amplitude distribution of all of the sound levels observed during a measurement period. Exceedance levels are designated L_n, where n can have a value between 0 and 100 in terms of percentage. Several sound level metrics that are reported in community sound monitoring are described below.

- L_{10} is the sound level exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder sounds like those from passing motor vehicles.

- L_{50} is the sound level exceeded 50 percent of the time. It is the median level observed during the measurement period. The L_{50} is affected by occasional louder sounds like those from passing motor vehicles; however, it is often found comparable to the equivalent sound level under relatively steady sound level conditions.
- L_{90} is the sound level exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when there are no obvious nearby intermittent sound sources.
- L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (*i.e.,* the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is typically A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by loud sounds if there are fluctuating sound levels.

The Project is subject to sound level requirements in Minn. R. Ch. 7030 for Noise Pollution Control. These rules are enforced by the MPCA through the use of Noise Area Classifications (NAC) that are defined in subpart 2 of Section 7030.0050 in terms of land use. The noise standards for each NAC are defined in subpart 2 of Section 7030.0040 as shown below in Table 8.3:

Table 8.3: MPCA State Noise Standards – Hourly A-Weighted Decibels

Noise Area Classification	Daytime		Nighttime	
	L50	L10	L50	L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

The above sound levels are total sound levels. Total sound levels include contribution from any sound sources in the environment, existing, and Project-related. NAC 1 receptors are protected by the lowest sound level limits of the MPCA. Since wind turbines can operate under conditions resulting in maximum sound power during both the day and at night, the Project would need to comply during the period with more stringent limits, nighttime. Furthermore, because wind turbine sound is generally steady during a relatively constant wind speed there would be minimal difference (*i.e.*, < 5 dBA) between the L_{50} and L_{10} sound levels due to a wind turbine. As the L_{50} and L_{10} noise limits differ by 5 decibels, the L_{50} limit is more restrictive for a wind energy facility. Therefore, NAC 1 receptors have been evaluated against the L50 sound level limit of 50 dBA in this analysis.

8.3.1 Description of Resources

The region is currently home to multiple existing wind energy facilities. Some wind turbines, currently owned and operated by NEER, will be decommissioned ("existing NEER" wind turbines) before construction of the Lake Benton Wind II Project. Other existing wind turbines in the vicinity of the Project are not owned or operated by Lake Benton Wind II, NEER, or its affiliates or subsidiaries and it is assumed that these wind turbines "existing non-NEER" will remain operational. These include: McBeth Wind, Moraine I Wind, Moraine II Wind, Shane's Wind Machine, and Tholen Wind. Non-NEER wind turbines also exist outside the Project Area to the north. Existing NEER and non-NEER wind turbine locations within the Project Area and existing non-NEER wind turbine locations outside the Project are shown on **Map 7 (Aerial Locus of Existing Wind Turbines)**.

An ambient sound level survey was conducted to characterize the current acoustical environment in the community surrounding and within the Project Area. Existing sound sources include: NEER and non-NEER operational wind turbines, vehicles on Highway 23 (including trucks) and on other local roads, wind, animals including: dogs, cows, and coyotes, some rustling vegetation, occasional distant aircraft, occasional trains, and birds.

Ambient sound levels were measured at five locations for one week following methodology in the LWECS Guidance document based on a preliminary wind turbine layout. The DOC requested that additional measurements close to State Highway 23 be taken without the contribution from existing wind turbines. Since no access permission had been granted at an alternate residential location near Hwy 23, short-term off-site measurements were performed alongside the road during a daytime and a nighttime period. Following commencement of the measurement program, it was ascertained that no pre-determined long-term measurement location would be in absence of wind turbine sound contribution. Accordingly, additional short-term measurements were performed at off-site locations that do not have existing wind turbine sound contribution. See **Map 8 (Sound Level Measurement Locations)** for a review of all monitoring locations with respect to the Project. Result summaries of the long-term and short-term measurements are provided in Table 8.3.1a and Table 8.3.1b, respectively. Further details of the measurement locations, methodology, and sound levels are provided in **Appendix C (Pre-construction Sound Analysis)**.

Table 8.3.1a: Long-term Ambient Sound Level Summary

Long-term Measurement Location	Sound Pressure Level (dBA)			
	Min L10	Max L10	Min L50	Max L50
LT-1	22	64	19	61
LT-2	36	67	26	64
LT-3	33	60	28	55

Long-term Measurement Location	Sound Pressure Level (dBA)			
	Min L10	Max L10	Min L50	Max L50
LT-4	21	56	17	52
LT-5	18	58	17	54

Table 8.3.1b: Short-term Ambient Sound Level Summary

Short-term Measurement Location	Sound Pressure Level (dBA)			
	Daytime L10	Nighttime L10	Daytime L50	Nighttime L50
ST-1	66	47	53	30
ST-2	39	31	36	24
ST-3	35	31	28	26
ST-4	45	25	40	22

The sound impacts associated with the proposed wind turbines were predicted using the Cadna/A sound level calculation software developed by DataKustik GmbH. This software uses the ISO 9613-2 international standard for sound propagation (Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation). The sound level analysis for the Project conservatively includes 48 wind turbines, of which four (4) are considered alternate locations. Of these 48 wind turbines, 37 wind turbines are GE 2.3-116 units, six (6) are GE 2.3-116 Low Noise Trailing Edge (LNTE) units, two (2) are GE 2.1-116 units, and three (3) are GE 2.1-116 LNTE units. LNTE units include serrations on the blades to reduce audible noise created from turbines by disrupting the rate at which turbulent air compounds which results in lower pressure fluctuations. Sound power levels from GE technical reports for the GE 2.3 wind turbine were used to assign worst-case sound power levels to each of the modeled wind turbines. Sound levels provided for the GE 2.3-116 wind turbines have been used for the GE 2.1 model in this analysis. As the technical documents have been labeled as confidential by GE, the specific sound power levels are not presented in this application. This Project will not result in any new significant sound sources at the points of interconnect.

As discussed, the Project Area currently contains Lake Benton Wind II and non-NEER wind turbines. The existing Lake Benton Wind II wind turbines will be decommissioned before construction of the Project, however the non-NEER wind turbines are assumed to remain as operational. To predict the future wind turbine sound levels in the vicinity of the Project, a cumulative modeling analysis was conducted which included the sound level contribution from these existing non-NEER turbines. Of the 27 non-NEER wind turbines within the Project Area, 18 were assumed to be GE 1.5-70.5 units and 9 were assumed to be Vestas V82-1.65 units. This

modeling scenario therefore included a total of 75 wind turbines (48 Project-related, 27 existing non-NEER). The WindPRO software package provided sound power levels for the existing non-NEER wind turbines to represent "worst-case" emissions.

Receptors within 2 miles of the Project Area (234) were input into the Cadna/A model. These receptors were modeled as discrete points at a height of 1.5 meters above ground level to mimic the ears of a typical standing person and were all assigned as NAC 1. Participation status for each modeling receptor was assigned. All modeling receptors are identified on **Map 9 (Sound Level Modeling Locations)** and are distinguished as either participating, participation pending, or non-participating. Parcels not identified as participating but contain proposed wind turbines are assigned as "participation pending" status. Any non-"participating" parcel that was within or partially within the 5 by 3 setbacks has been assigned a "participation pending" status.

Several modeling assumptions inherent in the ISO 9613-2 calculation methodology, or selected as conditional inputs by Epsilon, were implemented in the Cadna/A model to ensure conservative results (*i.e.*, higher sound levels). No uncertainty factor was provided by the wind turbine manufacturers; however, based on experience with other wind turbine manufacturers and wind turbine sound modeling, an uncertainty factor of 2.0 dBA was assumed and added to the sound power level for each modeled wind turbine (Project and existing non-NEER).

8.3.2 Potential Impacts

All modeled sound levels, as output from Cadna/A, are A-weighted equivalent sound levels (L_{eq}, dBA). Based on Epsilon's experience in conducting post-construction sound level measurement programs for wind energy facilities, the equivalent sound level has been comparable to the median (L_{50}, dBA) sound level when the wind turbine sound was prevalent and steady under ideal wind and operational conditions. Therefore, the modeled sound levels may be considered as L_{50} sound levels and directly compared to the Minnesota L_{50} limit.

The predicted worst-case sound level from the combination of the Project wind turbines and the existing non-NEER wind turbines (Project + Non-NEER) is below the 50 dBA limit at all modeled NAC 1 receptors as shown in Table 8.3.2. Modeled sound level isolines are presented on **Map 10 (Project and Existing Non-NEER L_{50} Sound Level Modeling Results)** for the Project + Non-NEER scenario. The highest L_{50} sound level is 49 dBA at receptors #775, #717, #706, and #707. These are all at non-participating receptors. Accordingly, total sound levels (Project + existing non-NEER wind turbines + non-wind-turbine ambient) will meet the Minnesota limit of 50 dBA when non-wind-turbine ambient sound levels are less than or equal to 44 dBA.[5] Short-term nighttime measurements showed non-wind-turbine ambient L_{50} (dBA) sound levels to be well below 44 dBA under low ground-level wind speeds and ranging from just

[5] The maximum modeled Project + Non-NEER L50 sound level is 49.3 dBA at receptor #775. 49.3 dBA + 44.0 dBA = 50.4 dBA. 50.4 dBA rounds to the whole decibel value of 50 dBA.

below to above the cut-in wind speed at hub height. Non-wind-turbine ambient sound levels in the Project Area fluctuate due to sound sources such as ground-level winds, vehicular traffic, and vegetation rustle, all of which can cause non-wind-turbine ambient sound levels to exceed the MPCA L_{50} nighttime limit of 50 dBA.

There are four locations, #775, #717, #706, and #707, which are modeled to have a wind turbine L_{50} sound level (Project + Existing Non-NEER) of 49 dBA. In all four instances, the primary sound source is an existing Non-NEER wind turbine. Existing Non-NEER wind turbine sound levels are presented on **Map 11 (Existing Non-NEER L_{50} Sound Level Modeling Results)**. In addition, in each case, the wind turbine is on the parcel with the modeling receptor. The next highest non-participating residence is receptor #674 which is modeled to be 47 dBA (Project + Existing Non-NEER); this is several decibels below the MPCA L_{50} nighttime limit.

Moreover, the highest predicted worst-case Project Only L_{50} sound level at a modeling receptor is 47 dBA and, therefore, meets the most restrictive MPCA sound limit of 50 dBA. This is at receptor #735 which is participating. The highest Project Only L_{50} sound level at a non-participant is 45 dBA (receptor #826). Modeled sound level isolines are presented in **Map 12 (Project-Only L_{50} Sound Level Modeling Results)** for the Project Only scenario.

Table 8.3.2 presents a summary of the Project + Existing Non-NEER and Project Only sound level modeling results. Appendix C (Pre-construction Sound Analysis) provides further details of the sound modeling analysis.

Table 8.3.2: Summary of Sound Assessment

Modeling Scenario	Maximum Modeled L50 Sound Pressure Level (dBA) at NAC 1 Receptors			
	All Receptors	Participating	Participation Pending	Non-Participating
Project + Existing Non-NEER	49	48	48	49
Project Only	47	47	47	45

An evaluation of low frequency (LF) and infrasound levels from a wind energy center at receptors is not required by the State of Minnesota. However, a discussion of LF and infrasound, as it pertains to wind turbines, is provided below for informational purposes.

Low frequency and infrasound are present in the environment due to other sources besides wind turbines. For example, refrigerators, air conditioners, and televisions generate infrasound and low frequency sound. The frequency range of low frequency sound is generally from 20 Hz to 200 Hz, and the range below 20 Hz is often described as “infrasound”. However, audibility can

extend to frequencies below 20 Hz if the energy is high enough. Since there is no sharp change in hearing at 20 Hz, the division between "low-frequency sound" and "infrasound" should only be considered "practical and conventional." The threshold of hearing is standardized for frequencies down to 20 Hz (International Organization for Standardization (ISO) 2003). Based on extensive research and data, Watanabe and Moeller have proposed normal hearing thresholds for frequencies below 20 Hz (Watanabe and Moeller 1990). These sound levels are so high that infrasound is generally considered inaudible. For example, the sound level at 8 Hz would need to be 100 dB to be audible.

A detailed infrasound and low frequency noise measurement program of wind turbines was conducted from 2013-2015 by the Ministry for the Environment, Climate and Energy of the Federal State of Baden-Wuerttemberg, Germany (Herrmann et al. 2016). The conclusions of the German study were:

> Infrasound and low-frequency noise are an everyday part of our technical and natural environment. Compared with other technical and natural sources, the level of infrasound caused by wind turbines is low. Already at a distance of 150 m (~500 ft), it is well below the human limits of perception. Accordingly, it is even lower at the usual distances from residential areas. Effects on health caused by infrasound below the perception thresholds have not been scientifically proven. Together with the health authorities, we in Baden-Württemberg have come to the conclusion that adverse effects relating to infrasound from wind turbines cannot be expected on the basis of the evidence at hand.

The Massachusetts Department of Environmental Protection (MA DEP) and the Massachusetts Department of Public Health (2016) commissioned an expert panel who found that: "Claims infrasound from wind turbines directly impacts the vestibular system have not been demonstrated scientifically. Available evidence shows that the infrasound levels near wind turbines cannot impact the vestibular system."

Health Canada, in collaboration with Statistics Canada, conducted one of the most extensive studies to understand the impacts of wind turbine noise to-date (Health Canada 2013). A cross-section epidemiological study was carried out in 2013 in the provinces of Ontario and Prince Edward Island on randomly selected participants living near and far from operating wind turbines. Many peer-reviewed publications have been written based on the Health Canada research, including an analysis of low frequency and infrasound data. For example, Keith et al. concluded that there was no advantage of using C-weighting to measure low frequency sound since the relationship between A-weighting and C-weighting are so highly correlated (Keith et al. 2016). In other words, acceptable A-weighted limits also eliminate low frequency and infrasound impacts.

Low frequency and infrasound has also been studied extensively in Japan. Tachibana et al. conducted extensive measurements of 34 wind farms nationwide and concluded that infrasound

from wind turbines is not audible/sensible, and that wind turbine noise is not a problem in the infrasound region (Tachibana et al. 2014).

As noted in the 2011 National Association of Regulatory Utility Commissioners (NARUC) report (NARUC 2011), "the widespread belief that wind turbines produce elevated or even harmful levels of low frequency and infrasonic sound is utterly untrue as proven repeatedly and independently by numerous investigators."

8.3.3 Mitigation Measures

Lake Benton Wind II has designed the Project to meet the MPCA state noise standards and to minimize the sound levels due to the wind turbines at the homes in the community as much as possible, while also meeting the other constraints of the project design and regulatory requirements.

Compliance with MPCA noise standards will be accomplished, in part, by including in its design a 1,400 setback from residences. Also, consistent with the 3 RD X 5 RD setback, turbines will be set back from non-participating properties by a minimum setback of at least 1,147 feet (350 meters or 3 RD) in the non-prevailing wind direction and at least 1,911 feet (583 meters or 5 RD) in the prevailing wind direction. In addition, the Applicant will also conduct a post-construction sound level measurement program to evaluate compliance with respect to MPCA noise standards.

8.4 Visual Impacts

8.4.1 Description of Resources

Aesthetic quality and appeal of a region generally derive from the terrain, natural features (*e.g.*, lakes, rivers, ponds, etc.), native flora, and cultural features that define the landscape. Individual observers will have differing opinions on the aesthetic appeal of a region and impacts that may alter the quality. Those likely to be viewing the proposed Project include permanent observers (residents) and temporary observers (motorists, tourists, or recreationalists passing by or using the area intermittently). Residents within and in the vicinity of the Project Area are expected to have a higher sensitivity to the potential aesthetic impacts than temporary observers as they will look at the Project more frequently than those individuals periodically passing through the area.

The general topography of the Project Area is described as undulating, rolling relief with approximate elevations between 1,790 and 1,960 feet (546 and 597 meters) above mean sea level (MSL). Refer to **Map 13 (Topographic Map)**. The Project Area generally has higher elevations in the central and northwestern sections with lower elevations in the northeast, southeast, and southwest. Agricultural fields, farmsteads, grasslands, and rolling topography visually dominate the Project Area. The landscape can generally be classified as rural open space.

Vegetation within the Project Area is predominantly agricultural crops, pasture, and wooded shelter belts surrounding residences and riparian areas. The main agricultural crops grown in this vicinity include corn and soybeans. Settlement in this area of Pipestone County includes residential and farm buildings scattered along rural county and township roads. There are 107 residences located throughout the Project Area. Additionally, the Town of Ruthton and associated clustered residences is located 0.9 miles (1.5 kilometers) east of the Project Area.

The main visual focal points within the Project Area are aspects of an agricultural landscape, which are broken up by residences, buildings, shelter belts, and small wooded lots. Viewsheds in the area are generally long and open with only small scattered areas where the view from a location would be blocked by vegetation, topography, or existing structures. Cemeteries are not located within the Project Area; however, two cemeteries are located within one mile of the Project Area (Holland Cemetery and Ruthton Cemetery).

The existing Lake Benton Wind II wind farm occurs within the Project Area and consists of 137 existing turbines distributed throughout the Project Area, which generate 0.75 MW each. This existing project will be decommissioned prior to the commercial operation of the proposed Project. There are a total of 27 wind turbines within the Project Area that are not owned by the Applicant or another NEER subsidiary. These turbines appear to be in commercial operation and Lake Benton Wind II is unaware of plans for these turbines to be decommissioned in the near future. The existing McBeth Wind, Tholen Wind, and Shane Cowell wind sites occur within the southeast portion of the Project Area and portions of the existing Moraine I and Moraine II wind farms occur within the southeast portion of the Project Area and continue off-site to the southeast. These existing wind facilities contain turbines of various heights and rotor diameters.

- The Tholen wind farm consists of five turbines that generate 1.65 MW each.
- The McBeth wind farm consists of three turbines that generate 1.65 MW each.
- The Shane Cowell wind site consists of one wind turbine that generates 2.1 MW.
- The Moraine I wind farm consists of 34 turbines that generate 1.5 MW each.
- The Moraine II wind farm consists of 33 turbines that generate 1.5 MW each.

MET towers associated with these wind facilities may also be present on the landscape. Generally, wind energy conversion systems within and adjacent to the Project Area contain slightly smaller sized turbine models than those proposed for this Project, with total heights ranging from approximately 300 feet to approximately 400 feet (91 meters to approximately 122 meters). An additional 15 wind farms are located within 10 miles (16 kilometers) of the Project Area. Refer to **Map 14 (Existing Turbine Locations)**.

Existing transmission lines of 69 kV and higher are not present within the Project Area. One existing transmission line, the Chanarambie to Lake Yankton 115 kV, runs north to south approximately 1 mile to the east of the southeastern portion of the Project Area. An additional approximately 177 miles (285 kilometers) of existing transmission lines are located within ten

miles (16 kilometers) of the Project Area. Refer to **Map 2 and Map 2a**. No new transmission lines above 69 kV are proposed for this Project. Existing transmission lines create existing visual impacts to the Project Area viewshed.

The FCC Antenna Structure Registration database identifies one antenna structure within the Project Area and 22 existing antenna structures within ten miles of the Project Area creating existing visual impacts to the Project Area viewshed.

8.4.2 Visual Impacts

As the number of turbines associated with the Project repower will be reduced from 137 to 44 and no new transmission lines or overhead distribution lines are proposed for the Project, it is anticipated that the repower will have a net positive impact on aesthetics. Two turbine models, the GE 2.3 MW and GE 2.1 MW, are proposed for the Project. Both models will be similar in appearance with three blades, a hub, and a monopole. Both turbine models have a 116.5 meter (382.2 foot) RD and differ slightly in hub height; the GE 2.3 MW model has a hub height of 90 meters (295 feet) and the GE 2.1 model has a hub height of 80 meters (263 feet). Therefore, these two models differ in total height. Refer to Table 8.4.1 below. In general, the larger the RD, the fewer turbines are required to produce the same energy output, creating less of a visual impact. The RD of the existing Lake Benton II wind turbines currently located within the Project Area is approximately 50 meters (USGS 2014a). There are 137 existing Lake Benton wind turbines located in the Project Area which will be decommissioned, and only 44 wind turbines are proposed for the Project.

Table 8.4.2: Rotor Diameter and Number of Turbines

Turbine Model	Rotor Diameter (meters/feet)	Rotor Tip Height (meters/feet)	Ground Clearance (meters/feet)	Number of Turbines	Number of Alternate Turbines
GE 2.1 MW	116.5/382.2	138.3/453.7	22/72.2	5	0
GE 2.3 MW	116.5/382.2	148.3/486.6	32/105	39	4

The turbines will be uniform in color and painted with a non-reflective/off-white color designed to minimize visual impacts. The towers and blades, including those with LNTE, will be of a color, design, operation, and appearance consistent with other turbines in the area. No advertising or graphics will be placed on any part of the tower or blades; however, the turbines will be clearly numbered for identification and emergency response. The towers will not be

illuminated except as required by the FAA. The FAA requires obstruction lighting or marking of structures over 200 feet (61 meters) above mean sea level because they have the potential to obstruct air navigation. Lake Benton Wind II will request FAA approval of a lighting plan that is compliant with FAA requirements.

The proposed Project will be visible to permanent observers (residents) and temporary observers (motorists, tourists, or recreationalists passing by or using the area intermittently). Visual impacts may also be noticeable to users of public lands and public snowmobile trails within and in the vicinity of the Project Area. Further information regarding the public lands and snowmobile trails in relation to the Project Area is found in Section 8.7. However, the proposed Project will not be introducing a new feature type to the landscape because existing wind turbines are prevalent within and in the vicinity of the Project Area.

Turbines will likely be viewed in one of three perspectives:

- As a visual disruption;
- As generally compatible with the rural agricultural heritage of the area, which includes windmills, silos and grain elevators, and existing wind turbines; or
- As adding a positive aesthetic quality to the landscape.

The topography in the vicinity of the Project Area is rolling and the vegetation is low, and the Project will be visible to residents of the area and to people traveling northeast and southwest along Minnesota 23, north and south along US Hwy 75, east and west along Minnesota 30, and north to south along Minnesota 91. However, the proposed Project will not create a new feature type within the landscape because the existing Lake Benton II wind farm is already present on-site, and several wind farms occur within Project Area and its immediate vicinity. The 44 wind turbines proposed for the Project will replace the 137 existing Lake Benton II turbines being decommissioned. Although the proposed turbines are taller, there will be significantly fewer turbines within the Project Area.

Additionally, alterations of the land with temporary impacts related to construction activities, such as temporary land use associated with equipment staging and laydown areas, crane paths, and installation of underground collection lines would be short-term and converted back to cropland or replanted with grasses and vegetation native to the area following the completion of construction. Visual impacts from an increase in traffic and human activity within the Project Area associated with Project construction would also be short-term. The long-term operation of the Project is not anticipated to increase visual impacts associated with human activity or traffic within the Project Area.

8.4.3 Shadow Flicker

With respect to wind turbines, shadow flicker can be defined as an intermittent change in the intensity of light in a given area resulting from the operation of a wind turbine due to its

interaction with the sun. While indoors, an observer experiences repeated changes in the brightness of the room as shadows cast from the wind turbine blades briefly pass by windows as the blades rotate. In order for this to occur, the wind turbine must be operating, the sun must be shining, and the window must be within the shadow region of the wind turbine, otherwise there is no shadow flicker indoors. A stationary wind turbine only generates a stationary shadow similar to any other structure.

A Project-specific shadow flicker analysis was conducted using the software package, WindPRO and is presented in **Appendix D (Shadow Flicker)**. The worst-case annual duration of shadow flicker was calculated based on the following modeling inputs:

- Proposed wind turbine locations. The modeling analysis included 48 wind turbines (44 proposed + 4 alternates).
- Wind turbine dimensions, i.e., rotor diameter and hub height. A combination of GE 2.1 and GE 2.3 wind turbines are proposed for this Project.
- Discrete modeling points, i.e., sensitive receptors, including residences, hospitals, schools and other potential sensitive receptors. These locations are consistent with the NAC 1 receptors modeled in the sound level analysis. All modeling receptors and participation status are presented on **Map 15 (Shadow Flicker Modeling Locations)**. 234 receptors are included in the analysis.
- In addition to modeling discrete points, shadow flicker was calculated at grid points in the area surrounding the modeled wind turbines to generate flicker isolines. A 20-meter spacing was used for this grid.
- There are no federal, state, or local regulations regarding the maximum radial distance from a wind turbine to which shadow flicker should be analyzed applicable to this Project. Various approaches for defining a calculation area are discussed in the detailed report. Conservatively, this analysis includes shadow flicker calculations out to 1.25 miles (2,012 m) from each wind turbine in the model for the proposed layout.
- Shadow flicker durations were only calculated when the angle of the sun was at least 3° above the horizon.
- The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey.
- Conservatively, obstacles (*i.e.*, buildings and vegetation) were excluded from the analysis. This is effectively a "bare earth" scenario which is conservative. When accounted for in the shadow flicker calculations, such obstacles may significantly mitigate or eliminate the flicker effect depending on their size, type, and location.

The WindPRO modeling was further refined by incorporating sunshine probabilities and wind turbine operational estimates by wind direction over the course of a year. The values produced

by this further refinement are known as the "expected" shadow flicker. Project specific inputs are presented below:

- Monthly sunshine probability values for each month from January to December. These numbers were obtained from a publicly available historical dataset for Sioux City, Iowa from the National Oceanic and Atmospheric Administration's National Centers for Environmental Information shown in Table 8.4.3a.

Table 8.4.3a: Monthly Sunshine Probability Values

Month	Possible Sunshine
January	57%
February	57%
March	59%
April	59%
May	62%
June	70%
July	73%
August	70%
September	65%
October	60%
November	48%
December	48%

- A Lake Benton Wind II provided 31-year hourly time series for wind speed and wind direction at 90 meters above ground level was used to calculate the typical annual number of operational hours per wind direction sector. These hours per wind direction sector are used by WindPRO in the estimation of the "wind direction" and "operation time" reduction factors. Based on this dataset, the wind turbines would operate 98% of the year. Table 8.4.3b shows the distribution of operational hours for the 16 wind directions.

Table 8.4.3b: Operational Hours per Wind Direction Sector

Wind Sector	Operational Hours
N	668
NNE	495
NE	401

ENE	328
E	295
ESE	263
SE	318
SSE	507
S	1,122
SSW	895
SW	495
WSW	362
W	431
WNW	587
NW	708
NNW	710
Annual	**8,585**

The modeled worst-case annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 91 hours, 55 minutes per year. The maximum flicker was at a receptor with pending participation (#1108). The maximum predicted annual flicker at a non-participating receptor (#849) is 54 hours, 49 minutes.**Map 16 (Shadow Flicker Modeling Results)** presents expected annual shadow flicker durations as isolines overlaid on aerial imagery. The predicted expected annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 30 hours, 25 minutes per year. The maximum expected flicker was at a receptor with pending participation (#1108). The maximum modeled expected annual flicker at a non-participating receptor (#849) is 19 hours, 4 minutes. The majority of the receptors (170) were predicted to experience no annual shadow flicker. 34 locations were predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that 29 locations would be expected to have 10 to 30 hours of shadow flicker per year. One receptor is expected to have over 30 hours of flicker per year. The modeling results are conservative in that modeling receptors were treated as "greenhouses" and the surrounding area was assumed to be without vegetation or structures ("bare earth").

Summaries of the modeling results are presented in Tables 8.4.3c, 8.4.3d, and 8.4.3e. **Appendix D** to this application provides the complete shadow flicker study and results for the Lake Benton Wind II Project.

Table 8.4.3c: Predicted Shadow Flicker Impacts at Participating Residents

Statistic	Duration (hrs:mins/yr)
Maximum Shadow Flicker - Worst Case	78:17
Maximum Shadow Flicker - Expected Case	26:07

Table 8.4.3d: Predicted Shadow Flicker Impacts at Participation Pending Residents

Statistic	Duration (hrs:mins/yr)
Maximum Shadow Flicker - Worst Case	91:55
Maximum Shadow Flicker - Expected Case	30:25

Table 8.4.3e: Predicted Shadow Flicker Impacts at Non-Participating Residents

Statistic	Duration (hrs:mins/yr)
Maximum Shadow Flicker - Worst Case	54:49
Maximum Shadow Flicker - Expected Case	19:04

Based on the current design and operation of typical modern wind turbines, shadow flicker is not a cause of epileptic seizures. According to the Epilepsy Foundation (Epilepsy Foundation 2013), "Generally, flashing lights most likely to trigger seizures are between the frequency of 5 to 30 flashes per second (Hertz)." The wind turbines for this Project have a maximum rotational speed of 15.7 rpm which corresponds to a shadow flicker frequency of 0.8 Hz. This frequency is well below the frequency identified by the Epilepsy Foundation; therefore, the triggering of epileptic seizures is not a concern with this Project.

8.4.4 Mitigation Measures

The decommissioning of the existing 137 existing Lake Benton II wind turbines mitigates the visual impact of the Project's proposed 44 replacement turbines as there will be far fewer

turbines visible on the Project Area landscape. Lake Benton Wind II will implement the following mitigation measures to minimize potential visual impacts:

- Turbines will be uniform in color;
- Turbines will not be located in sensitive areas such as public parks, Wildlife Management Areas (WMA), Scientific and Natural Areas (SNA) or Waterfowl Protection Areas (WPA);
- Turbines will be illuminated to meet the minimum requirements of FAA regulations for obstruction lighting of wind turbine projects;
- Electrical collection lines will be buried to minimize above-ground structures within the Project Area;
- Existing roads will be used for construction and maintenance, as appropriate, to minimize the number of new roads constructed; and
- Temporarily disturbed areas will be converted back to cropland or otherwise reseeded with seed mixes appropriate for the region.

The Project was designed to minimize shadow flicker exposure of the residences in the area. Lake Benton Wind II will use site specific mitigation measures to address shadow flicker impact, as appropriate, including the following:

- Meet with the homeowner to determine the specifics of their complaint;
- Investigate the cause of the complaint; and
- Provide the homeowner with reasonable mitigation alternatives including shades, blinds, awnings or plantings.

8.5 Public Services and Infrastructure

The Project is located in rural southwestern Minnesota (see **Map 1 - Project Location**). A network of roads and utilities provide access, electricity, water supply, and telephone service to rural residences, farmsteads, small industry, and unincorporated areas. Public services within the Project Area are provided by the Pipestone County Sheriff, Pipestone County Ambulance, Tyler Ambulance, Holland Fire Department, Ruthton Volunteer Fire Department, and the Lake Wilson Fire Department. An emergency response center in the City of Pipestone dispatches all 911 calls for the county, including for fire, medical and police emergencies. During pre-construction, construction, operations, and decommissioning, no external first responders are required or expected for any activities inside of Project wind turbine structures, including but not limited to medical or fire response. Lake Benton Wind II and its contractors are responsible for transporting a victim to ground level for hand off to local emergency personnel if the victim's condition warrants such assistance. Lake Benton Wind II personnel and contractors will be trained and appropriately equipped for high-angle rescue within turbines and all associated turbine components. The Project is expected to have a minimal effect on existing services and infrastructure and will be constructed and operated in accordance with associated federal, state

and local permits and laws. Industry construction and operation standards and best practices will also be followed. Extensive public service and infrastructure mitigation measures are not anticipated because only minor impacts to services and infrastructure are expected.

Lincoln Pipestone Rural Water provides the water supply within the Project Area and septic systems are typically used within the Project Area to provide household needs.

8.5.1 Traffic and Roads

Existing road infrastructure within the Project Area consists primarily of county and township roads that typically follow section lines, as well as farmstead driveways and farming access roads. The primary route through the Project Area is State Route 23 (TH 23), that travels in a northeast/ southwest orientation. Though not in the Project Area boundary, U.S. Highways 75 and 14 are the main access routes into the Project and to nearby communities. The county roads and township roads used to access the proposed Project access roads and turbine locations are either two-lane paved roads or gravel roads. A summary of roadways within the Project Area are found in Table 8.5.1.

Table 8.5.1: Summary of Roadways within Project Area

Road Type	Miles within Project Boundary (miles/km)
Federal Highways	0
State Highways	4.2/6.8
County Highways/Roads	38.1/61.3
Township Roads	24.6/39.6

Traffic within and around the Project Area has been summarized in Table 8.5.1a, below, based upon available MnDOT data (MnDOT 2016) TH 23 has the highest Average Annual Daily Traffic (AADT) count with 3,250 vehicles per day, using 2016 data, while the lowest traffic volume was CSAH 11 with 140 vehicles per day, using 2016 data. AADT data was not available for several roads within the Project Area, however, with the exception of TH 23, the AADT data ranged from 140 to 540 vehicles per day. Therefore, it can be inferred that roads lacking AADT data would likely support similar traffic, or potentially less traffic, per day.

Table 8.5.1a: Existing Daily Traffic Levels

Roadway Segment Description[1]	Approx. Miles Within Project Boundary	Traffic Volume	Year Data Collected
CSAH 7	1.36 (2.19 km)	180	2016
CSAH 8	1.00 (1.61 km)	145	2016
CSAH 10	5.35 (8.61 km)	385	2016
CSAH 11	5.00 (8.05 km)	140	2016
CSAH 16	4.11 (6.6 km)	200	2016
CSAH 18	5.31 (8.55 km)	540	2016
TH 23	4.22 (6.79 km)	3,250	2016

[1]Roads included if AADT data was available. Several roads within the Project Area did not have AADT data. Source: MnDOT, (2016), Office of Transportation Data & Analysis, Traffic Volume Program, 2016 AADT Product

8.5.2 Telecommunications

A review of the Project was conducted by the U.S. Department of Commerce, National Telecommunications and Information Administration (NTIA) as part of the Project's Telecommunications Study in **Appendix E**. The NTIA provided the Project information to the Interdepartmental Radio Advisory Committee (IRAC) which includes 20 federal agency members. Confirmation was received on August 21, 2017 that no IRAC member agencies had issues with turbine placement in the Project Area.

Telephone

Telephone service in the Project Area is provided to farmsteads, rural residences, and businesses by Alltel Communications, AT&T Mobility Spectrum, Century Link, Cunningham Telephone, Mediacom, Vast Broadband, and Verizon Wireless. Eleven cellular towers were discovered within 25 kilometers (15.5 miles) of the Project Boundary. Refer to Table 8.5.2 for a summary of FCC licensed signals and tower within the vicinity of the Project Area.

Microwave Beam Paths

The **Appendix E** study examined microwave beam paths in the vicinity of the Project Area and identified two microwave towers in the Project Area and twelve microwave beam paths that cross into the Project Area. An additional 2 microwave beam paths were identified near the Project Area. These beam paths are owned and operated by Affiniti, LLC, State of Minnesota, Minnesota Valley Television Improvement Corporation, and the West Central Minnesota Educational TV Corporation. WindLogics calculated Worst Case Fresnel Zones (WCFZ), which are determined by the 2nd Fresnel zone radius obtained at the midpoint of the microwave link. Utilization of the WCFZ, and an offset to account for the blade length, enables turbines to be sited such that impacts to microwave beam paths are avoided (**Map 17 – Microwave Beam Path Map**). Refer to Table 8.5.2 for a summary of FCC licensed signals and towers within the vicinity of the Project Area.

AM/FM Radio

The **Appendix E** study did not identify active AM or FM radio towers within the Project Area. One AM tower and six FM towers were identified within 25 kilometers (15.5 miles) of the Project Area. The AM tower has the call sign KLOH and the FM towers have the call signs K257FP, KISD, KJOE, KKCK, KNSW, and KRSW. Refer to Table 8.5.2 for a summary of FCC-licensed signals and towers within the vicinity of the Project Area.

Fixed Land Mobile Stations

Land mobile stations are used within the Project Area for public safety, emergency response, and local government communications. Land mobile stations will also be used by Project staff for communication between maintenance and operation crews. Typically, land mobile stations are unaffected by wind projects as their radio systems are designed with multiple transmitters to provide redundancies that allow signals to broadcast through wind turbines.

Table 8.5.2: Summary of FCC-Licensed Signals and Towers in and within the Vicinity of the Project Area

Communication System Type	Number of Signals and Towers
AM (AM Radio Signals)	1
FM (FM Radio Signals)	6
Microwave (Radio Wave Transmissions)	14
Cellular (Towers)	11

8.5.3 Other Local Services

Existing transmission lines of 69 kV and higher are not present within the Project Area. Approximately 177 miles of existing transmission lines are located within 10 miles of the Project Area. One railroad is located within the Project Area. The Burlington Northern and Santa Fe Railway operate the railroad that traverses the central portion of the Project Area from northeast to southwest. One (1) 8" non-highly volatile liquid pipeline owned and operated by Magellan Pipeline Company, LP crosses through the center of the Project Area in a northeast to southwest orientation. No other pipelines were identified on publically available databases or mapping. The Applicant is conducting a detailed review to identify other potential pipelines, easements, and buried infrastructure within the Project construction easement.

8.5.4 Television

The **Appendix E** study determined that digital or analog television towers are not located in the Project Area. However, there are 15 licensed television towers within 100 kilometers (62.1 miles) of the Project Area; including one that is within 50 kilometers (31.1 miles) of the Project Area and likely to be broadcasting to the region. Most of the television towers within 100 miles of the Project Area are low power stations or translator stations that have a limited range and are not anticipated to experience reception degradation. Two full power stations (call signs KDLT-TV and KSMN) have a possibility of experiencing reception degradation if the Project is in line-of-sight. These towers are located 72.2 kilometers (44.9 miles) and 20.9 kilometers (13.0 miles) from the Project.

Table 8.5.4: Digital Television Signals In the Vicinity of the Project Area

Call Sign	Station	Licensee	Signal Strength (kw)
KCSD-TV	24	South Dakota Board of Directors for Educational Telecommunications	80.9
KDLT-TV	47	Red River Broadcast Co., LLC	589
KLEO-TV	11	Nexstar Broadcasting, Inc.	30
KESD-TV	8	South Dakota Board of Directors for	15

Call Sign	Station	Licensee	Signal Strength (kw)
		Educational Telecommunications	
KRWF	27	KSAX-TV, Inc.	58
KSFY-TV	13	Gray Television Licensee, LLC	22.7
KSMN	15	West Central Minnesota Educational TV Corporation	200
KTTW	7	Independent Communications, Inc.	7.5
KWSD	36	J.F. Broadcasting, LLC	36.9
K35GR-D	35	Red River Broadcast Co., LLC	11.9
K56GF	23	Digital Networks-Midwest, LLC	15
K56GF	56	Digital Networks-Midwest, LLC	10.1
KAUN-LP	42	J.F. Broadcasting, LLC	0.88
KCPO-LP	26	G.I.G., Inc.	7.57
KCWS-LP	44	J.F. Broadcasting, LLC	0.68

8.5.5 Potential Impacts

Traffic and Roads

Temporary impacts are expected to public roads during the construction phase of the Project as materials, personnel and equipment will be brought in via existing U.S. Highways, county roads, and township roads. U.S. Highways 75 and 14 and State Highway 23 are the main access routes into the Project and would likely be used as corridors to bring materials and equipment to the Project site; however, the exact routes will be determined closer to construction and in coordination with local jurisdictions as appropriate. Construction traffic is expected to generate approximately 500 trips per day during peak construction. Local roads can accommodate this additional traffic as the functional capacity of a two-lane paved rural highway is in excess of 5,000 vehicles per day. However, some minor, short-term traffic delays within and near the Project site may occur during turbine and equipment delivery and construction activities.

Additionally, public road and intersection improvements, as well as temporary access road approaches and turning radii, are required for transportation and turbine component delivery during the construction phase of the Project. Another temporary activity associated with construction is a temporary route required for oversized crane machinery movement between turbine assembly points (*i.e.*, crane walk). Large components of the turbines, including but not limited to the tower, blades, rotor, and generator, will be delivered to respective turbine sites for assembly in place. Once a turbine is constructed, the crane will be mobilized to access the next turbine assembly point. In order to minimize damage over roads, temporary base material, such as sand will be applied where the crane will cross. Road improvements and traffic delays associated with the Project will require coordination with appropriate agencies. Temporary and/or permanent culvert crossings within regulated features will be installed where necessary for permanent access roads, access road approaches, intersection improvements, and/or the crane walk path. Proper placement and sizing of culverts will require approval from the appropriate federal, state, and local agencies. Temporary culverts will be removed after construction and temporarily disturbed areas will be converted back to cropland or otherwise reseeded with native seed mixes appropriate for the region.

During operations, only a small maintenance crew will utilize roads within the Project Area for regular inspections and maintenance. Nearby county roads have AADTs between 140 and 540 and traffic is not expected to noticeably increase during the operations phase of the Project.

Telephone

The Project is not anticipated to impact telephone or internet services. Underground utilities, if any, will be located using a utility locate service and collection line locations will be coordinated with local telecommunications providers to ensure there will be no impact to existing telephone

lines or other underground utilities. The **Appendix E** study indicates that interference would not occur to cellular telecommunications.

Microwave Beam Paths

No impacts to microwave beam paths are anticipated in the Project Area. The **Appendix E** study calculated the WCFZ for microwave beam paths within the Project Area and added a 68-meter (223 feet) offset to reduce the probability of harmful interference. Turbines have been planned so as to avoid microwave beam paths and comply with the WCFZ offset. See **Appendix E.**

AM/FM Radio

The **Appendix E** study determined that interference to AM or FM signals are expected to be minimal. Some AM/FM signal loss may occur in close proximity to individual turbines, but most AM/FM radio receptors are expected to be near residences and residences will have sufficient setback to minimize signal interruptions. Interference to AM towers would be limited to a distance equal to one wavelength from non-directional antennas and 10 wavelengths, or three kilometers (1.9 miles), from directional antennas. The closest AM tower, KLOH, is located 18.5 kilometers (11.5 miles) from the Project Area and has a wavelength of 285.7 meters (937 feet). Thus, the Project Area is greater than 10 wavelengths from the closest tower and thus impacts are not anticipated. Wind turbines have minimal effect to FM frequencies near 100 MHz at distances over 100 meters (328 feet) from the tower. There is also a potential for FM stations to experience interference at distances closer than four kilometers (2.5 miles) from turbines. However, there are no FM towers within four kilometers (2.5 miles) of the Project Area and thus impacts to FM frequencies are not anticipated.

Fixed Land Mobile Stations

Impacts to fixed land mobile stations are not anticipated to occur as a result of Project construction.

Television

The **Appendix E** study examined impacts to television (TV) service. While impacts to television reception are still not well known, interference is expected to be limited to areas near a turbine that is within the line-of-site between a transmitting tower and a TV receptor, areas near the edge of TV station reception, and in areas of complex topography. Impacts to low power stations and translator stations are not anticipated to occur because those stations have a limited range. Full power TV stations have the potential to experience impacts if the wind farm is located in the line-of-site of the TV tower. Two full power TV towers (call signs KDLT-TV and KSMN) could possibly experience reception degradation if the Project is in the line-of-sight between the towers and their receptors.

Other Local Services

Lake Benton Wind II has employed a minimum setback of 534 feet (163 meters) from railroad ROW. The Applicant will coordinate with the Burlington Northern Santa Fe Railroad regarding the installation of Project collector line underneath the railroad. The Applicant will obtain approval from the railroad and the crossing of the railroad will be in compliance with standards as required by Burlington Northern Santa Fe.

Efforts are underway to identify the exact location of the existing Magellan 8" pipeline located in the Project Area. Turbines will be setback from the pipeline a minimum of 1.1 times the turbine tip height. The Applicant will coordinate with the Magellan Pipeline Company regarding the installation of project facilities in the vicinity of the pipeline and will obtain agreement or approval from the pipeline company as appropriate.

No impacts are expected to other existing local services or infrastructure, as the Project will avoid all such infrastructure. Should unknown infrastructure be identified during Project development or construction activities, the Applicant will coordinate with infrastructure owners as appropriate to minimize impact to end-users.

Septic services will be managed via portable toilets throughout project construction. All waste materials will be removed and disposed of appropriately off-site. The O&M building will require the construction of a permanent dedicated septic system. This will be constructed in accordance with local regulations and internal best practices.

Water used throughout the construction phase will be responsibly sourced per local regulation and internal best practices. The O&M building as currently proposed will incorporate a permanent well as a water source, which is to be constructed in accordance with local regulations and internal best practices.

8.5.6 Mitigation Measures

Traffic and Roads

Turbines have been sited based upon national, state, and local guidelines and standards and will have a setback of no less than 250 feet (76 meters) from the edge of the public road ROW. Lake Benton Wind II has also located turbines to minimize traffic congestion along major highways that border the Project. Prior to construction, Lake Benton Wind II will coordinate with applicable local and state road agencies to ensure all applicable permits are obtained, delivery plans are communicated, traffic management plans are implemented where necessary, and weight limits are not exceeded. Lake Benton Wind II will formalize road development agreements with applicable roadway authorities to ensure that impacted or damaged roadways will be restored to their original condition or better. Lake Benton Wind II will require, through

its contract provisions, that the general contractor be in contact with the relevant road authorities during construction. Temporary impacts to the landscape associated with temporary access road approaches, the crane walk, and other temporary activities will be restored to previous conditions (*i.e.*, converted back to cropland or otherwise reseeded with native seed mixes appropriate for the region).

Telephone

At this time, impacts to telephone service are not anticipated. If inadvertent impacts to the system are identified during or after construction, Lake Benton Wind II will address these impacts on a case-by-case basis.

Microwave Beam Paths

Lake Benton Wind II has taken microwave beam paths into consideration during turbine siting and has worked to avoid impacts to these systems. Lake Benton Wind II will operate the Project in accordance with FCC regulation and other laws to avoid impacts to microwave, radio, or navigation systems.

AM/FM Radio

AM/FM radio stations are located far enough away from the Project Area that typical impacts are not expected. Lake Benton Wind II will address any reception impacts which may arise following construction of the Project on a case-by-case basis. Lake Benton Wind II does not propose specific mitigation measures at this time.

Fixed Land Mobile Stations

In the unlikely event that land mobile licenses experience impacts to coverage due to the Project, Lake Benton Wind II will address these issues on a case-by-case basis. Lake Benton Wind II does not propose specific mitigation measures at this time.

Television

The **Appendix E** study conducted an electromagnetic interference analysis for the Project and concluded that TV interference is expected to be limited to areas near a turbine that are within the line-of-site between a transmitting tower and a TV receptor. In the unlikely event that TV interference is reported following Project construction, Lake Benton Wind II will work with affected residents or businesses to determine the cause of interference and, when necessary, reestablish TV reception and service in a timely manner. Reported TV interference will be addressed by Lake Benton Wind II on a case-by-case basis, and if reported Lake Benton Wind II will:

- Log the report and determine if the interference is Project related;

- Meet with the landowner and the local communications technician to determine the status of the affected television reception equipment;
- 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 DBS service;
- At the landowner's election, Lake Benton Wind II will either install the recommended equipment or enter into an agreement to reimburse the landowner for the cost of comparable DBS service;
- If the landowner chooses DBS service, Lake Benton Wind II will consider the matter closed upon installation of the satellite dish;
- If the landowner elects antenna and/or amplifier installation and later reports continued interference issues, Lake Benton Wind II will send a technician to the property to assess the status of the equipment and provide any necessary repairs;
- If Project related interference remains an issue, Lake Benton Wind II will propose an agreement that reimburses the landowner for the cost of comparable DBS service and will remove the antenna and/or amplifier equipment, unless it was initially installed to service multiple households; and
- If Lake Benton Wind II and the landowner are unable to reach an agreement to resolve interference-related issues, Lake Benton Wind II will report the concern as an unresolved complaint and defer to the Commission's dispute resolution process to resolve the matter.

Other Local Services

In the unlikely event that impacts to other local services occur due to the Project, Lake Benton Wind II will address these issues on a case-by-case basis. Lake Benton Wind II does not propose specific mitigation measures at this time.

8.6 Cultural and Archaeological Resources

8.6.1 Sites Potentially Affected

The majority of the Project Area is located in the Southwest Riverine Archaeological Region, with a small portion of the northeast corner occurring within the Prairie Lakes Archaeological Region. The Southwest Riverine Archaeological Region covers the southwestern-most corner of Minnesota, including most of Pipestone County. The Prairie Lakes Archaeological Region covers most of southwestern and south central Minnesota and includes a small portion of northeast Pipestone County (Hudak et al. 2002). Archaeological resources are predominantly concentrated along the Rock River and its associated drainages in this area; specifically resources would be expected near water sources on terraces, bluffs, and hilltops. However, archaeological resources have been documented in all kinds of landforms within the region.

In June 2017, the Applicant met with The State Historic Preservation Office (SHPO) and Minnesota Office of the State Archaeologist (OSA) to gather cultural resources records related to the Project Area. A Phase Ia Cultural Resources Literature Review (Literature Review) was conducted for the Project Area as well as a one mile buffer surrounding the Project Area. The report is included in **Appendix F - Phase Ia Cultural Literature Review**. The Literature Review identified two architectural inventory resources documented within one mile of the Project Area.

The two architectural inventory resources are the GN Depot (PP-RTC-001) and the Ruthton Co-op Creamery (PP-RTC-003), both of which are located in the City of Ruthton, Minnesota. Very little information is contained within the records for these architectural resources. Review of current aerial imagery indicates the GN Depot and the Ruthton Co-op Creamery are no longer extant, and, therefore, are considered not eligible for National Register of Historic Places (NRHP). There are no historic properties listed on the NRHP, Minnesota State Historic Sites Network, and the Minnesota State Register of Historic Places located within the Project Area or within one mile of the Project Area.

A literature review also identified 19 previously inventoried archeological sites within the Project Area and two archaeological sites within one mile of the Project Area, which are set forth in Table 8.6.1. Of the 19 sites located within the Project Area, seven are prehistoric isolated finds, five are prehistoric artifact scatters, four are prehistoric lithic scatter, one is a prehistoric habitation site, one is a historic artifact scatter, and one is an artifact scatter and a historic structural ruin with both prehistoric and historic cultural components. Archaeological site 21PP0031 has been recommended as ineligible for the NRHP. The remaining 18 archaeological sites have not been formally evaluated for the NRHP. The two archaeological sites located within one mile of the Project Area have been recommended as ineligible for listing on the NRHP.

Table 8.6.1: Previously Reported Archaeological Sites within One Mile of the Project Area

County	State Site Number	Site Name	Site Type	Cultural Affiliation	NRHP Eligibility Recommendation	Project Area/Within One Mile
Murray	21MU112	Unnamed	Artifact Scatter	Pre Contact	Recommended Not Eligible	Within One Mile
Murray	21MU114	Unnamed	Artifact Scatter; Lithic Scatter	Pre Contact	Recommended Not Eligible	Within One Mile
Pipestone	21PP0022	Hauselog Site	Artifact Scatter	Prehistoric	Unevaluated	Project Area
Pipestone	21PP0025	The Disappointing Site	Artifact Scatter	Prehistoric	Unevaluated	Project Area

County	State Site Number	Site Name	Site Type	Cultural Affiliation	NRHP Eligibility Recommendation	Project Area/Within One Mile
Pipestone	21PP0026	The Kallemeyr Site	Artifact Scatter	Prehistoric	Unevaluated	Project Area
Pipestone	21PP0029	The LaBrune Site	Boulder Teepee Ring and Boulder semi-circles	Archaic	Unevaluated	Project Area
Pipestone	21PP0031	Unnamed3	Artifact Scatter	Prehistoric	Recommended Not Eligible	Project Area
Pipestone	21PP0032	Klaus Site	Artifact Scatter	Historic	Unevaluated	Project Area
Pipestone	21PP0033	Francis Jr. Site	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0034	Bouman Site	Pre-Contact Artifact Scatter; Historic Structural Ruin	Pre Contact; Historic	Unevaluated	Project Area
Pipestone	21PP0035	LaVon Henry Site	Lithic Scatter	Indeterminate Prehistoric	Unevaluated	Project Area
Pipestone	21PP0036	Gangstad	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0037	Gopher Trap Site	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0038	Vander-Sluis Site	Lithic Scatter	Pre Contact/ Plains Village	Unevaluated	Project Area
Pipestone	21PP0039	Houselog Site	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0040	Brands Site	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0041	Venniewenhuyzen	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0042	Snack Site	Artifact Scatter	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0043	Reese Site	Lithic Scatter	Indeterminate Prehistoric	Unevaluated	Project Area
Pipestone	21PP0044	Alderson	Single Artifact	Pre Contact	Unevaluated	Project Area
Pipestone	21PP0045	Barke	Lithic Scatter	Pre Contact	Unevaluated	Project Area

As of the date of this filing, archaeological surveys have been initiated within the Project Area, and additional archaeological survey is planned concurrent with final siting of Project facilities. Prior to initiating archaeological surveys, Lake Benton Wind II conducted micrositing to identify suitable locations for facility components. Lake Benton Wind II invited several Tribes in the area to participate in micrositing and subsequent archaeological surveys; the following tribes chose to participate: Yankton Sioux Tribe, Upper Sioux Community, and Rosebud Sioux Tribe.

During micrositing, the locations of six previously recorded archeological sites were reviewed in the field. These previously recorded archeological sites are listed in Table 8.6.1a below and descriptions of the field evaluations are provided. These sites were not able to be relocated in the field, with the exception of the structural ruins located at 21PP0034, and are listed as unevaluated for the NRHP.

Table 8.6.1a: Previously Recorded Archaeological Sites Reviewed During Micrositing

State Site Number	Site Name	Site Type	Cultural Affiliation	NRHP Eligibility Recommendation	Current Site Condition	Existing Infrastructure
21PP0032	Klaus Site	Artifact Scatter	Historic	Unevaluated	No site remains noted	Existing access road
21PP0033	Francis Jr. Site	Single Artifact	Pre Contact	Unevaluated	No site remains noted	Existing access road and existing turbine pad
21PP0034	Bouman Site	Pre-Contact Artifact Scatter; Historic Structural Ruin	Pre Contact; Historic	Unevaluated	Concrete rubble and structural ruins noted	Existing access road
21PP0038	Vander-Sluis Site	Lithic Scatter	Pre Contact/Plains Village	Unevaluated	No site remains noted	Existing access road and existing turbine pad
21PP0041	Venniewen-huyzen	Single Artifact	Pre Contact	Unevaluated	No site remains noted	Existing access road

21PP0045	Barke	Lithic Scatter	Pre Contact	Unevaluated	No site remains noted	Existing access road and existing turbine pad

As a result of the archaeological surveys, one isolated archaeological occurrence was identified. Based upon the isolated nature and limited informational potential of the isolated occurrence, the archaeological site listed in Table 8.6.1b below does not appear eligible for listing on the NRHP.

Table 8.6.1b: Identified Archaeological Sites within Proposed Project Infrastructure

Field Site Number	Site Name	Site Type	Cultural Affiliation	NRHP Eligibility Recommendation	Proposed Infrastructure
IO-39	None	Single Artifact	Pre Contact	Not Eligible	Proposed turbine pad

A total of five Native American Sensitive sites were identified during field investigations. These five Native American Sensitive sites are listed in Table 8.6.1c below. These five Native American Sensitive sites were located within areas initially planned for Project infrastructure; however, project infrastructure has since been redesigned to avoid these five sites. However, two Native American Sensitive sites, LBII-43 and LBII-G104, are located within existing infrastructure. The Rosebud Sioux Tribe provided an area of no intrusion to protect LBII-43 during existing project decommissioning and Project construction. Lake Benton Wind II plans to avoid the no intrusion area and is continuing discussions with Tribes in the region. The five Native American Sensitive sites have not been formally evaluated by the Tribes or for listing on the NRHP.

Table 8.6.1c: Identified Native American Sensitive Sites within Project Area

Field Site Number	Site Name	Site Type	Cultural Affiliation	NRHP Eligibility Recommendation	Proposed/Existing Infrastructure
LBII-34	None	Rock Feature	Pre Contact	Unevaluated	None
LBII-41	None	Rock Feature and Raised Feature	Pre Contact	Unevaluated	None
LBII-43	RST 110317-1	Rock Alignment	Pre Contact/ Lakota/Dakota/Nakota	Unevaluated	Existing turbine pad

LBII-44	RST 110317-1	Traditional Cultural Plants	Pre Contact	Unevaluated	None
LBII-G061	None	Rock Feature	Pre Contact	Unevaluated	In vicinity of existing turbine pad
LBII-G104	None	Rock Feature	Pre Contact	Unevaluated	In vicinity of existing turbine pad
LBII-G117	None	Rock Alignment	Pre Contact	Unevaluated	In vicinity of existing turbine pad
LBII-G119	None	Rock Alignment	Pre Contact	Unevaluated	In vicinity of existing turbine pad
LBII-G120	None	Rock Alignment	Pre Contact	Unevaluated	In vicinity of existing turbine pad

8.6.2 Potential Cultural and Archaeological Impacts

While Lake Benton Wind II implements an avoidance strategy for cultural resources, the proposed construction activities for the Project may impact unidentified archaeological sites within the region of the Project. Should impacts to cultural resources that appear eligible for listing on NRHP be unavoidable, Lake Benton Wind II will consult with the Tribes, SHPO and/or OSA on whether or not the resource is eligible for listing in the NRHP. In addition, should Lake Benton Wind II impact unidentified archaeological sites during Project construction Lake Benton Wind II will follow an unanticipated discovery plan (UADP) to address any unanticipated discoveries of cultural resources, including archaeological sites and possible human remains. Further information concerning the UADP is discussed below. With these avoidance and mitigation measures in place, impacts on cultural and archeological resources are expected to be minimal.

Coordination with the SHPO was initiated for the Project by submitting a letter which included the Phase Ia Cultural Resources Literature Review (see **Appendix F - Phase Ia Cultural Literature Review**) on October 11, 2017. The SHPO replied with a letter dated November 14, 2017 (SHPO Number 2018-0219) stating their concurrence with the avoidance of known archaeological resources, if at all possible, and recommending that a Phase I archaeological survey be completed for areas of proposed ground disturbance within previously determined high and medium archaeology probability areas (see **Appendix B - Agency Correspondence and Responses**). As previously stated, archaeological surveys have been initiated for the Project.

The locations of six previously recorded archaeological sites were re-examined during micrositing. These sites are located within existing infrastructure and are listed as unevaluated for listing on the NRHP. While existing infrastructure, such as access roads, will continue to be used for the proposed Project, additional ground disturbance is not planned to impact locations. One isolated archaeological occurrence was identified during archaeological survey efforts, IO-

39, which is located within proposed Project infrastructure. Atwell recommended IO-39 as not eligible for the NRHP and Lake Benton Wind II does not plan to avoid the site. As no NRHP listed or eligible sites have been identified, no impacts to NRHP resources are expected.

Five Native American Sensitive Sites were identified during micrositing and archaeological survey efforts. The proposed Project infrastructure was re-sited to avoid impacts to these five locations and as such no impacts to tribally sensitive sites are expected. Lake Benton Wind II continues to coordinate with Tribes in the region.

8.6.3 Mitigation Measures

Lake Benton Wind II will attempt to avoid impacts to previously recorded archaeological resources that are considered significant and any discovered significant archaeological, architectural or Native American sensitive resources during all phases of the Project. Additional Phase I archaeological surveys will be conducted prior to Project construction, as applicable. If significant archaeological resources are identified during the Phase I archaeological surveys, the integrity and significance of the resource(s) will be assessed in terms of the potential for NRHP eligibility. If the identified resource(s) are determined to be significant and cannot be avoided by the Project, further investigation and/or mitigation of the resource may be needed and will be coordinated with the Tribes, SHPO and/or OSA. While avoidance of archaeological resources would be the preferred option, mitigation of impacts to NRHP-eligible archaeological resources may be necessary. The results of this additional investigation or mitigation will be described and documented on a case-by-case basis by compilation into a report, or reports, and shared with the Tribes, SHPO, and/or the OSA.

The Applicant will develop and implement a UADP to be followed if cultural resources or human remains are inadvertently discovered to ensure that the appropriate authorities (SHPO and/or OSA, as applicable) are involved quickly and in accordance with local and state regulations. Should human remains be inadvertently discovered the UADP will also address Minnesota's *Damages; Illegal Molestation of Human Remains; Burials; Cemeteries; Penalty; Authentication Statute* (MS 307.08), which protects known or suspected human burials and burial grounds regardless of land ownership status.

8.7 Recreational Resources

8.7.1 Description of Resources

Pipestone County provides a variety of recreational opportunities including hiking, fishing, hunting, camping, snowmobiling, and nature viewing. Information from the USFWS, MNDNR, and Pipestone County were reviewed to identify recreational resources in the vicinity of the Project Area. Several WMAs, an SNA, a State Aquatic Management Area (AMA), WPAs, Walk-In Access (WIA) Program parcels, county parks, and snowmobile trails and are located within and near the Project Area.

WMAs are owned by the State of Minnesota and were established to protect and manage lands and waters for wildlife production, public hunting, trapping, fishing or other recreational activities. Minnesota has approximately 1,500 WMAs, consisting of over 1.3 million acres of public land (MNDNR 2017a). There are four WMAs within the Project Area comprising approximately 379 acres. Additionally, there are 50 WMAs located within ten miles of the Project Area. These WMAs are included in Table 8.7.1, below.

Table 8.7.1: Wildlife Management Areas within Ten Miles of the Project Area

Distance from Project Area (mi)	WMA Name	General Location Relative to Project Area	WMA Area (Acres)
0.0	Gromer's Draw WMA	Within Project Area	87.4 (35.4 hectares)
0.0	Buffalo Ridge WMA	Within Project Area	41.1 (16.6 hectares)
0.0	Woodstock WMA: East Unit	Within Project Area	203.9 (82.5 hectares)
0.0	Woodstock WMA: West Unit	Within Project Area	46.3 (18.7 hectares)
0.0	Van Beek WMA	Abuts Project Area	22.8 (9.2 hectares)
0.8 (1.3 km)	Holland WMA	West of Project Area	39.3 (15.9 hectares)
0.8 (1.3 km)	Coteau Pit WMA	West of Project Area	80.7 (32.7 hectares)
1.1 (1.8 km)	Lange WMA	East of Project Area	62.9 (25.5 hectares)
2.0 (3.2 km)	Adolph Lofthus WMA	East of Project Area	106.0 (42.9 hectares)
2.3 (3.7 km)	Van Eck WMA	East of Project Area	76.7 (31.0 hectares)
2.4 (3.9 km)	Ruthton WMA: West Unit	East of Project Area	54.5 (22.1 hectares)
2.7 (4.4 km)	Ruthton WMA: Central Unit	East of Project Area	158.9 (64.3 hectares)
2.8 (4.5 km)	Klinker WMA	East of Project Area	531.5 (215.1 hectares)
3.0 (4.8 km)	Terrace WMA	Southwest of Project Area	445.4 (180.3 hectares)
3.2 (5.2 km)	Ruthton WMA: East Unit	East of Project Area	80.1 (32.4 hectares)

Distance from Project Area (mi)	WMA Name	General Location Relative to Project Area	WMA Area (Acres)
3.5 (5.6 km)	Degroot WMA: West Unit	East of Project Area	69.4 (28.1 hectares)
3.9 (6.3 km)	Degroot WMA: East Unit	East of Project Area	5.3 (2.2 hectares)
4.0 (6.4 km)	Tutt WMA	East of Project Area	102.7 (41.6 hectares)
4.0 6.4 km)	Hole-In-Mountain WMA	Northwest of Project Area	637.9 (258.2 hectares)
4.1 (6.6 km)	Hope WMA	North of Project Area	213.8 (86.5 hectares)
4.2 (6.8 km)	Hjermstad WMA: Dather Slough Unit	East of Project Area	36.3 (14.7 hectares)
4.3 (6.9 km)	Altona WMA	West of Project Area	551.8 (223.3 hectares)
4.4 (7.1 km)	Tyler WMA	North of Project Area	400.9 (162.2 hectares)
4.7 (7.6 km)	Ellsborough WMA	East of Project Area	80.3 (32.5 hectares)
5.4 (8.7 km)	Discors WMA	North of Project Area	43.3 (17.5 hectares)
5.4 (8.7 km)	Hjermstad WMA: East Unit	East of Project Area	231.3 (93.6 hectares)
6.0 (9.7 km)	Winter WMA: East Unit	West of Project Area	12.9 (5.2 hectares)
6.0 (9.7 km)	Reinhold WMA	East of Project Area	21.4 (8.7 hectares)
6.0 (9.7 km)	Mccord-Laible WMA	East of Project Area	76.0 (30.8 hectares)
6.0 (9.7 km)	Shelburne WMA	East of Project Area	162.1 (65.6 hectares)
6.2 (10.0 km)	Nelson WMA: Streff Unit	East of Project Area	19.3 (7.8 hectares)
6.2 (10.0 km)	Nyroca Flats WMA	Northeast of Project Area	42.3 (17.1 hectares)
6.2 (10.0 km)	Nelson WMA: Main Unit	East of Project Area	181.3 (73.4 hectares)
6.2 (10.0 km)	Winter WMA: South Unit	West of Project Area	257.5 (104.2 hectares)
6.4 (10.3 km)	Troy WMA	West of Project Area	54.6 (22.1 hectares)

Distance from Project Area (mi)	WMA Name	General Location Relative to Project Area	WMA Area (Acres)
6.5 (10.5 km)	Current WMA: Island Unit	East of Project Area	4.1 (1.7 hectares)
6.7 (10.8 km)	Current WMA: Central Unit	East of Project Area	8.5 (3.4 hectares)
6.7(10.8 km)	Marshfield WMA	North of Project Area	74.7 (30.2 hectares)
6.8 (10.9 km)	Bergman WMA	East of Project Area	33.6 (13.6 hectares)
7.1 (11.4 km)	Winter WMA: West Unit	West of Project Area	310.6 (125.7 hectares)
7.2 (11.6 km)	Schindel WMA	Northwest of Project Area	156.2 (63.2 hectares)
7.3 (11.8 km)	Norgaard WMA	North of Project Area	21.1 (8.5 hectares)
7.4 (11.9 km)	Sioux Lookout WMA	Northwest of Project Area	83.1 (33.6 hectares)
7.7 (12.4 km)	Leeds WMA	Southeast of Project Area	153.8 (62.2 hectares)
7.7 (12.4 km)	Burke WMA	Southwest of Project Area	105.9 (42.9 hectares)
7.9 (12.7 km)	Chen Bay WMA	North of Project Area	257.2 (104.1 hectares)
7.9 (12.7 km)	Salt & Pepper WMA	South of Project Area	99.3 (40.2 hectares)
9.0 (14.5 km)	Great Oasis WMA	East of Project Area	123.5 (50.0 hectares)
9.1 (14.6 km)	Pipestone WMA	Southwest of Project Area	113.2 (45.81 hectares)
9.5 (15.3 km)	Chandler WMA: North Unit	Southeast of Project Area	38.6 (15.6 hectares)
9.5 (15.3 km)	Peters WMA	Southeast of Project Area	72.5 (29.3 hectares)
9.9 (15.9 km)	Dead Coon Marshes WMA	Northeast of Project Area	8.7 (3.5 hectares)
9.9 (15.9 km)	Collinson WMA	North of Project Area	19.3 (7.8 hectares)
9.9 (15.9 km)	Chandler WMA: South Unit	Southeast of Project Area	3.5 (1.4 hectares)

Minnesota's state SNAs are lands that are set aside for scientific study and to promote public understanding. They may consist of native plant and animal communities, rare species, and areas of significant biodiversity. The goals of the SNA program are to preserve Minnesota's natural heritage and to provide opportunities for nature-based recreation, education, and research (MNDNR 2017b). One SNA, Prairie Coteau SNA, is located within the Project Area and consists of approximately 420 acres (170 hectares). No other SNAs are located within ten miles of the Project Area.

State AMAs are management areas meant to protect, develop, and manage aquatic resources that are critical to the preservation of aquatic life for their water quality, intrinsic biological value, public fishing, and other outdoor recreational uses (MNDNR 2017c). State AMAs were not identified within the Project Area. However, one AMA, Lake Benton, is located approximately 5.3 miles (8.5 kilometers) from the Project Area. Additionally, other lakes, ponds, and rivers used for recreational purposes appear present within the Project Area and within ten miles (16 kilometers) of the Project Area.

WPAs are public lands managed by USFWS that are meant to preserve habitat for waterfowl and other wildlife. These areas are typically wetlands or grasslands that provide roosting and nesting habitat for waterfowl. Most of these federally-managed wetlands and surrounding uplands are open to hunting (USFWS 2015c). No WPAs are present within the Project Area. However, nine WPAs are located within ten miles (16 kilometers) of the Project Area and are displayed in Table 8.7.1a.

Table 8.7.1a: Waterfowl Production Areas within Ten Miles of the Project Area

Distance from Project Area (mi)	WPA Name	General Location Relative to Project Area	WPA Area (Acres)
5.9 (9.5 km)	Lyon County WPA	Northeast of Project Area	48.5 (19.6 hectares)
7.6 (12.2 km)	Lyon County WPA	Northeast of the Project Area	58.9 (23.8 hectares)
8.0 (12.9 km)	WPA	Northeast of the Project Area	235.7 (95.4 hectares)
8.1 (13.0 km)	Lyon County WPA	Northeast of the Project Area	11.0 (4.5 hectares)
8.2 (13.2 km)	Fox WPA	North of the Project Area	146.1 (59.1 hectares)

Distance from Project Area (mi)	WPA Name	General Location Relative to Project Area	WPA Area (Acres)
8.3 (13.4 km)	Lyon County WPA	Northeast of the Project Area	57.4 (23.2 hectares)
8.3 (13.4 km)	Lyon County WPA	Northeast of the Project Area	30.2 (12.2 hectares)
8.6 (13.8 km)	Weber WPA	North of the Project Area	160.1 (64.8 hectares)

The MNDNR WIA program provides the public an opportunity to hunt on private land that is already enrolled in an existing conservation program or that consists of high quality natural cover. Land owners, at their own discretion, may choose to enroll their property into the WIA program and allow residents of Minnesota to freely hunt on their property between September 1 and May 31. Typically, WIA agreements are active for one to three years (MNDNR 2017d). Review of GIS data identified four WIA parcels within the Project Area and an additional 14 WIA parcels within 10 miles (16 kilometers) of the Project Area. Table 8.7.1b, below, includes a list of the identified WIA parcels.

Table 8.7.1b: WIA Parcels within Ten Miles of the Project Area

Distance from Project Area (mi)	WIA Name	General Location Relative to Project Area	WPA Area (Acres)
0.00	Pipestone WIA #129	Within the Project Area	147.65 (59.75 hectares)
0.00	Pipestone WIA #225	Within the Project Area	80.68 (32.65 hectares)
0.00	Pipestone WIA #226	Within the Project Area	166.89 (67.54 hectares)
0.00	Pipestone WIA #358	Within the Project Area	48.30 (19.55 hectares)
0.02 (0.03 km)	Lincoln WIA #74	North of the Project Area	76.15 (30.82 hectares)

Distance from Project Area (mi)	WIA Name	General Location Relative to Project Area	WPA Area (Acres)
0.50 (0.80 km)	Murray WIA #144	East of the Project Area	104.99 (42.49 hectares)
1.50 (2.41 km)	Murray WIA #148	Southeast of the Project Area	62.78 (25.41 hectares)
2.52 (4.06 km)	Murray WIA #150	East of the Project Area	236.79 (95.83 hectares)
2.86 (4.60 km)	Lincoln WIA #348	Northeast of the Project Area	50.47 (20.43 hectares)
3.02 (4.86 km)	Murray WIA #141	Southeast of the Project Area	116.97 (47.34 hectares)
3.23 (5.20 km)	Pipestone WIA #179	Southwest of the Project Area	145.21 (58.76 hectares)
4.69 (7.55 km)	Lincoln WIA #217	North of the Project Area	10.80 (4.37 hectares)
5.12 (8.24 km)	Pipestone WIA #127	West of the Project Area	541.41 (219.10 hectares)
6.61 (10.64 km)	Lincoln WIA #219E	Northwest of the Project Area	95.13 (38.50 hectares)
6.82 (10.98 km)	Murray WIA #347	East of the Project Area	116.82 (47.28 hectares)
7.81 (12.57 km)	Lincoln WIA #219W	Northwest of the Project Area	64.38 (26.05 hectares)
8.06 (12.97 km)	Lincoln WIA #201	Northwest of the Project Area	161.54 (65.37 hectares)
8.98 (14.45 km)	Lincoln WIA #218	North of the Project Area	32.97 (13.34 hectares)

Parks and public trails are also types of publically-managed lands that provide outdoor recreational opportunities to the public. There are no federal, state, or city parks located within

the Project Area. However, three county parks are located within ten miles of the Project Area and are displayed in Table 8.7.1c. Additionally, one public trail, the Casey Jones Trail, occurs approximately 3.6 miles (5.8 kilometers) south of the Project Area, near Woodstock.

Table 8.7.1c: County Parks within Ten Miles of the Project Area

Distance from Project Area (mi)	County Park Name	General Location Relative to Project Area	County Park Area (Acres)
4.2 (6.8 km)	Twin Lakes County Park	Northeast of Project Area	27.5 (11.1 hectares)
6.3 (10.1 km)	Hole in the Mountain County Park	Northwest of Project Area	800 (324 hectares)
6.5 (10.5 km)	Norwegian Creek County Park	Northwest of Project Area	140 (57 hectares)

Snowmobiling is a popular recreational activity throughout Minnesota, with state designated trails traversing most of the state. Although the trails are state designated, most snowmobile trails are monitored and maintained by the local snowmobile clubs. The closest snowmobile trail to the Project, the "Hiawatha Sno" Blazers Trail, is located approximately 1.5 miles (2.4 kilometers) southwest of the Project Area, on the southwest side of Holland. Three additional snowmobile trails are located within 10 miles of the Project Area including the Lincoln County Drift Clipper Trails, Lyon County Trail, and Beaver Creek Trail.

8.7.2 Potential Impacts

Although several public and recreational lands are located within and adjacent to the Project Area, the Project has been designed in a way that will avoid direct impacts to recreational resources and public lands. No turbines have been sited within public lands or designated recreational resources, and turbines will be sited consistent with the 3 RD X 5 RD setback of WMAs, SNAs, AMAs, WPAs, and county parks. However, turbines located within the viewshed of recreational resources and lands managed by the MNDNR may affect the aesthetic quality of those areas. As many turbines already exist within the Project Area the Project will not introduce a new feature type within the viewshed of the Project Area.

As shown on **Map 6 (Public Land Ownership & Recreation)**, there are four WMAs, four WIAs, and one SNA within the Project Area, and additional 50 WMAs, one AMA, nine WPAs, three county parks, and 14 WIAs within ten miles (16 kilometers) of the Project Area. Additionally, there are four snowmobile trails within 10 miles of the Project Area, with the closest located approximately 1.5 miles (2.4 kilometers) southwest of the Project Area. No

direct impacts will occur to these resources due to responsible siting of turbines. Wind turbines may be visible from many of the public lands and snowmobile trails, but the exact degree of impact to the viewshed will vary based on type of observer and individual preference. Further information regarding potential visual impacts to public lands and recreational resources in relation to the Project Area is found in Section 8.4.

8.7.3 Mitigation Measures

No direct impacts to recreational resources are anticipated as a result of the Project as all turbines have been sited outside of recreational resources. Typical mitigation includes following, at minimum, the setback guidance for public lands of 3 RD X 5 RD. Additional mitigation measures related to potential visual impacts to public lands and recreational resources are detailed in section 8.4.3.

8.8 Public Health and Safety

8.8.1 Electromagnetic Fields and Stray Voltage

The term electromagnetic fields (EMF) refers to electric and magnetic fields that are coupled together, such as in high frequency radiating fields. For lower frequencies associated with power lines (referred to as extremely low frequencies or ELF), EMF should be separated into electric fields (EF), measured in kilovolts per meter (kV/m), and magnetic fields (MF), measured in milliGauss (mG). EFs are dependent on the voltage and MFs are dependent on the current. The intensity of an EF is proportional to the voltage of the line, and the intensity of an MF is proportional to the current flow through the conductors. Power lines in the United States operate at a power frequency of 60 Hz (cycles per second).

This section discusses electromagnetic fields associated with the Project.

8.8.1.1 Electric Fields

The 34.5 kV underground power cable used in the Project collector system is shielded, meaning the energized conductor is located at the center of the cable and is completely surrounded by a grounded metallic shield. This construction confines the electric field to the interior of the cable. Thus, there is no detectable EF produced by the cable or by any other components of the Project collection system.

8.8.1.2 Magnetic Fields

A MF is produced by the flow of current through a conductor or cable. The Project's collector system is a three phase system, which requires three separate cables to make up each circuit. The three cables that comprise a circuit are installed in close proximity to each other, with the entire assembly buried approximately 48 inches (122 centimeters) below grade. This method of installation causes the magnetic fields produced by each cable to be largely cancelled out by the

fields produced by the other cables, resulting in relatively low magnetic fields even at ground level directly above the cables.

The estimated MF calculations are assuming maximum current when all turbines are operating at 100% on the most heavily loaded cables. These maximum values represent the collection cables nearest to the substation, specifically, between the low side of Generator Step-Up transformer at collector substation and the first junction cabinet from the substation, with the cables laid flat but reasonably close together, so it represents the highest field that can reasonably be expected from the entire 34.5kV system. Table 8.8.1.2 shows maximum calculated MF values for the collection system home run cables. Home run cables are the largest cables carrying the most current within the collection system design. The values in Table 8.8.1.2 represent the maximum possible MF values, at a height of one (1) meter (3 feet) above the ground, under a maximum generation condition.

The MF profile data shows that MF levels decrease rapidly as the distance from the centerline increases (proportional to the inverse square of the distance from the source). The maximum calculated MF profiles around the collector lines considered for this project and for the life of the project are shown in Table 8.8.1.2.

Table 8.8.1.2: Estimated Magnetic Fields (mG)

Structure Type	System Condition	Current (Amps)	Distance to Proposed Centerline								
			-100' (-31 m)	-75' (-23 m)	-50' (-15 m)	-25' (8 m)	0'	25' (8 m)	50' (15 m)	75' (23 m)	100' (31 m)
Home run cable (34.5kV)	Normal	502	0.16	0.25	0.64	2.14	36.31	2.14	0.64	0.25	0.16

8.8.1.3 Stray Voltage

"Stray Voltage," as defined by IEEE, is "A voltage resulting from the normal delivery and/or use of electricity (usually smaller than 10 volts) that may be present between two conductive surfaces that can be simultaneously contacted by members of the general public and/or animals. Stray voltage is caused by primary and/or secondary return current, and power system induced currents, as these currents flow through the impedance of the intended return pathway, its parallel conductive pathways, and conductive loops in close proximity to the power system. Stray voltage is not related to power system faults, and is generally not considered hazardous."

"Stray voltage" generally refers to a voltage between the grounded neutral of a distribution system and the Earth. Most instances of stray voltage can be traced to unbalanced currents in distribution circuits, when the currents in the three phase conductors are not all equal. Lake

Benton Wind II's collector circuits are inherently balanced, so no appreciable neutral to Earth voltage is expected. Additionally, there will be no direct connection between Lake Benton Wind II's collection system and the local distribution system, and, therefore, no stray voltage from the electrical system is anticipated to impact the existing electrical system.

8.8.2 Potential Impacts

Extensive research has been conducted by the National Institute of Environmental Health regarding EMFs. To date, there is no conclusive research evidence that EMFs stemming from power lines pose significant impacts to health (Boorman GA et al. 1999). EMFs from underground electrical collection and feeder lines dissipates quickly and relatively close to the source due to the fact that they are buried underground, heavily insulated, and also shielded. Research has shown that electrical fields surrounding buried lines are negligible, and magnetic fields often dissipate significantly within approximately three feet (1 meter) of stronger EMF sources, such as transmission lines and transformers (CDC 2014).

Stray voltage is a natural phenomenon that is the result of low levels of electrical current flowing between two points that are not directly connected. Electrical systems, including farm systems and utility distribution systems, must be adequately grounded to ensure continuous safety and reliability and to minimize this current flow. Potential effects from stray voltage can result from a person or animal coming in contact with neutral-to-earth voltage. Stray voltage does not cause electrocution and is not related to ground current, EMF, or Earth currents.

8.8.3 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 residences, EMF's associated with the Project are not expected to have an impact on public health and safety.

Electrical equipment will be grounded per ASNI and NESC guidelines to ensure safety and reliability. Correctly connecting and grounding electrical equipment will prevent potential issues related to "stray voltage." Stray voltage is typically not associated with underground electric collector lines, which connect to the Project substation and are not tapped or diverted for other uses. Therefore, stray voltage is not expected to have an impact on public health and safety.

8.8.4 Aviation

A review of the FAA National Airspace Systems Resources database revealed seven active registered airports and heliports located within 20 miles (32 kilometers) of the Project Area (Capitol Airspace Group 2017). Details about these airports are set forth in Table 8.8.4. The public airports nearest the project are Tyler Municipal Airport (6.54 miles (10.53 kilometers)

north of the Project Area Boundary) and Pipestone Municipal Airport (10.53 miles (16.95 kilometers) southwest of the Project Area Boundary).

Table 8.8.4: Airports within 20 Miles of the Project Area

Airport Name	City	County, State	Distance from the Project Area Boundary (Miles)	Runway Information	Runway Elevation (ft)
Tyler Municipal Airport (Public)	Tyler	Lincoln, MN	6.54	1 Turf	1,742
Pipestone Municipal Airport (Public)	Pipestone	Pipestone, MN	10.53	1 Asphalt/ 1 Turf	1,736/1,727 1724/1,736
Pipestone County Medical Center Heliport	Pipestone	Pipestone, MN	10.78	Roof-Top	1,723
Dykstra Acreage Airport (Private)	Trosky	Pipestone, MN	14.34	Turf	1,690
Slayton Municipal Airport (Public)	Slayton	Murray, MN	15.06	Asphalt	1,615/1,623
Mulder Field Inc. Airport (Private)	Ivanhoe	Lincoln, MN	17.85	Turf	1,669
Flandreau Medical Center Heliport	Flandreau	Moody, SD	19.58	Concrete	1,723

(AirNav 2017)

There are no registered public airports located within the Project Area. The closest registered airport is the Tyler Municipal Airport located approximately 6.54 miles (10.53 kilometers) away from the northern extent of the Project Area. This is a public-use airport with one 2,600 foot (793 meter) turf runway (Runway 14/32) with no published instrument approach procedures.

Due to the agricultural use within the region, small private runways may be associated with crop dusting activities within or near the Project Area.

Aviation Towers

The **Appendix E** study did not identify active aviation towers within the Project Area. Aviation towers provide radio communications related to air traffic. Four aviation towers are located within 25 kilometers (15.5 miles) of the Project Area. The aviation towers have the call signs KFP4, KNB7, KXI9, and WQDA480. Refer to Table 8.5.2 for a summary of FCC licensed signals within the Vicinity of the Project Area.

8.8.5 Potential Impacts

Under 14 CFR Part 77.9, all structures exceeding 200 feet (61 meters) above ground level (AGL) must be submitted to the FAA so that an aeronautical study can be conducted. The purpose for the study is to identify obstacle clearance surfaces that could limit the placement of wind turbines. The end result of the aeronautical study is the issuance of a determination of 'hazard' or 'no hazard'. Additionally, a Tall Towers Permit and approval may be required by the MnDOT prior to developing the Project to ensure the safety of airspace within Minnesota. A permit from MnDOT is required for any of the following (MnDOT 2017a):

- Structure is greater than 500 feet (152 meters) AGL;
- Structure is more than 200 feet (61 meters) AGL within three nautical miles (6 kilometers) of an airport and increasing by 100 feet (31 meters) for each additional mile out to six miles or 500 feet (152 meters);
- Structure would increase an instrument approach minimum flight altitude or increase its flight visibility minimums;
- Structure would increase the minimum obstruction clearance altitude of a federal airway; or
- Structure penetrates any of the following imaginary surfaces: primary, horizontal, conical, approach, or transitional surfaces

To determine potential impacts to aviation associated with the development of the Project, Lake Benton Wind II contracted Capitol Airspace Group to conduct an Obstruction Evaluation for the Project Area for turbine heights up to 485 feet (148 meters). The summary of that report is detailed below.

At 485 feet (148 meters) AGL, the proposed turbines will not exceed 14 CFR Part 77.17(a)(1), 77.17(a)(2), or 77.19 imaginary surfaces.

Obstacle clearance surfaces overlying the Project Area are either constant 2,349 or 2,500 feet (716 or 762 meters) AMSL and are associated with Southwest Minnesota Regional Marshall/ Ryan Field Airport (approximately 23 miles (approximately 37 kilometers) northeast of the

Project Area) instrument approach procedures and Sioux Falls Airport (approximately 45 miles (approximately 72 kilometers) southwest of the Project Area) TRACON minimum vectoring altitude sectors. The proposed wind turbines that exceed these surfaces would require an increase to instrument approach procedure minimum altitudes and/or minimum vectoring altitudes. USGS elevation data indicates that 485-foot (148 meter) AGL wind turbines would require an increase to Sioux Falls TRACON Sector F minimum vectoring altitude.

In addition, at 485 feet (148 meter) AGL, all proposed wind turbines would be in line of sight of the Tyler Department of Defense (DoD) and Department of the Air Force (USAF) Common Air Route Surveillance Radar (CARSR). Proposed wind turbines that create unwanted clutter resulting in false radar returns and a decrease in radar sensitivity could impact air traffic control operations. The FAA may conduct additional analysis to identify potential safety hazards and the associated risks to the National Airspace System. The additional analysis may add time to the FAA's review of proposed wind turbines and could ultimately result in the determinations of hazard.

Crop dusting activity usually occurs during daylight hours with good visibility, allowing pilots to have a clear line of site with obstacles. Therefore, impacts to crop dusting activities are expected to be minimal.

Aviation Towers

The **Appendix E** study determined that harmful interference is not expected to impact aviation towers. Additionally, Lake Benton Wind II received a No Harmful Interference Anticipated (NHIA) response from the FAA on 11/20/2017.

8.8.6 Mitigation Measures

A Determination of No Hazard will be obtained from FAA for each turbine and MET tower prior to turbine and MET tower construction. In order to avoid potential impacts to air traffic, the Applicant will mark and light turbines to comply with FAA requirements. In order to obtain Determinations of No Hazard, mitigation for potential impacts related to Sioux Falls TRACON Sector F minimum vectoring altitudes may include direct coordination with the FAA Obstacle Evaluation Group during Project review and may include performing an air traffic analysis to determine the volume of operations within this sector. If it is determined that there will be impacts to Sioux Falls TRACON Sector F, Lake Benton Wind II will work with the FAA to implement an appropriate mitigation strategy to reach a Determination of No Hazard. Additionally, mitigation for potential impacts to CARSR may include direct coordination with the DoD and USAF and may include a Radar Effects and Mitigation Study. If it is determined that wind turbines will impact the CARSR system, Lake Benton Wind II will work with the DoD and USAF to implement appropriate mitigation strategies to reach a Determination of No Hazard.

8.8.7 Safety and Security

The Project is located in a predominately rural area of Pipestone County. Emergency management response services within the Project Area are provided by the Pipestone County Sheriff, Pipestone County Ambulance, Tyler Ambulance, Holland Fire Department, Ruthton Volunteer Fire Department, and the Lake Wilson Fire Department. Pipestone County has a specific plan for preparedness, response, recovery, and mitigation, and works closely with local, state, and federal officials to educate, prepare for, respond to, and recover from disasters and large-scale emergencies.

8.8.8 Potential Impacts

Potential safety and security impacts associated with the construction of the Project include human emergencies and accidents, natural hazards, hazardous materials incidents, and traffic accidents. Potential safety and security impacts associated with the operation of the Project, though rare, include danger of falling ice, unauthorized access to electrical and mechanical components of turbines, and turbine malfunction and/or collapse. The Project complies will all required setbacks, and each turbine will be regularly inspected and maintained in good repair and condition. In addition to proactive maintenance, modern turbine technology has reduced these potential operational risks to insignificant rates.

The overall population density within the Project Area is relatively low. With low overall population density, impacts from construction and maintenance are not expected on the safety and security of the local populations. In the event that local residents need emergency services during Project construction, construction will cease and any impeding construction equipment and vehicles will be relocated so that emergency vehicles and services may access the emergency location. During operation, the Project will not interfere with emergency services.

8.8.9 Mitigation Measures

Lake Benton Wind II will integrate current engineering standards with applicable regulatory requirements throughout the project design. As the project enters construction, adaptive management strategies for safety and security impacts identified in Section 8.8.8 will be incorporated as on-going improvements within the project. The Applicant will actively work with the Pipestone County and other agencies, as appropriate, to prepare an emergency management plan for the Project to respond to emergencies, natural hazards, hazardous materials incidents, human-made problems (*e.g.*, fire, etc.), and related incidents. Additionally, Lake Benton Wind II will work closely with the Pipestone County to ensure adequate assignment of 911 addresses for coordination of emergency responses.

Lake Benton Wind II will develop a site O&M manual as well as a health and safety training plan for the Project, which will include contacts, education and training materials, actions plans and procedures to reduce the potential for safety and security issues. In addition, during

construction of the Project, access to sensitive site areas such as the POI stations will be restricted access control measures, including the use of keyed locks and fencing, to protect against unauthorized access to the Project's facilities and subsequent exposure to potential hazards. Additionally, contracted security services will be employed through construction to ensure the security of construction equipment and facilities. The site team will work with landowners individually to ensure any specific security concerns they may have are being addressed to their satisfaction.

Safety and security measures will be implemented by Lake Benton Wind II for the protection of personal property and of personal injury. These measures include:

- Wind turbine locations will be registered with Pipestone County for emergency responses and procedures related to the Project;

- Project turbines and towers will comply with the setback standards established by the Commission;

- Proper health and safety training of construction and maintenance contractors will occur;

- Lake Benton Wind II will partner with contractors who demonstrate a strong safety culture including management commitment & engagement, safe work policies and programs, employee involvement, and historic safe work performance indicators. Contractors shall implement safe work requirements that meet or exceed OSHA requirements, applicable permits, applicable equipment manufacture and technical work instructions and any other prudent safety practices, methods, and/or standards prudently and generally engaged in or observed by the majority of construction contractors for similar work in the United States that, in the exercise of reasonable judgement, would have been expected to be implemented in a manner consistent with applicable laws, rules and regulations, as well as applicable permits while in sites to achieve an accident and injury-free work place.

8.9 Hazardous Materials

8.9.1 Description of Resources

The predominant land use in the Project Area is agriculture. Potentially hazardous materials associated with the Project Area would likely include petroleum products (diesel fuel, gasoline, propane, heating oil, lubricants, and maintenance chemicals), pesticides, and herbicides used in prior or ongoing agriculture related activities. Contaminants associated with asbestos and/or lead based paint may be present due to the age of many of farmsteads within the Project Area and

polychlorinated biphenyls may also be present associated with pad-mounted and pole-mounted transformers. In addition, in rural areas, trash or junk piles are a common occurrence.

The MPCA "What's In My Neighborhood?" database (MPCA 2016a) of known and potential sources of soil and ground water contamination was reviewed for the Project Area. The MPCA database indicated that a total of 56 sites are listed within the Project Area, 47 of which are listed as active. Of these sites, there are 47 feedlots; three construction stormwater sites; one air site; one above ground tank site; one underground tank site; two unpermitted solid waste sites; and one multiple program site enrolled in the aboveground tank, hazardous waste, and petroleum remediation programs (MPCA 2016a).

During the construction of the Project, hazardous materials will be temporarily stored and utilized within the Project Area. These hazardous materials may consist of fuel, lubricating oil, hydraulic oil, propylene glycol, and other materials required for the construction of a wind farm. Additionally, during operation of the wind farm, hazardous materials, such as hydraulic oil, lube oil, grease, and cleaning solvents are necessary to maintain wind turbines and other equipment. Also, pad mounted and grounding transformers required for the operation of the Project contain large quantities of cooling fluids, likely consisting of mineral oil.

8.9.2 Potential Impacts

Prior to construction, the Applicant will conduct an ASTM-conforming Phase I Environmental Site Assessment to identify and avoid existing recognized environmental conditions (RECs) within the Project Area, particularly associated with facilities identified by the MPCA database.

Due to the presence of hazardous materials during construction and operation of the Project, there is the potential for spills and/or leaks. The primary concerns associated with these spills and/or leaks are the potential impacts to surface and ground water resources and the potential for soil contamination within the Project Area. To avoid potential impacts to water and soil resources, hazardous waste stored outdoors will be stored within secondary containment. Secondary containment will ensure that leaks, if they occur, will be contained and unable to impact important natural resources. Additionally, a Spill Prevention, Control, and Countermeasure Plan (SPCC) will be created for both the construction and operational phases of the Project. The SPCC will detail the appropriate storage, cleanup, and disposal of hazardous wastes to ensure potential impacts are avoided.

8.9.3 Mitigation Measures

Information from the Phase I Environmental Site Assessment will be used to identify and avoid, if necessary, any identified RECs. If RECs cannot be avoided, appropriate remediation, if required, will be conducted to avoid potential concerns associated with RECs. Any wastes generated during any phase of the Project will be handled and disposed of in accordance with Minnesota Rule Chapter 7045, local rules and regulations, and the site specific SPCC. Any

monitoring, transportation, or handling of materials will be conducted by trained and qualified personnel utilizing established procedures and proper equipment.

8.10 Land-Based Economies

8.10.1 Description of Resources

Land use within the Project Area is primarily agricultural, accounting for approximately 16,057 acres (6,498 hectares), or approximately 62.7 percent of the Project Area, as shown on **Map 18 (Land Cover)**. An additional 30.8 percent consists of hay/pasture/herbaceous land cover, much of which is used for livestock grazing (Homer et al. 2015). According to the 2012 USDA Agricultural Census Report, over 80 percent of the land in Pipestone County (roughly 241,970 acres (97,922 hectares)) was used for agriculture on approximately 637 farms. Corn, soybeans, and forage crops are the primary crops grown in Pipestone County, while swine and cattle are the predominant livestock raised in the county. Market value of agricultural products sold in the County for 2012 was approximately $307.9 million, with crop markets at approximately $117.3 million and livestock markets at approximately $190.6 million (USDA 2014).

Approximately 54.8 percent of the Project Area is classified as prime farmland, while 16 percent is classified as prime farmland, if drained. Additionally, 12.9 percent of land within the Project Area is not prime farmland and 13.4 percent is considered farmland of statewide importance (NRCS 2017).

The use of feedlots is a common practice in raising livestock in the state of Minnesota. The MPCA administers rules regulating livestock feedlots in Minnesota. According to MPCA's "What's In My Neighborhood" map search tool, there are 665 registered feedlots in Pipestone County, 47 of which are in the Project Area (MPCA 2016a).

8.10.2 Potential Impacts

The Project is not expected to significantly impact agricultural land use or the general character of the area. While an average 0.56 acres (0.23 hectares) of land per turbine will be taken out of agricultural production for the life of the Project to accommodate the turbine pad, access roads, and ancillary facilities, the landowners may continue to plant crops near, and graze livestock up to the gravel roadway around each turbine pad. The placement of turbines in agricultural fields is suggested in the USFWS Land Based Wind Energy Guidelines (USFWS 2012). The primary impact to active agricultural land will be the reduction of crop production on a total of approximately 25 acres (10 hectares) of farmland in the Project Area. During construction, agricultural practices may be interrupted in areas that are typically farmed and construction activities may result in the temporary reduction in access to those areas and damage to drain tiles. This economic impact is offset by Lake Benton Wind II through lease payments agreed to by the landowner. Large-scale environmental impacts to agriculture or agricultural lands are not

anticipated with the placement of turbines, access roads, and ancillary facilities in agricultural fields.

Table 8.10.2 summarizes the impacts to prime farmland for the turbines, access roads, and O&M facility under consideration.

Table 8.10.2: Summary of Prime Farmland Impacts

Prime Farmland Type	Turbines (acres/hectares)	Access Roads (acres/hectares)	O&M Facility (acres/hectares)	Total (acres/hectares)
All Areas Prime Farmland	3.69/1.49	16.42/6.65	3.08/1.25	**23.19/9.38**
Prime Farmland if Drained	0.33/0.14	2.08/0.84	1.93/0.78	**4.34/1.76**
Farmland of Statewide Importance	1.00/0.41	6.10/2.47	0	**7.10/2.88**
Prime Farmland if protected from flooding or not frequently flooded during growing season	0	0.03/0.01	0	**0.03/0.01**
Not Prime Farmland	0.03/0.01	0.51/0.20	0	**0.53/0.22**
TOTAL	**5.05/2.04**	**25.14/10.17**	**5.01/2.03**	**35.2/14.25**

Livestock in pastureland may be temporarily disrupted during construction due to temporary activity and associated sound, but appropriate measures will be made to ensure fenced pastureland is secure. Temporary fencing may be put in place if fencing is impacted and will be repaired or replaced after construction.

Land that is used for agricultural production will largely remain unchanged. Crops will be able to be planted up to the gravel roadway around each turbine pad and up to the access roads. Changes

in agricultural equipment maneuvering routes around turbine structures will be required, but should have a nominal effect on overall production and are negotiated with each potentially affected landowner. Temporary impacts to farmland will include access road approaches, crane walks, turning radii, equipment laydown areas, and/or intersection improvements. When construction occurs outside of winter months, there is a higher possibility for temporary minor impacts including soil compaction, loss of planting opportunity, crop damage, and drain tile damage. The only farmland that will remain permanently altered will be land where permanent access roads, turbine pads, and supporting above-ground infrastructure are erected. Landowners will be compensated through lease payments for land taken out of agricultural production (approximately 0.56 acres (0.23 hectares) of land per turbine); lands adjacent to Project infrastructure can remain to be used for agricultural production and/or cattle grazing.

8.10.3 Mitigation Measures

Only the land for the turbines, certain electrical equipment, and access roads will be taken out of crop production. After construction is completed, all remaining land surrounding the turbines and access roads may still be farmed. The permanent loss of approximately 25 acres (10 hectares) of agricultural land will not result in the loss of agricultural-related jobs or net loss of income. Additionally, any revenue lost from the removal of land from agricultural production will be offset by lease payments to landowners according to their respective contracts with Lake Benton Wind II.

The Applicant will coordinate with landowners to identify property features, such as drain tiles, that need to be avoided during construction activities and will avoid these features where practicable. Where identified features, such as drain tiles cannot be avoided, the drain tile or other features will be repaired following construction and landowners will be compensated for crop damages or losses related to the damage. To the extent possible, staging areas and associated infrastructure will be placed in areas where previous soil impacts have occurred to avoid impacting undisturbed farmland. Should incidental soil compaction occur as a result of temporary construction activities, including staging areas, laydown areas, and crane paths, appropriate measures will be taken to ensure farmland is restored in accordance with the lease agreement between the landowner and Lake Benton Wind II. Where soil compaction occurs, restoration measures will include ripping up the compacted areas with a grader and revegetating the areas as discussed in Section 10.5.

8.10.4 Forestry

There are no economically important forestry resources within the Project Area. According to 2011 Land Cover Data, approximately 0.2% of the Project Area consists of wooded areas (Homer et al. 2015). Most wooded areas within the Project Area consist of shelterbelts or small woodlands surrounding active farmsteads or streambanks. No impacts to economically important forestry resources are expected to occur; therefore, no mitigation will be necessary.

8.10.5 Mining

Quarries, gravel, and sand pits exist throughout Pipestone County, but are largely inactive, abandoned, or their use is limited to a private landowner. Based on review of MnDOT County Pit Maps and USGS topographic maps for the Project Area, six (6) active pits are scattered throughout the Project Area (MnDOT 2002, USGS 2014b). Refer to **Map 19 (Site Geology and Depth to Bedrock)**. Review of aerial imagery indicates that five of these pits are likely abandoned/ inactive and have been returned to agriculture. Also, five of the pits are listed as "prospected," indicating that the pit has been prospected and/or leased by MnDOT. The "prospected" classification does not necessarily imply that the source is actually producing aggregate at the present time. Project infrastructure will not be located within sand or gravel operations.

8.10.6 Potential Impacts

Negative impacts to mining resources are not anticipated. Project infrastructure will not be located within mining resources; therefore, direct impacts to mining resources will not occur. Lake Benton Wind II may request to use aggregate from mining operations for use during construction. Lake Benton Wind II will coordinate with the local mining operations, as appropriate.

8.10.7 Mitigation Measures

Lake Benton Wind II will design the Project to avoid locating infrastructure within or near mining operations. As impacts to mining operations are not anticipated, mitigation is not proposed.

8.11 Tourism

Pipestone County offers tourism and recreational opportunities throughout the year. In 2015, annual leisure and hospitality expenditure in Pipestone County was approximately $11.7 million, which equated to about 318 tourism-related jobs in the County (MnEED 2017). Generally, tourism in Pipestone County focuses on promoting the area's cultural history as well as outdoor recreational activities. Pipestone County offers tourism draws such as the Pipestone National Monument, the Pipestone County Museum, historic district walking tours, and Split Rock Creek State Park, while local community events include Pipestone Ghost Walks, the Watertower Festival, and Pipestone Civil War Days.

As shown in Section 8.7, there are 54 WMAs, nine WPAs, one SNA, one AMA, 18 WIAs, three county parks, and four snowmobile trails are located within ten miles of the Project Area. Five WMAs, four WIAs, and one SNA occur within, or abut, the Project boundary. These public resources provide recreational and tourism opportunities including biking, camping, wildlife

watching, hunting, fishing and snowmobiling. Refer to **Map 6 (Public Land Ownership & Recreation)**.

8.11.1 Potential Impacts

The Project facilities are expected to be located mostly on private lands, and, therefore, relatively few, if any, direct impacts are anticipated on existing recreational facilities and tourism activities. Proposed setbacks from recreational facilities, public roads and non-leased properties will minimize any indirect impacts. Potential impacts will be mostly visual in nature, as the Project may alter the viewshed from public lands within and around the Project. However, turbine structures are already a feature type within the viewshed of the Project Area. Therefore, the Project is not anticipated to have a negative effect on area tourism.

8.11.2 Mitigation Measures

No direct impacts to tourism are anticipated as a result of the Project. Additional mitigation measures related to potential visual impacts to the viewshed from public and recreational lands are detailed in section 8.4.3.

8.12 Local Economies

According to the ACS 2011-2015 estimates, educational services, health care, and social assistance accounted for 24.7% of jobs statewide in Minnesota, followed by manufacturing at 13.5% and retail trade at 11.2% (U.S. Census Bureau 2015). The 2011-2015 ACS also estimates that educational services, health care, and social assistance accounted for 22.3% of jobs in Pipestone County, followed by retail trade at 12.8% and agriculture, forestry, fishing and hunting at 11.8% (U.S. Census Bureau 2015). Similarly, the Minnesota Employment and Economic Development Quarterly Census of Employment and Wages indicates the top industries in Quarter 2 of 2017 for Pipestone County are education and health services at 26.3% followed by trade, transportation, and utilities at 20.7% (MNDEED 2017b).

8.12.1 Potential Economic Impacts

Overall, the Project will positively impact the region by adding infrastructure, temporary and permanent jobs, increasing the counties' tax base, and providing lease payments to Project participants. The communities near the Project are also expected to receive positive economic benefits as construction will necessitate the need for numerous temporary and full time positions. Approximately 200 construction and 7 to 12 full time operations and maintenance jobs are expected as part of the Project. Lake Benton Wind II plans to use some local contractors and suppliers, where feasible, for portions of construction which will contribute to the overall economy of the region. Purchase of products to construct and operate the facilities such as fuel, equipment, services, and supplies will benefit businesses in the counties as well as in the state.

Minor short-term impacts to the socioeconomic resources of the area are anticipated. It is likely that some land will be removed from agricultural production or other land use for the length of the Project. However, this impact will be offset through annual payments over the life of the Project to those landowners having a turbine or other Project facility constructed on their land, which will also help strengthen the local economy. Lake Benton Wind II does not have the authority to exercise eminent domain for the Project. Land lease agreements and wind easement agreements are voluntary and will be agreeable by all involved parties to ensure the landowners are fairly compensated.

8.12.2 Tax Payments

Pipestone County is expected to experience short-term positive economic impacts associated with tax payments during the construction phase of the Project through the use of the hotels, restaurants, and other consumer goods and services by the various workers, as well as the purchase of materials such as fuel, concrete, and gravel from local vendors. It is anticipated that the economic impact would also expand into towns and cities within adjacent Lincoln, Lyon, and Murray counties.

Wind energy infrastructure in the Project Area will provide significant long-term positive economic benefits to local landowners, the state, and the local economy of southwestern Minnesota. Landowners in the Project Area will benefit from annual lease payments, while, in accordance with state and county law, Lake Benton Wind II will pay property tax and production taxes on the land and energy production to local governments. For example, the Project will pay a Wind Energy Production Tax to the local units of government of $0.0012 per kWh of electricity produced. This would result in an annual Wind Energy Production Tax of $500,000-$600,000 for Pipestone County once the Project is repowered. In comparison to the existing project to be decommissioned, which had an average annual Wind Energy Production Tax of approximately $335,000 between the years of 2006 and 2017, the proposed Project will result in a higher annual Wind Energy Production Tax to the local units of government.

8.12.3 Mitigation Measures

Adverse economic impacts as a result of the Project are not expected. Regional businesses and service providers are anticipated to experience a temporary increase in business during the construction of the proposed Project, while annual lease payments to landowners are expected to offset potential losses from agricultural production. Additionally, Pipestone County will experience an increase in tax revenues due to the Wind Energy Production Tax and property tax payments.

8.13 Topography

8.13.1 General Description

The general topography of the Project Area is described as undulating, rolling relief with approximate elevations between 1,790 and 1,960 feet (546 and 597 meters) above MSL. The Project Area generally has higher elevations in the central and northwestern sections with lower elevations in the northeast, southeast, and southwest. Local slopes vary throughout the Project Area but generally slope to the northeast, southeast, and southwest from the center of the Project Area (see **Map 13 - Topographic Map**).

According to the MNDNR Ecological Classification System, the Project Area is located partly within the Inner Coteau Subsection (251Bc) and the Coteau Moraines Subsection (251Bb) of the North Central Glaciated Plains Section of the Prairie Parkland Province. The Inner Coteau and Coteau Moraines Subsections are generally characterized by rolling topography, Late Wisconsin highly dissected moraines, with loess caps. The highest elevation within these subsections includes Buffalo Ridge, a ridgetop that traverses southeast Minnesota in a northwest to southeast orientation. The highest elevation of this ridge occurs within northern Pipestone County, and reaches approximately 1995 feet (608 meters) above MSL. Buffalo Ridge crosses through the center of the Project Area, creating the undulating landscape (MNDNR 2017c).

8.13.2 Potential Impacts

Some limited, localized impacts to the topography within the Project Area will come from the construction of turbine pad sites, access roads, and associated Project facilities. Anticipated impacts, however, will be minor in nature as construction of these features will not require significant excavation or fill for foundations or road bases.

8.13.3 Mitigation Measures

No significant impacts to topography are anticipated; therefore, no mitigation measures will be implemented. Lake Benton Wind II will implement construction Best Management Practices (BMP) in accordance with the MPCA's *Stormwater Best Management Practices Manual* and the approved Project Stormwater Pollution Prevention Plan (SWPPP) to ensure erosion and sedimentation are minimized. In addition, Lake Benton Wind II will also avoid construction activities in areas with steep slopes (>10 percent), where feasible, to minimize the risk of erosion and sedimentation.

8.14 Soils

8.14.1 General Description

Overall, the Project Area is largely comprised of four soil associations with similar characteristics. These include Lamoure-Estelline (s3546), Vienna-Kranzburg-Hidewood

(s3545), Langhei-Hamerly-Barnes (s3467), and Flom-Barnes (s3542) associations, and are generally composed of silt loam to silty clay loam soils that are moderately dark in color and occur on level to steep slopes (see **Map 20 - Soils**). These soil associations are generally deep, poorly drained to well drained, and are formed from loess and glacial till (NRCS 2017). Soil associations and their coverage of the Project Area are listed in Table 8.14.1 below.

Table 8.14.1: Soil Associations in Project Area

Soil Association	Area (Acres)
Lamoure-Estelline (s3546)	3,337.65 (1,350.70 hectares)
Vienna-Kranzburg-Hidewood (s3545)	3,626.89 (1,467.75 hectares)
Langhei-Hamerly-Barnes (s3467)	15,012.66 (6,075.41 hectares)
Flom-Barnes (s3542)	3,619.70 (1,464.84 hectares)

8.14.2 Potential Impacts

Construction and operation of the proposed Project will result in short and long-term impacts to soils within the Project Area. Short-term and minor impacts will result from the clearing of vegetation, generation of dust, and the excavation, stockpiling, and redistribution of soils. These activities are described further in Section 10. During construction, there is also the potential for localized soil erosion and sedimentation. Long-term impacts will include soil compaction. However, following Project completion, Project facilities will be decommissioned and soils will be returned back to agricultural use. The total percent and acres of soil that would be impacted can be determined following final design and siting. Refer to Section 8.10.2 for additional information related to impacts related to prime farmland.

8.14.3 Mitigation Measures

A National Pollutant Discharge Elimination System (NPDES) permit, a SWPPP, and BMPs will be developed and implemented prior to the commencement of construction. Sedimentation and erosion will be reduced through the use of BMPs including, but not limited to, mulching, hydroseeding, erosion control blankets, silt fence installation, jute matting, revegetation and/or interim reclamation. Water and chemical application will be used to suppress dust as discussed in Section 10. Following the completion of construction, all impacted property that will not continue to be used for operation of Project facilities will be restored to pre-construction

condition in accordance with landowner lease agreements as described further in Section 10.5. As part of the restoration efforts, compacted soils will be ripped up with a grader and revegetated. Soil will be used as backfill, will be spread out around the construction areas, graded in some locations to drain away from turbines, and topped with gravel or topsoil as appropriate. Areas where infrastructure is not located will be topped with topsoil and revegetated. In implementing these systems, plans and practices, measures will be taken to protect surface waters from direct and indirect impacts of sedimentation and erosion, while simultaneously preventing any adverse impacts to soil resources.

8.15 Geologic and Groundwater Resources

8.15.1 General Description

The majority of the bedrock that is located beneath the Project Area and surrounding vicinity is made up of Sioux Quartzite with some scattered portions of the bedrock comprised of undifferentiated rock (see **Map 19 - Site Geology and Depth to Bedrock**). This Sioux Quartzite was formed during the early part of the Paleozoic Era approximately 1,600 million years ago. Wisconsin Glaciation glacial till and loess (wind-blown silt) overlies the Early Proterozoic rock and makes up the present day surface of the Project Area. The glacial till can be up to 100 feet (31 meters) thick and is largely comprised of sand, gravel, silt and clay (Pipestone County et al. 2015).

Groundwater resources are not abundant or widely distributed within this portion of the state because of lower precipitation rates and the quaternary and bedrock geology present in this region (Adolphson et al. 1982). The limited groundwater resources in this region have prompted the establishment of an extensive network of water pipelines which transport groundwater from a few select areas with productive groundwater wells to the majority of the region (Patterson 1997).

Groundwater in the region is supplied by a shallow water table or bedrock wells in sandstone and fractured Sioux Quartzite aquifers (Bradt 1997). Regional ground-water flow in these aquifers is variable and much of the water supplies come from surficial sand and gravel deposits.

According to the Minnesota Department of Health's County Well Index online database (MDH 2017), wells are interspersed throughout the Project Area. Well depths within the Project Area vary widely, with most being less than 100 feet deep (MDH 2017).

8.15.2 Potential Impacts

Footings designed to support turbines will in some cases require minor impacts to glacial drift. Geotechnical testing will occur at turbine locations prior to construction to determine soil stability and depth to hard rock.

Major impacts to groundwater resources and wells are not expected from Project related activities due to Lake Benton Wind II's abidance of water-related setbacks and the minimal water-related needs of the Project. A well will be installed to fulfill the O&M building water requirements. Water may be needed if a temporary batch plant is needed on-site to supply concrete for the construction of the Project. The temporary batch plant will be located at the laydown yard or O&M building. In the event that a batch plant is required, appropriate permitting will be obtained prior to construction. The water used for concrete production, dust abatement, etc. would either come from a local well or may be trucked in from a suitable local resource and stored at the concrete batch plant site. The source of water will be determined closer to construction. Construction dewatering may occur depending on the respective site, weather, and soil conditions. Dewatering consists of the removal of surface water and/or groundwater by diverting and/or removing construction areas within water features or wet areas, as needed for construction.

8.15.3 Mitigation Measures

Well locations will be taken into account and turbines will be set back following state and county standards. Construction and operation of the proposed project is not expected to impact groundwater resources, so no mitigation is proposed. While dewatering is not anticipated, should dewatering occur, mitigation measures to address dewatering are summarized in Section 8.16.5.

8.16 Surface Water and Floodplain Resources

8.16.1 Lake, Rivers, Streams, and Ditches

The Project Area is located within portions of the Missouri River Basin; Rock River watershed (HUC8 10170204) and the Upper Mississippi River Basin; Redwood River watershed (HUC8 07020006) (USEPA 2017a, b). Within these drainage basins, numerous intermittent and ephemeral watercourses and a few perennial watercourses are scattered across the Project Area.

According to the USGS NHD dataset, the Project Area contains approximately 99.7 acres (40.35 hectares) (0.39%) of NHD waters (USGS 2017) (see **Map 21 - Surface Water**). Three of the watercourses within the Project Area are MN Public Water Inventory (PWI) Public Watercourses with designated 50-foot (15 meter) buffer requirements according to the MN Buffer Law (MNDNR 2017d). This includes the Redwood River in the northeast portion of the Project Area, the Rock River in the central portion of the Project Area, and the East Branch Rock River in the southwest portion of the Project Area. Additionally, there are nine un-named watercourses that drain away from the Project Area along the eastern and western boundaries. Further, a number of PWI "public ditches" in the central portion of the Project Area have a 16.5 foot (5.0 meter) designated buffer requirement. Based on aerial photograph interpretation, a moderate number of the aforementioned watercourses would likely be considered jurisdictional Waters of the U.S. (WOUS) due to their proximity to the Red or Minnesota Rivers.

Public waters are identified on PWI maps that display waters of the state and are designated as public waters under MNDNR's Public Waters Permit Program (Revisor of Statutes, State of Minnesota 2016) (see **Map 21 - Surface Water**). The following table outlines public waters within the Project Area.

Table 8.16.1: Public Waters Inventory

PWI Type	PWI Feature Name	PWI Unique Feature ID	Length within Project Area (miles)
PW Natural	Redwood River	59047a	1.92 (3.09 kilometers)
PW Natural	Rock River	59011a	2.49 (4.01 kilometers)
PW Natural	Rock River, East Branch	51052a	2.06 (3.32 kilometers)
PW Natural	Unnamed Stream	N/A	0.84 (1.35 kilometers)
PW Natural	Unnamed Stream	59001a	1.54 (2.48 kilometers)
PW Natural	Unnamed Stream	59053a	1.10 (1.77 kilometers)
PW Natural	Unnamed Stream	42001a	0.98 (1.58 kilometers)
PW Natural	Unnamed Stream	41053a	0.35 (0.56 kilometers)
PW Natural	Unnamed Stream	59048a	0.002 (0.003 kilometers)
PW Natural	Unnamed Stream	59061a	1.85 (2.98 kilometers)
PW Natural	Unnamed Stream	51016a	0.50 (0.80 kilometers)
PW Natural	Unnamed Stream	59058a	0.93 (1.50 kilometers)
		Total:	14.57 (23.45 kilometers)

Section 303(d) of the Clean Water Act requires each state to list streams and lakes that are not meeting their designated uses because of excess pollutants every two years. Three recorded waterbodies within the Project Area are listed as impaired by the MPCA (2016b). The Redwood River, Rock River, and East Branch Rock River fail to meet one or more of the following water quality standards including turbidity, E. coli, and/or failing to meet one or more bioassessment standards for macroinvertebrates.

8.16.2 Designated Wildlife Lakes and Special Waters

The MNDNR commissioner may formally designate lakes for wildlife management under the authority of Minn. Stat. § 97A.101 subdivision 2 (a) after notice and a hearing. There are no MNDNR designated wildlife lakes within the Project Area. There are also no identified outstanding resource value waters or trout streams within the Project Area (MNDNR 2015).

8.16.3 FEMA Floodplains

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) have been created and are available for most of the Project Area, but the majority of base flood elevations have not been determined. There are no 100-year flood plains (Zone A) located within the Project Area (FEMA 2017). A large expanse of the Project Area that has "public ditches" has been determined to be an area with minimal flood hazards (Zone C). A floodplain map is provided as **Map 22 (FEMA Flood Zone Map)**. FEMA Floodplain Panels are included in **Appendix G (FEMA Floodplain Panels)**.

8.16.4 Potential Impacts

Overall, surface waters will remain largely unimpacted because the Project will be designed to avoid or minimize adverse impacts to surface waters. Permanent dewatering will not occur, though the possibility exists that temporary dewatering of turbine foundations and collection lines will occur as needed. Temporary or permanent impacts to surface water runoff may be associated with crane paths, access roads, turbine pads, subsurface electrical collector lines, the substation, and the O&M facility.

There is potential for erosion and sedimentation to occur associated with ground-disturbing activities. Moderately to strongly sloped ground can also be subject to sheet and rill erosion or slumping.

8.16.5 Mitigation Measures

Reclaimed topographic conditions will be similar to pre-disturbance conditions. The reclaimed landscape will blend with the surrounding contours, and erosion prevention and maintenance of current hydrology will be necessary. In addition to reclamation seeding, depending on site specific needs, structured construction scheduling, surface roughening, erosion control blankets, straw wattles/bales, rolls, tackifiers (*i.e.*, chemical compounds that increase the stickiness of

adhesives so as to help seed or soil stay in place), mulch, vegetative buffers, hydromulch, sediment fencing, and waterbars may be used to manage soil erosion. In some cases, a narrower construction corridor may be considered to minimize impact. Temporary (annual) seed may be used to help prevent erosion. A BMP Selection Summary is presented in the following table.

Table 8.16.5: BMP Selection Summary

BMP Category	Grade or Trigger	BMP to Use
Erosion Prevention	Throughout	Vegetation preservation
		Vegetative buffers
		Scheduling
		Surface roughening
		Erosion control blanket
		Tackifiers
		Mulch
		Hydromulch
Slope Breakers	5%–15% slope (300-foot (91-meter) spacing)	Straw wattles
		Waterbars
		Straw bale check dams
	>15%-30% slope (200-foot (61-meter) spacing)	Straw wattles
		Waterbars
		Straw bale check dams
	>30% slope (100-foot (31-meter) spacing)	Straw wattles
		Waterbars
		Straw bale check dams
Sediment Barrier	At waterbody crossings	Sediment fencing
		Straw wattles
		Low water crossings
		Vegetative buffers
		Straw bale check dams

The type of control measure will vary depending upon slope gradients and the susceptibility of soil to wind and water erosion. The aforementioned BMPs will not only be employed to protect topsoil and minimize soil erosion, but will also protect surface water quality and floodplain resources from direct and indirect impacts. A SWPPP will be developed and a NPDES permit will be obtained prior to construction. BMPs will be employed to ensure that excavated material is contained, exposed soil is protected, restored material is stabilized and disturbed areas are re-vegetated with non-invasive species. Use of BMPs will also ensure that access roads and drainage ways will be designed in a manner that allows water to flow unrestricted from upper portions of the watershed to lower portions of the watershed. Significant adverse Project-related

impacts to surface waters and/or floodplains are not anticipated because of design considerations and the implementation of stormwater BMPs.

While dewatering is not anticipated, it can readily be implemented in conjunction with deep foundation installation. Sediment basins and filters can help filter the dewatered water before it is discharged to a surface water within uplands. Dewatering would be conducted in a manner such that the velocity of the discharged water would not cause scouring of the receiving area. If the receiving area is a structural BMP (*i.e.*, basin or sump), the design of the BMP should be based on the anticipated flow from the dewatered area. Should dewatering occur, mitigation measures to address dewatering would include measures such as the following to ensure sediment laden water will not be directly discharged to surface waters. Reducing the turbidity of water can be addressed by the following measures:

- Constructing a temporary sediment trap for turbine water discharge pretreatment.
- Use of a portable sediment containment system such as dumpsters.
- Application of natural based flocculent technology such as chitosan in sediment traps or a series of ditch checks to contain sediment.
- Discharge water through a series of fiber logs or a rock weeper into a large, vegetated buffer area.
- Provide energy dissipation and erosion control BMPs at all discharge points.
- Utilize a dewatering bag to ensure discharged water does not contribute sedimentation to receiving waters.

In addition to the mitigation measures listed above, the Project Area is within federally designated critical habitat for the Topeka shiner (*Notropis topeka*) (USFWS 2017a). Specific Topeka shiner management minimization recommendations for the Big Sioux River and Rock River Watersheds (approximately 47.7% of the Project Area) have been developed by the USFWS Twin Cities Field Office (2016) and include (but are not limited to) the following:

- Do not dewater or temporarily divert streams for construction;
- Do not conduct in-stream work before August 15 to avoid disrupting spawning;
- Follow all applicable requirements and best management practices for stormwater permits from the Minnesota Pollution Control Agency (MPCA);
- Minimize removal of riparian vegetation;
- Mulch areas of disturbed soil and reseed promptly;
- Implement appropriate erosion and sediment prevention measures;
- Ensure that erosion control features are in place;
- Design and install instream structures (*e.g.*, box culverts) in a manner that will not impair passage of Topeka shiners after construction is completed;
- Do not operate motorized vehicles instream;
- Backfill placed in the stream shall consist of rock or granular material free of fines, silts, and mud; and
- Prevent materials and debris from falling into the water during construction.

Additional details regarding Topeka shiners in the context of the Project Area are discussed further in Section 8.19.

If impacts to PWI surface waters are unavoidable, the Applicant will apply for the necessary permits prior to construction and will work with officials to minimize adverse impacts. Also, in Section 8.17.1 and 8.17.3 there is additional information regarding regulatory agencies and potential use of compensatory mitigation methods for the impacts to features.

8.17 Wetlands

8.17.1 Description of Resources

The Project Area contains both isolated wetlands and wetlands associated with watercourses scattered across the Project Area. The Project Area is dominated by freshwater emergent wetlands with some mapped emergent, shrub/scrub, and forested wetlands (see **Map 23 - National Wetland Inventory Update for Minnesota**). Some wetlands within agricultural settings appear to exhibit anthropological disturbance. Based on aerial photograph interpretation, a moderate number of the aforementioned wetlands would likely be considered jurisdictional WOUS due to their proximity to the Red or Minnesota Rivers.

According to the MNDNR update to the USFWS National Wetland Inventory (NWI) database, the Project Area contains approximately 2,031.8 acres (822.2 hectares) of mapped NWI wetlands and open waterbodies (7.9% of the Project Area) (MNDNR 2017e, USFWS 2017b). Wetland types and their associated acreages are illustrated in Table 8.17.1.

Table 8.17.1: NWI Wetland Type and Acreage

NWI Type	Acres	Percent of Project Area
Freshwater Emergent Wetland (PEM)	1,744.9 (706.1 hectares)	6.8%
Freshwater Forested/Shrub Wetland (PFO/PSS)	40.7 (16.5 hectares)	0.2%
Freshwater Pond (Open Waters)	74.7 (30.2 hectares)	0.3%
Riverine Waters	171.5 (69.4 hectares)	0.7%
Total:	**2031.8 (822.2 hectares)**	**7.9%**

Calcareous fens are a rare (*e.g.*, approximately 200 known locations within Minnesota) and distinctive wetland type characterized by non-acidic peat with a constant supply of calcium and magnesium bicarbonate rich groundwater. This specialized environment is dominated by a calcium-loving plant community (MNDNR 2016). Calcareous fens have been identified in the vicinity of the Project Area (northeast of the Town of Holland), and one calcareous fen has been identified within the Project Area. Calcareous fens are protected under both federal (Section 404 of the Clean Water Act) and state law (Minnesota Wetland Conservation Act) (MNDNR 2016).

In the State of Minnesota, some wetlands are designated as Public Water Inventory Basins (PWI Wetlands). All PWI Wetlands are identified as Types 3, 4, and 5 as defined by the USFWS Circular 39 (USFWS 1971) and that are 10 acres or more in size in rural areas and two and one half acres in size in incorporated areas. There are approximately 180.1 acres (72.9 hectares) of Type 3 wetlands; 46.4 acres (18.8 hectares) of Type 4 wetlands, and 26.3 acres (10.6 hectares) of Type 5 wetlands within the Project Area. There are three PWI Wetlands mapped within the Project Area as shown on **Map 21 (Surface Water)**. No project infrastructure is planned within PWI Wetlands and the Project will avoid impacts to PWI Wetlands.

In the State of Minnesota, agencies representing three levels of government (federal, state, and local) regulate certain activities that affect wetlands, lakes, and watercourses. Most other wetlands not listed in the PWI are regulated under the Minnesota Wetland Conservation Act of 1991. The WCA is administered by the Minnesota Board of Water and Soil Resources and is implemented by Local Government Units (LGU). The LGU administering the WCA within the Project Area is the Soil & Water Conservation District of Pipestone County. Generally, an LGU Replacement Plan is required by the WCA for an impact that wholly or partially drains or fills a wetland). Wetlands are also federally protected under Section 404 of the Clean Water Act. A wetland permit from the USACE is required when discharging dredged or fill material into jurisdictional wetland and/or non-wetland WOUS. A permit and/or pre-construction notification may also be required by the local watershed district depending upon the location, size and type of impact.

8.17.2 Potential Impacts

Turbines and meteorological towers will be sited in upland, higher elevation areas to maximize the wind resource and, as such, are likely to avoid wetlands and surface waters that are typically found at lower elevations. Access roads and Project-related infrastructure will be designed and sited to avoid or minimize permanent impacts to wetlands to the greatest extent possible. Temporary impacts to wetlands may occur based on construction easement extents. Field work to delineate wetlands is ongoing so that wetland areas can be avoided. In the event that permanent or temporary wetland impacts cannot be avoided during the siting of project infrastructure, Lake Benton Wind II will coordinate with the appropriate agencies including USACE, WCA, and the Soil & Water Conservation District of Pipestone County.

8.17.3 Mitigation Measures

During the design phase of the Project, measures will be taken to avoid impacts to wetland areas, where possible, and to minimize impacts to wetlands in cases were the impacts cannot be avoided. Results of the wetland desktop analysis and micrositing field event will be considered by Lake Benton Wind II in an effort to avoid siting Project components in wetlands to the maximum extent practicable. Directional drilling of collector and communication lines may be utilized to avoid or reduce the amount of acreage where wetland impacts occur. .. If adverse impacts to wetlands are unavoidable, the impacts will be minimized to the maximum extent practicable. BMPs will be employed to protect topsoil, minimize soil erosion, and protect wetland resources from direct and indirect impacts. Minimizing soil erosion near wetlands helps to protect the wetland water quality, reduces the likelihood for fill of the wetland, and helps to maintain the integrity of the wetland. Wetland soils and moderately to steeply sloped ground can also be subject to sheet and rill erosion or slumping. Depending on site specific needs, seasonal construction scheduling, cutting trees where the stumps remain, temporary timber matting, erosion control blankets, mulch, straw bales, rolls, tackifiers (*i.e.*, chemical compounds that increase the stickiness of adhesives so as to help seed or soil stay in place), temporary seeding, hydromulch, and sediment fencing may be used to manage soil erosion. In some cases, a narrower construction corridor may be considered to minimize impact.

A SWPPP and NPDES permit will be obtained prior to construction. BMPs will be employed to ensure that excavated material is contained, exposed soil is protected, restored material is stabilized and disturbed areas are re-vegetated with non-invasive species. Significant adverse Project-related impacts to wetlands are not anticipated because of design considerations and the implementation of stormwater BMPs. Compensatory mitigation may be required if certain state and/or federal impact thresholds are surpassed. Currently, compensatory mitigation is not anticipated for the development of the Project.

8.18 Vegetation

8.18.1 Description of Resources

The Project Area is located within the Prairie Parkland Province, which was the part of the state that historically was dominated by tallgrass prairie (MNDNR 2017c, f). This Province is further divided into Sections and Subsections. The WRA is within the North Central Glaciated Plains Section (251B), characterized by mainly treeless fire-dependent communities, with upland prairie communities in a level to rolling region of calcareous till landscape (MNDNR 2017g), and the Inner Coteau Subsection (251Bc) historically dominated by tallgrass prairie and dry prairies over shallow bedrock (MNDNR 2017h, c).

The 2011 National Landcover Database – Land Use-Land Cover dataset (Homer et al. 2015) indicates that the Project Area contains approximately 16,057 acres (6,498 hectares) of cultivated land or about 63% of the Project Area. In addition to cultivated lands, agricultural regions

typically also include idle lands, pastures and grasslands. The 2011 National Landcover Database – Land Use-Land Cover dataset indicates that the Project Area contains approximately 720 acres (291 hectares) of pastures, or approximately 2.8% of the Project Area, and approximately 7,172 acres (2,902 hectares) of grassland/herbaceous habitat, or approximately 28% of the Project Area (see **Map 18 - Land Cover**). Grasslands, areas used as pastures, filter strips (*i.e.*, buffer strips), or areas that are not actively farmed, can have the ecological functions of grasslands. These grassy areas can serve the same purpose as native prairie, providing valuable habitat for grassland nesting or foraging birds. The remaining land cover type within the Project Area consists primarily of developed/disturbed space.

Table 8.18.1: Land Cover Types and Their Relative Abundance in the Project Area

Land Cover	Sum of Area (Acres)	Percent of Project Area
Cultivated Crops	16.057.4 (6,498.2 hectares)	62.7%
Grassland	7,171.9 (2,902 hectares)	28%
Hay/Pasture	720.3 (291.5 hectares)	2.8%
Disturbed/Developed	1,207.7 (488.7 hectares)	4.7%
Open Water	70.6 (28.6 hectares)	0.3%
Wetlands	316.3 (128.0 hectares)	1.2%
Deciduous Forest	47.9 (19.4 hectares)	0.2%
Barren Land	2.9 (1.2 hectares)	0.01%
TOTAL	**25,596.9 (10,358.7 hectares)**	**100%**

Sites of Biodiversity Significance

The Minnesota Biological Survey (MBS) identifies 25 Sites of Biodiversity Significance that are located completely within and/or overlap the Project Area (see **Map 24 - Unique Natural Features**). The MBS uses four classifications denoting the level of biological diversity to rank sites. These rankings are "outstanding", "high", "moderate", and "below". While sites ranked "outstanding" contain the highest probability of occurrence likelihood of the rarest species (including rarest native plant communities or the most intact native ecosystem), sites ranked "below" have low probability of occurrence likelihood of rare species, intact ecological communities, or are highly disturbed. The "high" and "moderate" rankings fall in between these classifications (MNDNR 2017i). The aforementioned rankings are used to communicate native biodiversity significance to natural resource professionals, state and local government officials, and the public as well as to guide conservation and management of the State's natural resources.

One of the MBS Sites of Biodiversity Significance within the Project Area has been given an "outstanding" biodiversity significance ranking, six sites are ranked as "high", nine sites are ranked as "moderate", and nine sites are ranked as "below". Table 8.18.1a below shows MBS Sites of Biodiversity Significance, and their associated acreage, that occur within the Project Area.

Table 8.18.1a: Sites of Biodiversity Significance within the Project Area

Site of Biodiversity Significance	Number of Sites Within Project Area	Acres
Outstanding	1	472 (191 hectares)
High	6	1,387 (561 hectares)
Moderate	9	1,485 (601 hectares)
Below	9	615 (249 hectares)

Native Plant Communities

Six native plant communities are located within the Project Area (see **Map 24 - Unique Natural Features**). One (1) native plant community type consisting of bulrush marsh (MRp93a; 37.3 acres (15.1 hectares)), ranked as Critically Imperiled (S1) community type and Condition "NR" (Not Ranked) is located within the southern portion of the Project Area west of Woodstock WMA. A native plant community type classified as a calcareous fen (OPp93b; 1.0 acres (0.4 hectares), ranked as Imperiled (S2) and Condition "B" (good ecological integrity), is located within the Project Area near the western boundary. Native plant community type WMp73a

(164.6 acres or 66.6 hectares), Prairie Meadow/Carr, ranked as Vulnerable to Extirpation (S3) and Condition "C" (fair ecological integrity) is found in several locations in the central and southeastern portions of the Project Area. The remaining three native plant communities within the Project Area are native prairies (see Table 18.8.1b below for a breakdown of approximate acreage and ecological classification for these prairies).

MNDNR has assigned a biodiversity rank to these communities. Table 18.8.1b below provides the acreage and biodiversity ranking associated with the six plant community types present in the Project Area.

Table 18.8.1b: Native Plant Community Types within the Project Area

Native Plant Community Type	Acreage within Project Area by Biodiversity Rank		
	Outstanding	High	Moderate
MRp93a – Bulrush Marsh	N/A	37.3 acres (15.10 hectares)	N/A
OPp93b – Calcareous Fen	N/A	1.0 acre (0.4 hectares)	N/A
WMp73a – Prairie Meadow/Carr	48.7 acres (19.7 hectares)	56.8 acres (23.0 hectares)	59.1 acres (23.9 hectares)
UPs23a – Mesic Prairie (Southern)	N/A	5.58 acres (2.26 hectares)	N/A
UPs13d – Dry Hill Prairie (Southern)	262.5 acres (106.2 hectares)	424.7 acres (171.9 hectares)	180.4 acres (73.0 hectares)
WPs54b – Wet Prairie (Southern)	13.7 acres (5.5 hectares)	2.3 acres (0.9 hectares)	30.6 acres (12.4 hectares)

Native Prairie

As covered in the discussion on native plant communities, the MNDNR has mapped 49 native prairies within the Project Area. The 49 mapped prairies consist of three different classifications. Forty-four (44) of these prairies are classified as UPs13d, Dry Hill Prairie (Southern). The MNDNR describes this prairie type as grass dominated, but forb rich, occurring on medium- to fine-textured soils on moderate to steep slopes in glacial till or loess-mantled till (MNDNR 2017j). The Dry Hill Prairie (Southern) prairie type makes up approximately 868 acres (351 hectares) within the Project Area.

Four (4) prairies are classified as WPs54b, Wet Prairie (Southern), accounting for approximately 47 acres (19 hectares) of the Project Area. The MNDNR describes this prairie type as grass dominated, but forb rich, occurring on poorly drained to very poorly drained loam soils formed in lacustrine sediments, unsorted glacial till, or less frequently outwash deposits. Saturation typically persists in the lower part of the rooting zone for much of the season (MNDNR 2009). One (1) prairie is classified as UPs23a, Mesic Prairie (Southern), and is characterized as grass dominated, forb rich, and occurring on somewhat poorly drained to well-drained loamy soils (MNDNR 2017j). This prairie type accounts for approximately six (6) acres (2 hectares) of the Project Area.

8.18.2 Potential Impacts

Vegetation will be removed during construction and installation of Project infrastructure to allow for construction of turbine pads, access roads, substation, and O&M facilities. Lake Benton Wind II will design the site to place the majority of Project infrastructure in agricultural fields. Less than 2 percent of the total Project Area will be permanently converted to sites for wind turbines or other Project infrastructure. Table 8.18.2 below details anticipated permanent impacts to vegetation and unique vegetation types within the Project Area. Project infrastructure will be sited so as to avoid Sites of Biodiversity Significance that are ranked high or outstanding. For those Sites of Biodiversity Significance ranked moderate or below, field verification as to whether these sites meet the criteria for these rankings has occurred and will continue as project details are developed. Should project infrastructure be planned in areas with moderate or below rankings, Lake Benton Wind II will coordinate with MNDNR regarding potential impacts to these areas. Mapped Native Plant Communities will be avoided to the extent practical. Where project infrastructure is planned in these areas, field verification as to whether these areas exhibit native plant communities has occurred and will continue as project details are developed. Should infrastructure be planned in areas mapped as Native Plant Communities, it will be coordinated with MNDNR. The Project has been designed to avoid temporary and permanent impacts to Native Plant Communities. If the location of Project infrastructure shifts within the Project Area, Lake Benton Wind II will attempt to avoid impacts to Native Plant Communities and will coordinate with MNDNR as appropriate.

Table 8.18.2: Summary of Estimated Permanent Impacts to Vegetation

Land Cover Type	Turbines (acres/ hectares	Access Roads (acres/ hectares)	O&M Facility (acres/ hectares)	Total (acres/ hectares)
Cultivated Crops	3.58/1.45	16.25/6.57	5.01/2.03	**24.83/10.05**
Hay/Pasture	0.12/0.05	0.15/0.06	0	**0.27/0.11**
Developed, Open Space	0	0.50/0.20	0	**0.50/0.20**
Developed, Medium Intensity	0	0.01/0.005	0	**0.01/0.005**
Herbaceous	1.36/0.55	8.23/3.33	0	**9.59/3.88**
Native Plant Community	0	0	0	**0**
Total	**5.05/2.05**	**25.14/10.18**	**5.01/2.03**	**35.20/14.25**

Temporary vegetation impacts will occur during construction and will be associated with such activities as contractor laydown and staging areas, crane walkways, and the installation of underground collection lines. As ground will be disturbed by equipment deliveries from different geographic areas, introduction of noxious weeds may occur, though Lake Benton Wind II will work collaboratively with all Project construction parties to minimize and prevent the introduction of invasive species. Direct permanent and temporary impacts to natural areas and sensitive vegetation will be avoided and minimized.

8.18.3 Mitigation Measures

Lake Benton Wind II will make every effort to avoid direct permanent and temporary impacts to natural areas, including wetlands, native plant community types, and MBS Sites of Biodiversity Significance within the Project Area, including native prairie. Additionally, Lake Benton Wind II will avoid impacts to conservation land such as WMAs. Approximately 71% of turbines are planned on lands currently under crop cultivation. Access roads are expected to impact agricultural fields and, potentially, grassed areas associated with roadsides and ditches, while avoiding grasslands, shrubland, and wooded areas. Access road construction or collection line installation may result in some temporary impacts to unavoidable drainages, grasslands, shrublands, and wetlands. Lake Benton Wind II will coordinate with the local NRCS office to ensure the reseeding of these areas with locally sourced native mixes should these impacts occur

during construction activities. Lake Benton Wind II will prepare a prairie protection and management plan in consultation with the MNDNR. The prairie protection plan will detail efforts to avoid impacts to prairies through site design. Additionally, any impacts expected to occur to MBS Sites of Biodiversity Significance will be coordinated with MNDNR as appropriate. Lake Benton Wind II will implement BMPs for all Project construction entities entering the Project Area to control and prevent the introduction of invasive species as designated by the Minnesota Department of Agriculture (MDA 2017). These BMPs include limiting invasive species spread via maintenance equipment and vehicles via early detection of invasive species, cleaning mowers and bladed equipment, minimizing disturbance to native areas, limiting traffic through weed-infested areas, if possible, and frequently inspect equipment storage areas for weeds. In the event that invasive weeds are detected within the Project control via properly timed cutting and targeted herbicide use will be conducted in keeping with the herbicide BMPs published by the MnDOT and MDA (MDA 2017, MnDOT 2017b).

8.19 Wildlife Resources

The USFWS Land-based Wind Energy Guidelines were issued on March 23, 2012 to provide a structured and scientific approach to wildlife concerns at all stages of land-based wind energy development (USFWS 2012). The guidelines use a tiered approach of collecting information, with each tier increasing in the detail of research and information. The tiered approach provides the opportunity for evaluation and decision-making at each step of the Project to enable the developer to abandon or proceed with development, or to collect additional information. The tiers are briefly outlined as follows:

- Tier 1 – Preliminary, landscape-level evaluation of a site or sites for habitat for species of concern using readily and publicly available sources of information.
- Tier 2 – Site characterization that involves detailed site and database research, as well as a site reconnaissance visit by a qualified biologist.
- Tier 3 – Field studies to document wildlife conditions at the site and predict Project impacts. These can include avian point count surveys, raptor nest surveys, and eagle surveys.
- Tier 4 – Post-construction mortality monitoring.
- Tier 5 – Other post-construction studies that the developer, in conjunction with USFWS, may deem important on-site.

Appendix I, Ia and Ib (Wildlife Studies) contains a copy of each of the Tier 3 studies. It is important to note that depending on each tier's findings, not all tiers are recommended or necessary for all projects.

Results of Tier 1 and Tier 2 Studies

A Tier 1 and Tier 2 Site Characterization Study (SCS) was completed for the Project Area in November 2017 (Atwell 2017). Information for this study was gathered through MNDNR and

USFWS database research, additional resources and a site visit by a qualified biologist in January 2017. Tier 1 questions help determine potential environmental risk at the landscape scale, while Tier 2 questions help to determine potential environmental risk at the project scale (USFWS 2012). For additional detail on the SCS see **Appendix H (Site Characterization Study)**.

8.19.1 Potential and Observed Wildlife Usage

Information on existing wildlife within the Project Area was obtained through various sources including: MNDNR; USFWS; Minnesota Breeding Bird Atlas; avian use pre-construction surveys (initiated in September 2016); site reconnaissance; and an aerial raptor and eagle nest survey. See Table 8.19.1 for a summary of the Tier 3 wildlife studies that were completed for the Project Area. The following section includes a discussion on general wildlife within the area. This section includes a discussion of wildlife that is considered threatened, endangered or of special concern.

Table 8.19.1: Tier 3 Wildlife Studies

Study Type	Completed By	Year
Year 1 Avian Use Study	WEST, Inc.	2016-2017
Bald Eagle and Raptor Aerial Nest Survey	WEST, Inc.	2017

Birds

Two types of avian pre-construction surveys including fixed-point avian use surveys and an aerial raptor nest survey were conducted over a 12 month period within the Lake Benton Wind II Project. Survey methods follow those outlined in the USFWS Land-Based Wind Energy Guidelines (USFWS 2012) and are consistent with the Eagle Conservation Plan Guidance document (USFWS 2013).

Fixed-point avian use survey

Fixed-point avian use field studies were conducted for 12 consecutive months from September 2016 to August 2017 at 16 points within the Project Area. A total of 192 surveys were conducted during the 12-month period where 74 unique species were observed (**Appendix I, Appendix Ia and Ib– Wildlife Studies**). The most abundant species observed were Canada goose (*Branta canadensis*) and snow goose (*Anser caerulescens*). Large flocks of mixed species of blackbirds were also observed during the fall of 2016. Species richness for small birds was highest in the summer and lowest in the winter. Small bird use within the Project Area was highest in fall (37.23 birds/100-m (328-ft.) plot/10-min survey, primarily due to large flocks of

blackbirds) and lowest in winter (5.46 birds/100-m (328-ft.) plot/10-min survey). Species richness for large birds was highest in spring and lowest in summer. Large bird use (*e.g.*, raptors, waterfowl, and waterbirds) within the Project Area was highest in winter (43.9 birds/800-m (2,625-ft.) plot/60-min survey, due to large flocks of Canada geese and snow geese in late winter) and lowest in summer (4.0 birds/800-m (2,625-ft.) plot/60-min survey); use in fall (17.9 birds/800-m(2,625-ft plot/60-min survey) and spring (16.6 birds/800-m (2,625-ft.) plot/60-min survey) was intermediate.

Through the course of the year, eight (8) species of diurnal raptor were observed during large bird surveys: sharp-shinned hawk (*Accipiter striatus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), Swainson's hawk (*Buteo swainsoni*), northern harrier (*Circus cyaneus*), bald eagle (*Haliaeetus leucocephalus*), American kestrel (*Falco sparverius*), and merlin (*Falco columbarius*). Diurnal raptor use was highest during spring (0.75 birds/800-m (2,625-ft.) plot/60-min survey), followed by fall (0.65 birds/800-m (2,625-ft.) plot/60-min survey), summer (0.56 birds/800-m (2,625-ft.) plot/60-min survey), and winter (0.08 birds/800-m (2,625-ft.) plot/60-min survey). Red-tailed hawk made up most of the diurnal raptor use during fall, spring, and summer; diurnal raptor use in the winter was comprised of single observations of bald eagle, American kestrel, merlin, and an unidentified raptor.

During each survey, the flight paths of large birds were documented to create a record of spatial use within the project. Documented flight paths of large birds do not indicate that any portion of the Project Area supports more use than other areas. The majority of use documented in these surveys was by waterfowl which were observed moving through the Project Area during their spring and fall migration periods.

No federal or state threatened or endangered species were observed during the surveys. Three (3) special status species were documented including: American white pelican (*Pelecanus erythrorhynchos*; Minnesota special concern), Franklin's gull (*Leucophaeus pipixcan*; Minnesota special concern), and bald eagle (*Haliaeetus leucocephalus*; Bald and Golden Eagle Protection Act). Franklin's gull and American white pelican were observed only during migration periods. Six (6) bald eagle observations occurred within the southern half of the Project Area during late winter, spring, and summer, with four (4) eagles observed during fixed –point surveys; two (2) additional bald eagles were observed incidentally as biologists traveled between survey locations within the Project Area. Over the 192 hours of surveys, 30 bald eagle minutes were recorded, of which eight (8) minutes (5 minutes in March; 3 minutes in June) documented eagle flight within 800 m (2,625-ft.) and below 200 m (656-ft.) in height (*i.e.*, the area of risk important for assessing eagle exposure rate under the Eagle Conservation Plan Guidance).

Aerial raptor nest survey

Aerial surveys were conducted from a helicopter to identify raptor and eagle stick nests within and near the Project Area. Surveys were conducted in the period before leaf-out when raptors

are typically attending nests. In 2017, surveys were conducted on the following dates: March 29-30, April 2, and April 4, 2017. Surveys within the Project Area and a one-mile buffer of the Project Area documented all potential raptor nests, including bald eagles, while the surveys out to the ten-mile buffer of the Project Area focused only on identifying large stick nests that could be potential bald eagle nests. A total of 24 raptor nests representing three (3) raptor species were detected during the aerial survey. No eagle nests were documented within the Project Area. Two (2) active bald eagle nests were observed at 7.6 and 7.7 miles (12.2 and 12.4 kilometers) respectively outside the Project Area within the surveyed 10-mile buffer (16-kilometer). Additional raptor stick nests documented during the survey included two (2) occupied and active great horned owl (*Bubo virginianus*) nests, five (5) occupied and active red-tailed hawk stick nests, one (1) occupied and active stick nest with a Canada goose, two (2) occupied and active stick nests of unknown smaller raptor species, one (1) occupied and inactive stick nest of an unknown species, and 11 unoccupied and inactive stick nests of unknown species.

Mammals

Many common mammal species are likely to utilize the Project Area, including white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), red and gray fox (*Vulpes fulva* and *Vulpes urocyon*), Virginia opossum (*Didelphis virginiana*), gray squirrel (*Sciurus carolinensis*), fox squirrel (*Sciurus niger*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), striped skunk (*Mephitis mephitis*), short-tailed weasel (*Mustela erminea*), and badger (*Taxidea taxis*) (**Appendix H - Site Characterization Study**). The larger mammal species are most likely to utilize the wooded areas and uncultivated grassland areas that are present within the Project Area, while the smaller mammal species are likely to use those areas as well as the cultivated areas within the Project Area.

Since the existing Lake Benton II Project was constructed prior to the release of the Wind Energy Guidelines, pre-construction bat surveys were not conducted. Post-construction studies of the original Lake Benton II Project (previously referred to as Buffalo Ridge Phase III) occurred from 1998 – 1999, and in 2001 and 2002. A total of 44 bat fatalities were detected in this Phase III area in 1999, 46 were found in 2001 and 25 were found in 2002 (Johnson et al. 2000, 2004). The majority of fatalities were tree bats, most of which were hoary bats (*Lasiurus cinereus*); smaller numbers of eastern red bats (*Lasiurus borealis*), big brown bats (*Eptesicus fuscus*), silver-haired bats (*Lasionycteris noctivagans*) and little-brown bats (*Myotis lucifugus*) were also documented. No northern long-eared bats (NLEB, *Myotis septentrionalis;* currently listed as federally threatened; Minnesota special concern) or tri-colored bats (*Perimyotis subflavus,* Minnesota special concern) were documented in any of the post-construction studies. Two (2) additional bat species which are now Minnesota species of special concern were observed during the previous post construction monitoring at the existing Lake Benton II Project, big brown bat and little brown bat (Johnson et al. 2000, 2004).

A desktop assessment was conducted to evaluate the potential for NLEB presence in the Project Area during the summer season following the NLEB January 2014 Interim Conference and Planning Guidance (USFWS 2014a). This assessment quantified habitat patches that could serve as NLEB habitat during the summer season, including: 1) commuting/travel habitat (*i.e.*, 0 – 14 acres [ac] (0 – 6 hectares [ha]) in size), 2) small roost/foraging habitat (*i.e.*, 15 – 49 ac (6 – 20 ha) in size), and 3) medium/large roosting/foraging habitat (*i.e.*, 50+ ac (20 + ha) in size). The habitat mapping effort indicates that there is one planted woodland within the northwestern portion of the Project Area which could serve as a corridor habitat during the summer (Figure 10, **Appendix J – Wildlife Conservation Strategy**). However, because there are no waterbodies in the vicinity of the wooded corridor and the surrounding area is primarily cropland and grazed pasture, it is anticipated that the summer use by NLEB is likely low. During migration periods when the species is not strongly associated with wooded habitat, NLEB may fly through the Project Area, similar to elsewhere in their range.

To assess current levels of bat activity, acoustic bat surveys consisting of three (3) ground-based acoustic detectors located in the Project Area are planned for survey deployment in April - October 2018.

Refer to Section 8.19.2 for a discussion on federally or state designated conservation concern species.

Reptiles and Amphibians

A variety of reptiles and amphibians may be present within the Project Area, such as the American toad (*Anaxyrus americanus*), northern leopard frog (*Lithobates pipiens*), western chorus frog (*Pseudacris triseriata*), painted turtle (*Chrysemys picta*), snapping turtle (*Chelydra serpentine*), wood turtle (*Glyptemys insculpta*), prairie skink (*Plestiodon septentrionalis*), and the common and plains garter snake (*Thamnophis sirtalis* and *Thamnophis radix*) (**Appendix H - Site Characterization Study**). Most of the species listed here live in habitats associated with wetlands, streams and ditches. A few of the aforementioned species (*e.g.*, wood turtle and garter snakes) may be found in open areas, such as grasslands or fallow agricultural fields.

Insects

The Project Area has the potential to harbor a number of federally and state listed insect species such as the Dakota skipper (*Hesperia dacotae;* federally threatened and state endangered), Poweshiek skipperling (*Oarisma poweshiek;* federally threatened and state endangered), and ottoe skipper (*Hesperia ottoe;* state endangered) (**Appendix H - Site Characterization Study**). Habitat requirements for these species are very specific and consist exclusively of native prairie. The habitat preferences of these insects largely overlap one another and grassland habitats dominated by non-native grasses are generally not suitable for these species. There are 49 MNDNR mapped native prairies within the Project Area that may provide suitable habitat for these listed insect species. Furthermore, two federally designated critical habitat units for the

Dakota skipper and one federally designated critical habitat unit for the Poweshiek skipperling occur within the Project Area.

A desktop analysis aimed at identifying suitable habitat for the Dakota skipper and Poweshiek skipperling was conducted within the Project Area in June 2017 (SWCA Environmental Consultants 2017). The desktop analysis identified a patchwork of potentially suitable habitat for these species within the Project Area. Given the similar habitat preferences of the ottoe skipper, it is likely that suitable habitat for the ottoe skipper is also present within the Project Area.

8.19.2 Rare and Unique Natural Features

Threatened and Endangered Species

The USFWS provides distribution lists of federally-listed threatened, endangered, and candidate species on a county-by-county basis. The USFWS county list indicates that Pipestone County is within the range (*i.e.*, has documented records, harbors critical habitat, and/or has the potential to harbor critical habitat for the designated species) of the federally threatened northern long-eared bat, western prairie fringed orchid (*Platanthera praeclara)*, and Dakota skipper, and the federally endangered Topeka shiner (USFWS 2017a). In the state of Minnesota, the western prairie fringed orchid and the Dakota skipper are also listed as state endangered. See Table 8.19.2 below for the USFWS IPaC results.

Table 8.19.2: Federally Listed Species Known to Occur in Pipestone County

Species	Federal Status
Northern Long-eared Bat	Threatened
Topeka Shiner	Endangered
Dakota Skipper	Threatened
Western Prairie Fringed Orchid	Threatened

The impetus for the listing of the northern long-eared bat by USFWS was primarily due to the threat posed by the white-nose syndrome (WNS), a fungal disease that has affected several bat populations (USFWS 2016). The decision to list the bat as threatened with a 4(d) rule provides protection to address conservation needs of this bat species (USFWS 2016). For areas in the United States where WNS affects bat populations, the conservation measures provided in the 4(d) rule exempt "take" (defined under the ESA as harming, harassing, or killing of protected species) as a result from certain activities (*i.e.*, wind turbine operation, forest management, maintenance of utility right-of-ways, tree/shrub removal for prairie maintenance, and limited

tree-removal activities, etc.) (USFWS 2016). The USFWS consider all Minnesota counties to be a part of the WNS zone as of June 30, 2017 (USFWS 2017c) and thus the Project Area is within the WNS zone. The 4(d) rule applies to the Project Area, but would only affect the project in terms of tree clearing restrictions if a roost tree was confirmed within the Project. According to publically available data, the closest known NLEB roost tree to the Project Area is approximately 160 miles (258 kilometers) to the northeast within Morrison County (MNDNR and USFWS 2017).

The northern long-eared bat ranges from eastern Quebec west to central Saskatchewan, Canada to northern Florida (Sparks et al. 2011, USFWS 2014a). In Minnesota, the northern long-eared bat is considered relatively common, likely to occur in the eastern half of the state within forested habitat (Baker 2016), and hibernate from mid-October to early April in caves and mines (USFWS 2015a). This species of bat has been known to be found in the same hibernacula as several other bat species, including the Indiana bat (*Myotis sodalis*). The closest northern long-eared bat hibernacula in Minnesota are located on the border between Nicollet and Le Sueur counties (approximately 105 miles (169 kilometers) to the east of the Project Area) (USFWS 2007, MNDNR and USFWS 2017). Although there is limited information on the movement of this species between winter and summer habitat, a maximum migration distance of 35 miles (56 kilometers) was reported farther south in the species' range (from Missouri), but further research may determine longer migrations (Boyles et al. 2009).

The northern long-eared bat roosts under bark, cavities, or crevices of dead and living trees during summer (Carter and Feldhamer 2005, USFWS 2015b). Summer roosting is generally sexually segregated; females form maternity colonies and males roost singly or in small groups in trees; however, colonies can be found in manmade structures as well (Boyles et al. 2009). Foraging habitat is generally located within forests interiors beneath the forest canopy, but above the shrub strata; however, northern long-eared bats have been known to forage over tallgrass prairie habitat where insects are gleaned from vegetation (Boyles et al. 2009). The bat may occur as a migrant within the Project Area, but the absence of high quality woodlands or floodplain forests within the Project Area limit the bat's likelihood to occur as a summering or wintering species within the Project Area.

The Topeka shiner is a federally endangered species that occurs in small prairie streams in pools containing clear, clean water (Berg et al. 2004). The Topeka shiner is known to occur in portions of South Dakota, Minnesota, Kansas, Iowa, Missouri, and Nebraska. Most Topeka shiner streams are perennial (flow year-round), but some are small enough to stop flowing during the drier summer months (MNDNR 2017l). Topeka shiner preferred habitat generally consists of streams with clean gravel, rock, or sand bottoms. The Topeka shiner is restricted to small, prairie streams that are tributaries to the Missouri River in Lincoln, Murray, Nobles, Pipestone, and Rock counties in southwestern Minnesota (MNDNR 2017l).

Final critical habitat was designated by USFWS for the Topeka shiner on July 27, 2004 and encompasses streams within the entirety of the Project Area and approximately 196 miles (315 kilometers) of 21 stream segments in Pipestone County, Minnesota (USFWS 2004). The closest NHIS occurrence records to the Project Area consist of two records within one mile of the Project Area along the southern and western margins of the Project Area (the most recent of which was in 2015). However, the USFWS Twin Cities Field Office has prepared specific recommendations for projects impacting waters containing Topeka shiners in Minnesota (USFWS-Twin Cities Field Office 2016). These recommendations are restricted to the Big Sioux River and Rock River watersheds within Pipestone County. These two watersheds make up approximately 48% of the Project Area. Refer to Section 8.19.6 for Topeka shiner impact mitigation and minimization measures.

The Dakota skipper is a federally–listed threatened species and state listed endangered species in Minnesota. The Dakota skipper is thought to prefer native drier prairie, where medium grasses are a major element of the vegetation. The most productive sites in Minnesota feature some topographic relief (Swengel and Swengel 1999). Adults will forage into nearby lowland prairie (mesic and wet prairie) for nectar. Final critical habitat was designated by USFWS for the Dakota skipper on October 1, 2015 and includes about 19,900 acres in units in Minnesota, North Dakota, and South Dakota (USFWS 2014b). Two federally designated critical habitat units for the Dakota skipper occur within the Project Area and are associated with Woodstock WMA East Unit in the eastern portion of the Project Area and Prairie Coteau SNA in the western portion of the Project Area. NHIS data reveals two (2) occurrence records at each of these designated critical habitat sites as recently as 2007/2008.

A desktop analysis aimed at identifying potential suitable habitat for the Dakota skipper and Poweshiek skipperling was conducted in June 2017. The desktop analysis, based off aerial imagery, identified a patchwork of potentially suitable habitat (remnant native prairie and wetlands) for both the Dakota skipper and Poweshiek skipperling scattered throughout the Project Area.

In recent decades, the skipper has disappeared from states to the south and east of Minnesota and has become increasingly rare and local in its remaining range (Cochrane and Delphey 2002). Despite recent targeted survey effort for this species, recent confirmed records of this species in western Minnesota have become very rare (MNDNR 2017k). However, these survey results provide a limited picture of the species, as this species' survey window is extremely limited each summer (a three week period from late June to mid-July during calm periods in the morning only). Furthermore, there are a very small number of qualified surveyors who can identify this inconspicuous species in the field. As a result this species does have the potential to occur in appropriate grassland habitats within the Project Area.

The Western prairie fringed orchid is a federally threatened and state listed endangered species in Minnesota. Western prairie fringed orchids are very local in their distribution and are largely

restricted to remnant native prairies or sedge meadows. These sites typically occur in full sunlight on moist till or sandy soils. There are very few remaining suitable sites for this orchid within its range as this species requires no cattle grazing and limited if any historical mowing for wild hay (MNDNR 2017m). Remnant native prairie and wetlands occur in the Project Area; however there are no NHIS records of this species within the Project Area or within one mile (1.6 kilometers) of the Project Area. As such, this species is expected to have a low chance of occurring within the Project Area.

The Applicant received a formal Natural Heritage Review letter from the MNDNR for the Lake Benton Wind II Project on July 18, 2017. In addition to the formal Natural Heritage Review letter from MNDNR, the Applicant queried the electronic database for rare species occurrences within one mile of the Project Area.

Results from the MNDNR NHIS database review for the Project Area indicated 15 records of nine different types of rare plants or animals within one mile of the Project Area boundary. The mapped occurrences include five records of vertebrate animals, seven records of invertebrate animals, and three records of vascular plants (see Table 8.19.2.1 below). The NHIS maintains that it is not an exhaustive inventory, and, thus, does not represent all occurrences of rare features within the state. In addition, ecologically significant features for which the NHIS has no records may exist within the Project Area.

Table 8.19.2.1: NHIS Species Recorded within One Mile of the Project Area

Type	State Status	Scientific Name	Common Name	Number of Mapped Occurrences within One Mile (1.6 kilometers) of Project Area	Year of Most Current Observation
Vertebrate Animal	State Endangered	*Athene cunicularia*	Burrowing Owl	1	1989
Vertebrate Animal	State Endangered	*Lanius ludovicianus*	Loggerhead Shrike	1	1995
Vertebrate Animal	State Threatened	*Emydoidea blandingii*	Blanding's Turtle	2	2007
Vertebrate Animal	State Threatened	*Fundulus sciadicus*	Plains Topminnow	1	2006

Type	State Status	Scientific Name	Common Name	Number of Mapped Occurrences within One Mile (1.6 kilometers) of Project Area	Year of Most Current Observation
Invertebrate Animal	Federal Threatened, State Endangered	*Hesperia dacotae*	Dakota Skipper	2	2008
Invertebrate Animal	State Endangered	*Hesperia ottoe*	Ottoe Skipper	1	1995
Invertebrate Animal	Federal Endangered, State Endangered	*Oarisma poweshiek*	Poweshiek Skipperling	4	2007
Vascular Plant	State Endangered	*Sagittaria brevirostra*	Short-beaked Arrowhead	1	2006
Vascular Plant	State Threatened	*Rhynchospora capillacea*	Hair-like Beak Rush	2	2006

It is important to note that some of the species listed are restricted to aquatic environments and are not expected to be impacted by development of the Project (*e.g.*, the plains topminnow is confined to creeks and small rivers). Typical construction BMPs will likely mitigate any potential impacts to aquatic species. Furthermore, several species identified are typically found in open, native prairies. Native prairie and open grasslands functioning as prairie are not anticipated to be impacted by development of the Project.

The MNDNR identified the possible occurrence of sensitive grassland breeding species, such as loggerhead shrike (*Lanius ludovicianus*; state endangered), as a possible development constraint in its July 18, 2017 Natural Heritage Review letter to Lake Benton Wind II (refer to **Appendix B - Agency Correspondence and Responses**). MNDNR requested that construction activities be avoided from late April through July where feasible to minimize potential impacts to these species.

Native Plant Community

Table 8.19.2.2: NHIS Native Plant Communities Recorded within One Mile of the Project Area

Native Plant Community Type	Number of NHIS Records within the Project Area	Number of NHIS Records within One Mile (1.6 kilometers) of the Project Area
Bulrush Marsh (Prairie)	1	1
Calcareous Fen	1	5
Dry Sand – Gravel Prairie (Southern)	0	4
Dry Hill Prairie (Southern)	44	47
Mesic Prairie (Southern)	1	1
Prairie Meadow/Carr	10	19
Wet Prairie (Southern)	4	5

The MNDNR has mapped rare and unique native plant communities as part of its NHIS database. These native plant communities have the potential to provide habitat for rare species of flora and fauna. The native prairie type habitats and calcareous fens native plant communities are both identified as a constraint by the MNDNR in the July 18, 2017 Natural Heritage Review letter. For additional details on these communities, please refer to the Vegetation and Wetlands portions of this document, in Section 8.17 and Section 8.18.

8.19.3 DNR Waterfowl Feeding and Resting Areas

No MNDNR Waterfowl Feeding and Resting Areas are located within or adjacent to the Project Area.

8.19.4 Important Bird Areas

The Important Bird Areas (IBA) program works to identify and conserve areas that are essential to birds and biodiversity. The program works with Audubon chapters, non-profit organizations, public agencies, and private landowners to manage and conserve land within the IBAs.

The Prairie Coteau IBA was designated to help protect remaining grassland habitat in southwestern Minnesota. The Prairie Coteau IBA is a complex of six (6) separate areas within the Prairie Pothole and Eastern Tallgrass Prairie Bird Conservation Regions, occurring mostly within Pipestone County, but with portions in Yellow Medicine, Lincoln, Murray, and Rock Counties. The six areas making up the IBA are not contiguous, though are ecologically similar and represent prairie and grassland bird habitat in a landscape that is otherwise highly fragmented and dominated by agriculture (National Audubon Society 2017).

Of the six separate areas that comprise the Prairie Coteau IBA complex, one area overlaps the Project, encompassing 57% of the Project Area, or 14,700 acres.

8.19.5 Potential Impacts

Field and desktop studies indicate that wildlife usage in the Project Area is comparable to that documented at other wind energy conversion systems sited in agricultural areas of the Midwest. Impacts to wildlife and wildlife habitat are expected to be minimal because grasslands, wooded areas, shrublands and other areas identified as important to wildlife will be avoided whenever possible. Additionally, these important wildlife features occur in relatively small amounts within the Project Area. The micrositing process will allow Lake Benton Wind II to identify and avoid important wildlife habitat resources. Additionally, minor impacts to grasslands, shrublands and wetlands that may occur as a result of Project construction will be temporary in nature. Construction and operation of the Project is not expected to change land use within, or adjacent to, the Project.

Impacts to wildlife would primarily occur to avian and bat populations. It can be expected that there is a likelihood that bird and bat fatalities will occur at the Project, but these fatalities are unlikely to affect populations of most species, including species of a conservation concern. However, impacts to birds and bats as a result of Project construction and operation are not expected to differ markedly from those reported by other previous studies in agricultural settings within Minnesota.

Birds

This Project is a repowering of an existing facility and the current layout minimizes impacts to avian species and their habitats by concentrating activity in agricultural lands. By siting the repowering turbines in cultivated fields and designing the associated infrastructure to avoid or minimize impacts on the native plant communities, grasslands, wetlands, and streams, Lake Benton Wind II has designed the Project facilities to avoid and minimize impacts on species of concern and other avian species, including direct (mortality) and indirect (displacement, habitat loss and fragmentation) impacts. The repowering footprint as currently planned reduces the amount of grassland fragmented by turbines and roads, and minimizes avian displacement effects. Thus, adverse effects on avian species of concern and their habitats are not anticipated to occur as a result of construction and operation of the Project.

Thirty-one (31) species of birds were detected in post-construction fatality surveys at the currently operational turbines from 1996 - 1999 (Johnson et al. 2000). The majority (74%) of fatalities in the area were smaller birds, passerine species, such as warblers, sparrows, swallows, flycatchers, and blackbirds. The total adjusted fatality rate for birds (based on scavenger removal and searcher efficiency) at Phase III (now called Lake Benton II) was estimated to be 4.45 birds/turbine/year, or 5.93 birds/MW/year. Raptors fatalities were not documented at Lake Benton II and raptor fatality estimates are minimal for the region (Table 5 of **Appendix J – Wildlife Conservation Strategy**). It is anticipated that the fatality rate per MW would remain similar to other wind projects in southwest Minnesota.

The two species of Minnesota special concern (American white pelican and Franklin's gull) recorded in the 2016 -2017 avian use surveys were detected migrating through the Project Area and are likely to occur within or near the Project Area only during spring and fall migration. These species would not be expected to be observed during the breeding and nesting season as habitat within the Project Area is limited. While both of these species were seen during avian use counts in the four-year Buffalo Ridge Study (Johnson et al. 2000), none were documented as fatalities, indicating a relatively low risk of collision.

The site poses a relatively low risk to bald eagles due to lack of eagle use and suitable nesting or foraging habitat in the Project Area. In addition, abundant prey for eagles is not expected to be present within the Project Area. Limited foraging opportunities may be present in the form of carrion, livestock carcasses, small game within grasslands/croplands, and waterfowl that may stop in Project Area crop fields or in adjacent WMAs.

Bats

Bat fatality rates among wind energy facilities of the Buffalo Ridge area is relatively low compared to rates elsewhere in the Midwest (Johnson et al. 2004). Previously, bat fatalities at the Lake Benton II (previously referred to as Phase III) project were estimated to range from 2.04 bats/turbine/year (2.72 bats/MW/year) (Johnson et al. 2000), with similar estimates during subsequent years (3.71 bats/MW/year in 2001; 1.81 bats/MW/year in 2002) (Johnson et al. 2004). The repowering of the Project is not expected to result in bat fatalities at rates higher than similar facilities in areas dominated by agriculture with minimal forested habitat. As with other facilities in Minnesota, tree bats such as hoary bats and eastern red bats are anticipated to be at greatest risk of fatality. Risk to the federally listed NLEB is expected to be relatively low, due to the lack of suitable summer habitat and the fact that no fatalities have been found at the currently operating turbines. Results of post-construction studies after repowering will be compared to these rates, but it is expected that the per MW bat fatality rate will remain similar to facilities elsewhere in southwestern Minnesota which is generally low compared to other areas of the U.S.

Rare and Unique Natural Features

The majority of identified rare and unique natural features flagged during the MNDNR's NHIS data review for the Project Area are of grassland-associated invertebrates (butterflies) and vascular plants concentrated in the central third of the Project Area in association with existing state owned SNA and WMA properties and grassland dominated areas (see **Map 6 – Public Land Ownership & Recreation** and **Map 18 - Land Cover**). Pro-active avoidance of native grassland habitat and public lands within the Project Area has been suggested by the MNDNR to the greatest extent practicable. Furthermore, limiting impacts to native grassland and wetland areas during the construction and siting process will reduce the potential impacts for these rare and unique natural features (*e.g.*, Dakota skipper and any other listed plants and animals).

DNR Waterfowl Feeding and Resting Areas

Given the absence of MNDNR Waterfowl Feeding and Resting Areas within or in close proximity to the Project Area, there are no potential impacts to MNDNR Waterfowl Feeding and Resting Areas as a result of the proposed project development. As a result, no mitigation measures are warranted for MNDNR Waterfowl Feeding and Resting Areas.

Important Bird Areas

Approximately 57% of the Project Area is within the Prairie Coteau IBA. The IBA is designated for grassland associated species in a landscape that is otherwise highly fragmented and dominated by agriculture (National Audubon Society 2017). By siting the repowering turbines in cultivated fields and designing the associated infrastructure to avoid or minimize impacts on the native plant communities, grasslands, wetlands, and streams, Lake Benton Wind II has designed the Project facilities to avoid and minimize impacts on avian grassland species of concern, including direct (mortality) and indirect (displacement, habitat loss and fragmentation) impacts.

8.19.6 Mitigation Measures

Lake Benton Wind II will implement the following measures to avoid potential impacts to wildlife and Rare and Unique Natural Features during selection of the turbine locations and Project development and operation:

- Avoid and minimize siting turbines in mapped native prairie, native plant communities, and MBS sites of biodiversity significance ranked moderate, high or outstanding;
- Maintain MNDNR recommended setback distances from WMAs, WPAs, SNAs and state parks to reduce risk to waterfowl and grassland-associated birds and butterflies when siting turbines in the Project;
- Avoid or minimize placement of turbines in high quality grassland or pasture areas that may act as native grasslands for breeding grassland bird and butterfly species;

- Avoid or minimize placement of turbines in previously undisturbed shrub/scrub vegetation types that may provide additional habitat for breeding birds;
- Protect existing trees and shrubs by avoiding tree removal for turbines, access roads and underground collector lines;
- Avoid or minimize disturbance of individual wetlands or drainage systems during Project construction. Wetland delineations and micrositing of turbines will be conducted prior to construction to identify limits of wetland boundaries and to avoid placement of turbines in sensitive wildlife habitat;
- Lake Benton Wind II will prepare a prairie protection and management plan in consultation with the MNDNR;
- Should siting and construction plans change, and impacts to wooded habitat that is potential roosting habitat for northern long-eared bats cannot be avoided, additional activity and cutting restrictions may be warranted per USFWS 4(d) rule and will be conducted in consultation with USFWS;
- Maintain appropriate water and soil conservation practices during construction through the implementation of construction BMPs. These practices include silt fencing, temporary reseeding, permanent seeding, mulching, filter strips, erosion blankets, grassed waterways and sod stabilization;
- Topeka shiner related management minimization recommendations (USFWS-Twin Cities Field Office 2016) for the Big Sioux and Rock River Watersheds (approximately 47.7% of the Project Area) include (but are not limited to) the following and will be implemented as appropriate:
    - Do not dewater or temporarily divert streams for construction;
    - Do not conduct in-stream work before August 15 to avoid disrupting spawning;
    - Follow all applicable requirements and best management practices for stormwater permits from the MPCA;
    - Minimize removal of riparian vegetation;
    - Mulch areas of disturbed soil and reseed promptly;
    - Implement appropriate erosion and sediment prevention measures;
    - Ensure that erosion control features are in place;
    - Design and install instream structures (*e.g.*, box culverts) in a manner that will not impair passage of Topeka shiners after construction is completed;
    - Do not operate motorized vehicles instream;
    - Backfill placed in the stream shall consist of rock or granular material free of fines, silts, and mud; and
    - Prevent materials and debris from falling into the water during construction.
- Construct wind turbines using tubular monopole towers;
- Light turbines in accordance with FAA requirements;

- Coordinate with local NRCS staff to revegetate non-cropland and pasture areas disturbed during construction or operation of the wind facility with native seed mixes appropriate to the region;
- Inspect and control noxious weeds in areas disturbed by the construction and operation of the Project;
- Conduct Tier 4 post-construction monitoring in order to better understand bird and bat impacts that are attributable to the Lake Benton Wind II operation and adjust operations based on the level of mortality observed;
- Prepare and implement a Wildlife Conservation Strategy (WCS) during construction of the Project. The WCS incorporates the components of an Avian Bat Protection Plan (ABPP) and has been developed in accordance with the guidelines and recommendations set forth in the USFWS Land-based Wind Energy Guidelines (2012) and the Wind Turbine Guidelines Advisory Committee's Recommended Guidelines to the USFWS (2010). A draft WCS is attached to this Application as **Appendix J (Wildlife Conservation Strategy)**;
- Lake Benton Wind II is committed to minimizing avian and wildlife impacts within the Project and will implement measures to avoid and minimize impacts to sensitive wildlife species and habitat. Lake Benton Wind II continues to maintain communication with USFWS and MNDNR regarding appropriate mitigation measures for wildlife impacts.

9.0 SITE CHARACTERIZATION

9.1 Description of Resources

To simulate wind flow patterns for the Project site, WindLogics performed a detailed modeling process consisting of a mesoscale model to simulate the large scale weather patterns, as well as a wind flow model to resolve small scale terrain and land features. The model output was then adjusted to on-site conditions using meteorological data normalized to long-term climatic means using the WindLogics Enhanced Measure-Correlate-Predict (E-MCP) methodology.

In addition to a thorough meteorological analysis of the site, WindLogics used archived weather data resources and physics-based numerical simulations (weather models) to calculate wind flow patterns at the site for the year 2014. Further analysis was performed utilizing multiple long-term data points from the Modern-Era Retrospective Analysis for Research and Applications (MERRA2) data set as compiled by the National Aeronautics and Space Administration (NASA), which are processed together using the E-MCP method to estimate long-term characteristics of the wind resource. The results of the E-MCP processing phase provides a thirty-year normalized time-series, representative of the long-term wind distributions at the site, which is then applied to wind turbine manufacturer's turbine power curves. This combination of meteorological modeling and normalization offers the best available assessment of the long-term wind resource at the site.

One meteorological tower was used in WindLogics' analysis (4256). The data was collected in ten-minute intervals at the location for six years and five months. Based on the measured data, the overall average wind speed based on the turbine locations is 9.34 m/s (30.64 ft./s or 20.89 mph) at hub height.

9.1.1 Interannual Variation

Interannual variation is the variation in expected annual wind speeds over the timeline of the project. There is a strong correlation between the Lake Benton Wind II's meteorological tower data and the long-term reference data sets available through the NASA's MERRA2 reanalysis program. Based on the analysis of measured and model data in the project area, the annual variation of wind speed is expected to be approximately 0.08 m/s (0.02 ft./s).

9.1.2 Seasonal Variation

Seasonal variation is represented by the change in monthly wind speeds. Table 9.1.2 shows the estimated average seasonal variation based on long-term data. The months of November through April are expected to have the highest wind speeds, and the months of June through September are expected to have the lowest wind speeds.

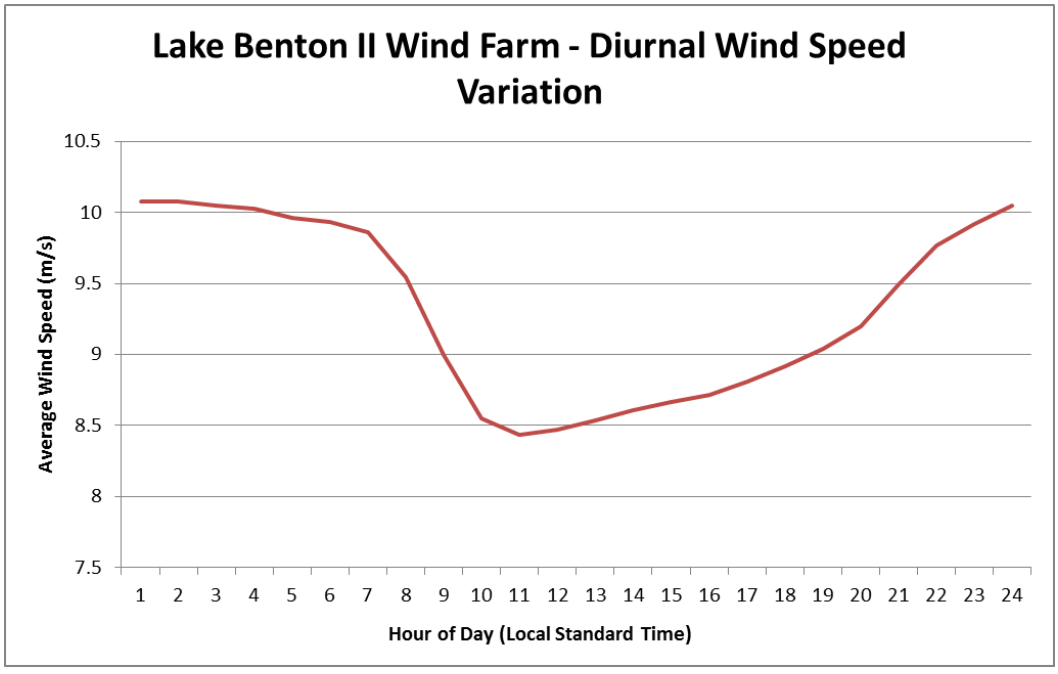
Table 9.1.2: Average Wind Speed

Month	Wind Speed (m/s)
January	9.9 (32.5 ft./s)
February	9.6 (31.5 ft./s)
March	9.8 (32.2 ft./s)
April	9.9 (32.5 ft./s)
May	9.3 (30.5 ft./s)
June	8.5 (27.9 ft./s)
July	8.0 (26.3 ft./s)
August	8.0 (26/3 ft./s)
September	9.2 (30.2 ft./s)
October	9.7 (31.8 ft./s)
November	10.0 (32.8 ft./s)
December	9.9 (32.5 ft./s)
Annual Average	**9.3 (30.5 ft./s)**

9.1.3 Diurnal Conditions

Diurnal variation represents the changes in weather patterns over the course of a day. Figure 9.1.3 shows the variation in wind speeds at the Lake Benton Wind II Project Area. The wind speeds are typically higher during the evenings and lower in the mornings and afternoons.

Figure 9.1.3: Lake Benton Wind II Diurnal Wind Speed Variation



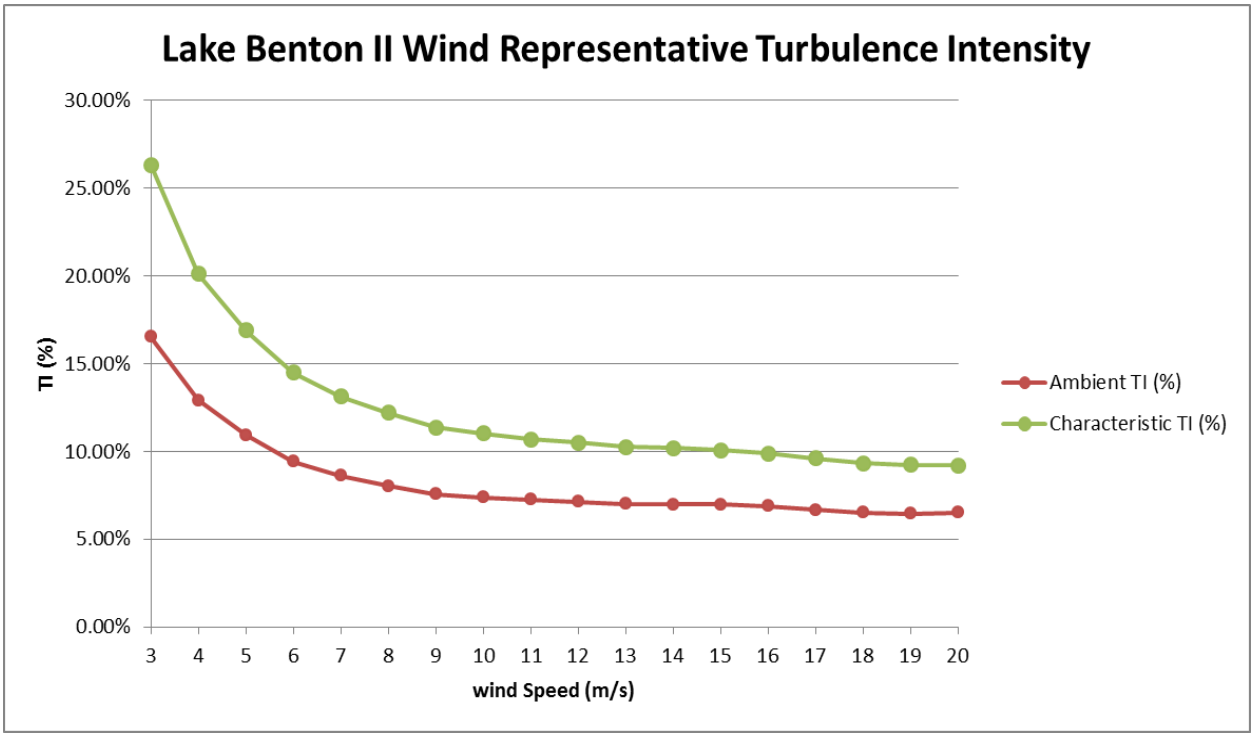
9.1.4 Atmospheric Stability

The thermal stability of the atmosphere fluctuates with respect to time of day, season, and instantaneous meteorological conditions. Generally, stability classes characterize the magnitude of vertical temperature gradient with unstable conditions associated with highly mixed atmospheric layer and stable conditions associated with stratified conditions. Among other things, atmospheric stability affects wind power production by dictating the amount of vertical wind shear. The thermal stability at Lake Benton Wind II is expected to be slightly stable based on on-site measurements and global reanalysis data.

9.1.5 Hub Height Turbulence

Turbulence intensity can be defined as the measured standard-deviation of wind speed over the mean wind speed for some time period. Turbulence intensity can be represented in wind speed bins. For 15 m/s (49 ft./s) wind speeds at Lake Benton Wind II, the ambient turbulent intensity at the site is 7.0% and the characteristic intensity is 10.1% at hub height (90m or 295 ft.). These measurements are based upon wind data measured from the meteorological towers present at the site. Overall, the turbulence intensity for the site is considered to be in the optimal range.

Figure 9.1.5: Lake Benton Wind II Representative Turbulence Intensity



These values are taken from 6.4 years of data at M4256 and are considered to be representative of the site. Overall, the turbulence intensity for the site is considered to be reasonable for the region and terrain.

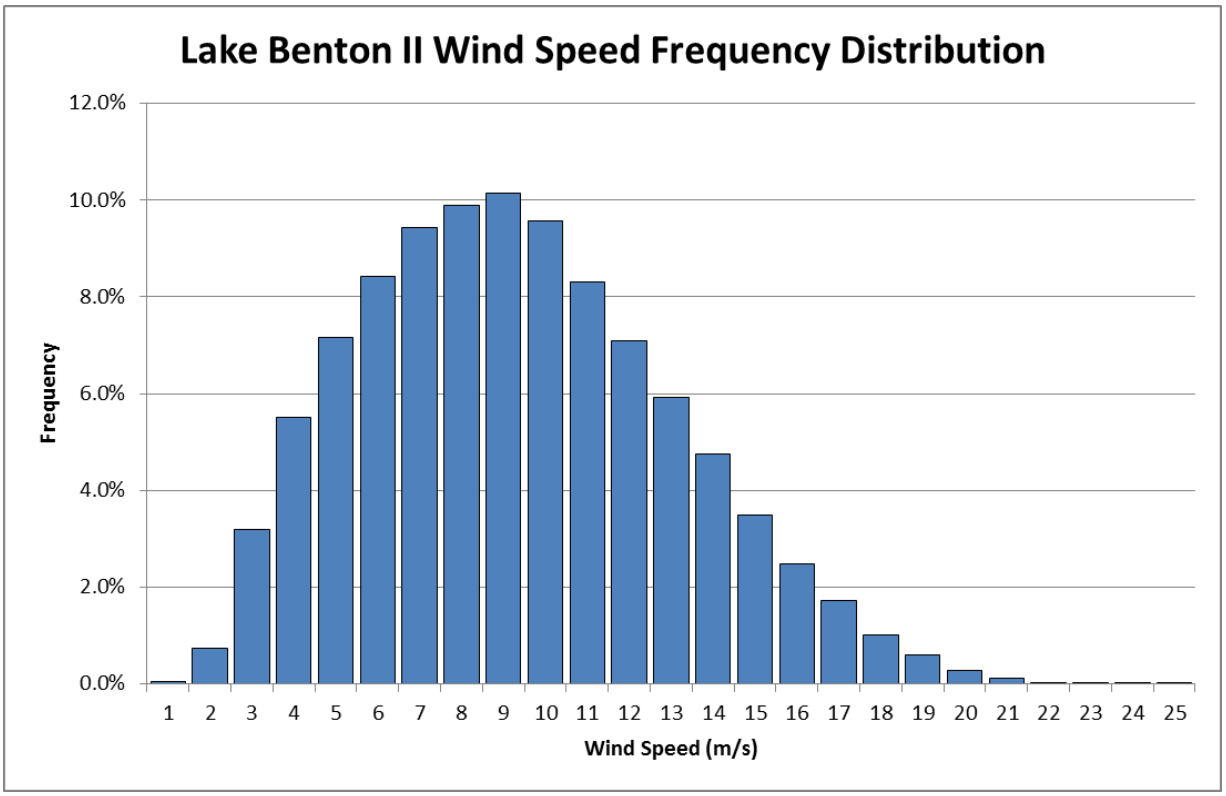
9.1.6 Extreme Wind Conditions

The maximum 10 minute average wind speed measured at the Lake Benton Wind II Project Area during the period of record was 25.8 m/s (84.7 ft./s). Long-term extreme winds were calculated at the site using a Periodic Maxima method and the Harris 1996 Gumbel-fit of the observed annual maximum wind speeds. Using this method, the maximum 50-year 10 minute mean wind speed and 3 second gust for Lake Benton Wind II are expected to be 30.7 m/s (23 ft./s) and 34.4 m/s (112.5 ft./s), respectively. These values are calculated from data collected from one meteorological tower spanning 6.5 years of measurements.

9.1.7 Wind Speed Frequency Distribution

Figure 9.1.7 provides the anticipated long-term annualized wind speed frequency distribution for the Lake Benton Wind II Project Area. The frequency distribution is calculated from one on-site meteorological tower and is normalized to the 25 closest grid points of the NASA MERRA2 dataset. A majority of the winds occur between 4 m/s (13 ft./s) and 14 m/s (45.9 ft./s).

Figure 9.17: Wind Speed Frequency Distribution at the Project



9.1.8 Wind Variation and Height

Wind shear is the change in wind speeds with increasing elevation. Wind shear is calculated using the power law equation based on the relative distance from elevation. The equation used for calculating wind shear is $v_2 = v_1 \left(\frac{z_2}{z_1}\right)^{\alpha}$ where v and z correspond to the wind speeds and heights at two levels and α is the shear coefficient. The shear coefficient can vary greatly due to geographical location and site site-specific characteristics such as terrain roughness, elevation, and atmospheric stability. Based upon data collected at the site, the representative wind shear at the site is 0.22.

Table 9.1.8: Lake Benton Wind II Measurement Speeds and Shears

Met Tower	Short-Term 90m Wind Speed (m/s)	Long-Term 90m Wind Speed (m/s)	Overall Shear
4256	8.97 (29.43 ft./s)	9.28 (30.45 ft./s)	0.22

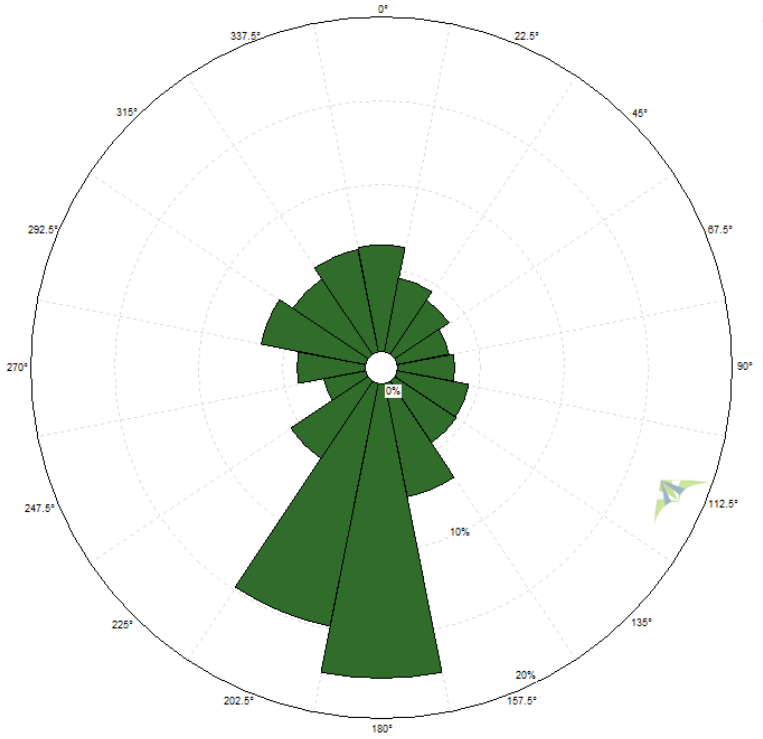
9.1.9 Spatial Wind Variation

As noted previously, the wind resource assessment is based on one metrological tower. The mean expected spatial variation in wind speed across the Lake Benton Wind II Project Area is between 8.9 and 9.5 m/s (between 29.2 and 31.2 ft/s) based on the turbine locations and their respective hub heights.

9.1.10 Wind Rose

A wind rose displays a graphical representation of the prevailing wind directions and wind speeds gathered from measured data. Figure 9.1.10 shows a representative wind rose from the metrological tower at Lake Benton Wind II.

Figure 9.1.10: Wind Rose from Meteorological Tower 4256



9.1.11 Other Meteorological Conditions

The proposed Project will undergo a Mechanical Loads Assessment performed by GE. The analysis takes into consideration terrain complexity, wind speed distributions, turbulence intensity, and other extreme weather and temperature conditions. Minnesota's winter climate presents significant risks factors of low temperatures and possible icing events. The average temperature at the proposed site is 7.9 C (46.22 F) with minimum and maximum temperatures of -35.8 C (-32.44 F) and 41.9 C (107.4 F). Each turbine is equipped with a cold weather package to mitigate hazards associated with extreme temperatures. The wind turbines will shut down at temperatures below -30.0 C (-22 F) and above temperatures 40 C (104 F) to mitigate the chances of catastrophic failures.

9.2 Other Nearby Wind Turbines

There are a total of approximately 155 identified wind turbines located within 5 miles (8 kilometers) of the Project Area. Based on data available through the FAA database, there are a number of existing commercial-scale wind projects located north, east, and south of the project area in Lincoln, Murray, and Pipestone counties (FAA, 2017). Northern Alternative Energy is located to the north of the Project Area and consists of approximately 24 wind turbines. Moraine Wind I and II are located east and south of the Project Area and consist of approximately 34 turbines each. Ridgewind Power Partners, enXco, and a number of small wind farms (Tholen,

McBeth, Boeve Windfarm, Fey Windfarm, K-Brink Windfarm, and Windcurrent Farm) are located south of the Project Area. Diversified Energy also has another turbine east of the Project Area.

10.0 PROJECT CONSTRUCTION

A number of pre-construction and construction activities will be completed to facilitate commercial operation. The majority of these activities relate to equipment ordering lead-time, as well as design and construction of the Project. The following provides a summary of key activities:

- Order all necessary components including towers, nacelles, blades, foundations, transformers, etc.;
- Finalize turbine micrositing;
- Complete surveys to establish locations of structures and roadways;
- Complete geotechnical soil borings, testing and analysis for proper foundation design and materials;
- Complete construction of new access roads and upgrades to existing access roads to be used for construction and maintenance, and construct temporary roadway improvements;
- Construct collection and feeder lines and communication cables;
- Retrofit existing POI stations to replace aged infrastructure and accommodate new equipment;
- Install tower foundations;
- Place towers and set wind turbines;
- Complete Project backfeed and testing; and
- Commence commercial operation.

As an initial step in Project construction, land will be graded where above-ground project infrastructure will be installed including areas for the turbine pads, culverts, access roads, the O&M building and additional facilities, as necessary. Grading may also be employed at a temporary laydown area. Typically, from the time grading begins the physical construction of the facility takes approximately 5 to 7 months for turbines to be erected and commencement of the reclamation process.

During construction, water and chemical applications are applied to roadways and construction areas for dust abatement. In high traffic areas, chemical applications, such as calcium chloride can be used to suppress dust. The use of chemical applications is confirmed via coordination with road authorities during the development of road use agreements. Water is typically applied in front of residences that are located along haul routes or that are in proximity to construction areas. Water is routinely and proactively applied in higher traffic and near residences so as to mitigate dust during construction.

During grading and excavation, top soil is removed, typically to a depth of 8 to 12 inches, depending on local soil conditions. Topsoil is stockpiled for use during restoration and reseeding as discussed in Section 10.5. In areas where excavation occurs, excavated soil is piled to heights of approximately 6 feet or less.

10.1 Roads and Infrastructure

During construction, temporary roadway improvements are anticipated on some public roads within the Project Area. Existing state, county, and township roads will be used for the transportation of equipment, construction materials and personnel to and from and within the Project Area. Final turbine and Project infrastructure layout, impact analyses, land owner requests, feedback from roadway jurisdictions, and other factors will assist the Applicant in determining which existing roads will be used for Project construction activities and what upgrades or maintenance may be required. Temporary roadway improvements will be installed along specific routes as necessary to facilitate the movement of equipment. There will be turning radii installed at various intersections to allow for turbine component deliveries. The Applicant will coordinate with the State, counties, and townships, as applicable, regarding the planned use of haul routes that may require road improvements or traffic control measures during the construction period and to ensure that any overweight permits, road use permits, road maintenance agreements and other approvals are secured.

During construction, the Applicant will perform routine maintenance and roadway repairs associated with upkeep needed or damage resulting from the Project activities.

10.2 Access Roads and Crane Paths

Access roads are necessary to connect the public roadway network to each turbine location. A total of approximately 13 miles (21 kilometers) of access roads will be necessary and permanent roadways will be gravel roads approximately 16 feet (5 meters) wide. New access roads will be constructed and some existing access roads from the existing Lake Benton II project will remain in place to be utilized and upgraded as appropriate for the proposed Project. Approximately 6.5 miles (10.5 kilometers) of new access roads are anticipated and 6.7 miles (10.8 kilometers) of existing access roads will be used. Actual final lengths of access roads will be determined by final turbine road layout, environmental constraints, land owner requests and other factors. After construction is complete, a gravel roadway approximately 20 feet (6 meters) wide will be installed around the base of each turbine so as to facilitate driving around turbine bases.

The typical cross section of access roads will be dependent on terrain, grade, and drainage considerations. Access roads may incorporate geotechnical fabric and cement stabilization measures beneath the aggregate roadway cap.

The installation of access roads may require gates, fences, or other existing landscape modifications to change. Modifications will be discussed with the landowners and gates and

fences will be repaired, replaced, or reconfigured, as needed and in coordination with the landowner. Lake Benton Wind II will work with landowners to ensure the location of access roads minimize adjacent land use disruptions to the extent practicable. Access roads will include appropriate drainage and culverts as necessary and permits for drainage and culvert installation will be obtained as required.

To facilitate crane movement and equipment delivery during construction, crane pathway locations will be finalized based on final turbine and road layout, landowner requests, avoidance of environmental constraints such as wetlands, sites of biological significance, prairies, sensitive habitat, and other factors.

Temporary roadways during construction will be installed to a maximum of 40 feet (12.2 meters) in total width. Access roads widened for crane paths and equipment deliveries will be reduced to their permanent width of approximately 16 feet (4.9 meters) upon completion of construction. Where temporary installations are removed, areas will be graded to natural contours, soil de-compaction and re-seeding will occur as described further in Section 10.5.

10.3 Associated Facilities

The Project will include construction of an O&M facility, installation of up to two (2) permanent MET towers, and an electrical collection system. The electrical collection system connecting the turbines to up to four POI stations will be installed underground at a minimum depth of 48 inches (122 centimeters), which is a sufficient depth to accommodate existing agricultural land use practices aboveground. Crossings at streams, railroads, roads, and other features where necessary, will be managed via directional-drilling beneath features. Directional drilling will include installation of conduit casings through which three-phase electrical cabling and fiber optic lines will be run. The collection system's electrical layout will require occasional aboveground features, including junction boxes, pad-mounted transformers, and cross bonding cabinets, all of which will be located on participating landowners' properties once adequately surveyed for environmental, cultural, and other considerations.

In addition, a temporary laydown area will be established for construction parking, equipment storage, and temporary office trailers. A concrete batch plant will be temporarily established at the laydown area or O&M building if necessary, to provide concrete production during construction. Areas used temporarily during construction will be restored in conjunction with post-construction clean-up.

10.4 Turbine Site Selection

10.4.1 Foundation Design

It is anticipated that the freestanding tubular wind turbine towers will be erected on reinforced concrete spread footing foundations. The bearing surface of the foundation will be at a depth up

to 12 feet (4 meters), with a width of up to approximately 68 feet (21 meters). The tubular steel tower will be connected to the concrete foundation through a base plate and high strength anchor bolts embedded in the concrete foundation. Approximately 35 tons of steel will be required in the rebar design of the foundation for structural support. The concrete turbine foundations will require up to approximately 2,400 cubic yards of excavation depending on soil requirements and turbine size. The installed foundation concrete is anticipated to be up to approximately 600 cubic yards (459 cubic meters) of material. Geotechnical data, turbine loads, and costs considerations will dictate the final design of the foundation at each site. Excavated soil will be used for backfill once turbine foundations are installed. Areas around the turbine are graded so that drainage will flow away from the base of the turbine. Excavated soil is also used in the construction of roads and is spread across construction areas as discussed further in Section 10.5.

10.4.2 Tower

The construction of the wind turbine towers will be modular, with individual components arriving at the site pre-fabricated. The majority of on-site assembly will consist of bolted connections and electrical wiring. Once the foundations are cured in the ground, two mobile cranes will be utilized to stack tower sections on the foundation and place the nacelle atop the completed tower assembly. The rotor (consisting of hub and blades) will then be assembled on the ground and picked up as a single unit to be bolted to the nacelle. At this point, tower crews will work within the tower to ensure all mechanical and electrical connections are completed to facilitate energization.

10.5 Post-Construction Cleanup and Site Restoration

Following the installation of turbines and the turbine being mechanically complete (fully erected), gravel driveways will be placed around the base of each turbine and left in place permanently. All temporary road radius improvements and temporary culverts will be removed and restored as turbines become mechanically complete. For any section of state, county, or township road used as a haul route, the roadway will be restored to its pre-construction state or better, as negotiated from road use agreements. This may consist or re-grading, re-paving, enhancing the shoulder of the road or enhancing the segment of roadway in a manner agreed upon by the Applicant and the responsible road authority.

Areas temporarily disturbed by construction activities will be re-graded to original contours. Excavated soil will be used as backfill, will be used in the construction of access roads, and remaining soil will be spread over temporary construction areas. Where excavated soil is spread and grading occurs, topsoil will be placed atop the excavated spoils and the areas will be revegetated. In areas where soil compaction occurred from construction activities, areas will be ripped up with a grader to decompact the soil. These areas will then be topped with topsoil and will also be revegetated.

Restored temporary construction areas will be reseeded unless the area is in a tillable agricultural field. Reseeded areas will be monitored to confirm that the seeding results in revegetation. Additional seed will be applied as necessary. Storm water BMPs, such as silt fence and straw wattle, will not be removed until at least 70% revegetation/regrowth has occurred, unless the area is in a tillable agricultural field. If the area is in tillable agricultural field, a cover crop will be planted to minimize soil loss.

10.6 Operation and Maintenance of Project

As explained in Docket No. E-002/M-16-777, Lake Benton Wind II is a build and transfer project. Thus, the Project will be transferred to NSP on the commercial operations date. O&M of the Project will be conducted by NSP consistent with the applicable North American Electric Reliability Corporation Reliability Standards. NSP will be responsible for maintenance and operations of the project upon final turnover. There will be 24 hours per day, 7 days a week operational monitoring of the Project through SCADA. During operations, the O&M crew will be comprised of approximately 7 to 12 primary staff who largely will be wind technicians (*i.e.*, technicians who carry out the maintenance on the turbines) along with a site supervisor. These workers will work out of the Project O&M building.

Turbines and the substation are monitored remotely by an O&M contractor 24 hours a day at the O&M Contractor's monitoring center and faults are reset when possible to ensure high turbine availability. Wind technicians are called out on non-resettable faults based on time of day and wind conditions. Certain turbine data is monitored for abnormalities at a NSP Maintenance and Diagnostic Center in Denver, Colorado. Engineers also provide performance and reliability optimization using various methods and replicate best practices across the fleet.

Maintenance is performed on a combination of time based and predictive maintenance schedules and is modified as needed based on engineering decisions. Scheduled time based turbine maintenance is performed on lower wind days whenever possible to maximize site output on high wind days. Substation and collection system maintenance is scheduled in the summer during low wind periods. Spare parts are kept on site to address long lead times, and frequently used items are kept to ensure failed equipment is returned to service as quickly as possible.

10.7 Costs

The Capital Expenditure for the Project is estimated to be approximately $170 million. This includes all costs of development, design, and construction. General costs associated with project operation, maintenance, initial spare parts, operating equipment, and operating supplies is estimated to be approximately $140,000 for the first year and is estimated to be an average of approximately $3.3 million per year for the following 24 years (assuming 25-year depreciation).

10.8 Schedule

Consistent with the terms of the agreement with NSP, the anticipated date of commercial operations is September 2019. The following schedule sets forth the milestones needed to meet the agreed on commercial operations date.

Table 10.8: Project Schedule

Activity	Estimated Completion
Site Permit Order	January 2019
Notice to Proceed	March 2019
Construction	Q2-Q3 of 2019
In-Service Date	September 2019

10.9 Energy Projections

A net capacity factor of approximately 49.5 to 57.5 percent is expected annually. The projected average annual output of approximately 469,685 MWh is anticipated for the Project.

10.10 Decommissioning and Restoration

10.10.1 Anticipated Life of the Project

The Project is expected to have an operational life of approximately 25 years.

10.10.2 Estimated Decommissioning Costs in Current Dollars

A site decommissioning estimate for the Project indicates that decommissioning will cost approximately $47,000 to 48,000 per turbine.

The decommissioning estimate includes the following assumptions:

- Decommissioning of turbines and towers estimates include dismantling of turbine components and transporting off site.
- Deduction for salvage value of the components.
- Tower foundations, transformer foundations, conduits and collection system would be removed to a depth of at least four feet (1.2 meters) below existing grade.
- Foundations at each site would be graded to match surrounding contours and restored to conditions that will support surrounding vegetation.
- All aggregate base roads would be scarified, loaded and removed from site to a location (within 10 miles (16 kilometers) roundtrip). The remaining subgrade would be de-

compacted and graded to match existing and natural grade. The area would then be re-established to conditions to support the surrounding vegetation.

- Removal of the electrical collection system would include the removal of termination sections near transformers to a depth 48 inches (122 centimeters) below the existing ground line.
- After dismantling and excavating the facility, high value components will be removed for scrap value. The remaining materials will be reduced to transportable size and removed from the site for disposal. Materials will be disposed where disposal is permitted and where there is capacity for the disposal.

10.10.3 Method of Ensuring that Funds are Available for Decommissioning

The Permittee will submit a decommissioning plan to the Commission at least fourteen (14) days prior to the pre-operation meeting, and provide updates to the plan every five (5) years thereafter. The plan will provide information identifying all surety and financial securities established for decommissioning and site restoration of the Project in accordance with the requirements of Minn. R. 7854.0500, subpart 13.

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

Over the life of the Project, funds to cover decommissioning costs will be maintained. Lake Benton Wind II has a contractual obligation with landowners for remediation of the properties back to a condition comparable to that of the property prior to the installation of the wind project.

10.10.5 Anticipated Methods of Site Decommissioning and Restoration

A decommissioning plan will be submitted at least fourteen (14) days prior to the pre-operation meeting that will provide an itemized breakdown of costs of decommissioning all project components, which will include labor and equipment. The plan will identify cost estimates for the removal of turbines, turbine foundations, underground collection cables, access roads, crane pads, substation(s) and other project components. The plan may also include anticipated costs for the replacement of turbines or repowering the project by upgrading equipment. This plan will be implemented at end of the Permit term, unless the Applicant requests and is granted a longer or renewed term by the Commission.

As an overview, the decommissioning plan will include, but will not be limited to, the following:

- Removal of the turbine, tower, infrastructure and foundation to a level of 48 inches (122 centimeters) below grade and return the grade to a condition comparable to conditions prior to the construction of the Project.

- Turbine disassembly would be accomplished using large cranes similar to those used for installation. Components would be removed in reverse-order of installation, and placed

either directly onto trucks for removal from the Project, or onto the ground near the turbine base for eventual loading onto trucks.

- Tower sections would be lowered to grade and cut into transportable sections for delivery to a scrap metal purchaser. Control cabinets in the base would be stripped of high value components and the balance turned over to a scrap company for haul and disposal. The options for wind turbine recycling are evolving and are expected to be very different at the time of Project decommissioning than they are currently.

- Foundations would be exposed using backhoes, bulldozers and other heavy earth moving equipment. Turbine foundations would be excavated to a depth sufficient to remove all anchor bolts, rebar, conduits, cable and concrete to a depth of 48 inches (122 centimeters) below grade. After removal of all noted foundation materials, the areas would be filled with clean compatible sub-grade material compacted to a density similar to the surrounding sub-grade material. All disturbed areas will be restored to pre-existing conditions and contours.

- Above-ground elements of the collection system, such as the, junction boxes, and pad-mounted transformers would be removed and the materials would be disposed, recycled, or sold. Environmental and agricultural impacts are minimized by leaving the underground cables in place. The electrical collection system is primarily an underground facility, therefore, decommissioning of the facility would be minimal.

- To perform the decommissioning activities, it may be necessary to return some roads to their construction stage widths. This would allow for efficient crane access to the turbine sites and facilitate removal of the wind turbine components by truck. A road survey will be conducted to determine the condition of the roads prior to work decommissioning activities. During the decommissioning process, where necessary, roads will be cleared, compacted, graded and maintained. Once decommissioning has been completed, the roads will be removed and reclaimed, unless the underlying landowner requests otherwise. This would likely include the removal of aggregate and any unnecessary culverts, de-compaction of the road base, and re-contouring of larger cuts and fills.

Restoration activities would also include, but not be limited to, the following:

- Topsoil would be removed prior to removal of structures from all work areas and stockpiled and separated from other excavated material. The topsoil would be de-compacted to match the density and consistency of the immediate surrounding area. The topsoil would be replaced to original depth and original surface contours reestablished where possible. Any topsoil deficiency and trench settling shall be mitigated with imported topsoil consistent with the quality of the affected site.

- All disturbed soil surfaces within agricultural fields would be seeded with a seed mix agreed upon with the landowner in order to maintain consistency with the surrounding agricultural uses. All other disturbed areas would be restored to a condition and forage density reasonably similar to surrounding conditions at the time of decommissioning. In all areas restoration will include leveling, terracing, mulching, and other necessary steps to prevent soil erosion, to ensure establishment of suitable grasses and to control noxious weeds and pests, as required.

11.0 IDENTIFICATION OF OTHER POTENTIAL PERMITS

The Applicant identified in Table 11 known or potentially required permits, reviews, and approvals for the Project.

Table 11: Other Potential Permits, Reviews and Consultations

Regulatory Authority	Permit/Approval
FEDERAL	
Federal Aviation Administration	• Form 7460-1 Notice of Proposed Construction or Alteration (Determination of No Hazard) • Form 7460-2 Notice of Actual Construction or Alteration
Federal Communications Commission	• Non-Federally Licensed Microwave Study • NTIA Communication Study
U.S. Army Corps of Engineers	• Clean Water Act Section 404 coordination (General or Nationwide permit if required)
U.S. Fish and Wildlife Service	• Informal coordination under Section 7 of the Endangered Species Act
Environmental Protection Agency (region 5) (EPA) in coordination with the Minnesota Pollution Control Agency (MPCA)	• Spill Prevention Control and Countermeasure Plan
U.S. Department of Agriculture	• Informal consultation if required for properties in Conservation / Grassland / Wetland Easement and / or Reserve Programs
STATE	
Minnesota Public Utilities Commission	• Site Permit for Large Wind Energy Conversion System
Minnesota Department of Labor and Industry	• Electrical Plan Review, Permits, and Inspections
Minnesota State Historic Preservation	• Informal SHPO coordination for Cultural and Historical resources review including State and

Regulatory Authority	Permit/Approval
Office (SHPO)	National Register of Historic Sites review
Minnesota Pollution Control Agency	• National Pollutant Discharge Elimination System/State Disposal System Permit (NPDES/SDS) – General Storm Water Permit for Construction Activity • License for a Very Small Quantity Generator of Hazardous Waste • Spill Prevention Control and Countermeasure Plan • Aboveground Storage Tank Notification Form • Clean Water Act Section 401 Water Quality Certification • NPDES and SDS General Permit MNG490000 for Nonmetallic Mining Operations and Associated Activities
Minnesota Department of Health	• Environmental Bore Hole approval for subsurface geotechnical studies • Plumbing Plan Review if required for O&M building • Water Well Permit if required for O&M building
Minnesota Department of Natural Resources	• Informal coordination for Endangered Species Statutes • Coordination on a Wildlife Conservation Strategy • General Permit for Water Appropriations, Dewatering • Native Prairie Protection Plan • Wetlands/Waters coordination for Public Waters Work Permit and/or License to Cross Public Lands and Waters
Minnesota Department of Transportation	• Oversize/Overweight Permit for State Highways • Access Driveway Permits for MnDOT Roads • Tall Structure Permit

Regulatory Authority	Permit/Approval
	• Utility Access Permit
LOCAL	
Pipestone County	• Building Permit for O&M • Laydown Yard Conditional Use Permit • Roadway Access Permit • Drainage Permit • Working in Right-of-Way Permit • Overweight/Over-Dimension Permit • Utility Permit
Pipestone County Soil and Water Conservation District	• Wetland Conservation Act Approvals
Townships	• Right-of-way permits, crossing permits, road access permits, and driveway permits for access roads and electrical collection system, as needed
OTHER	
MISO	• Turbine Change Study • Generator Interconnection Agreement

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APPENDIX A – Agencies Contacted Regarding Project

Agency Contact List, Lake Benton II Wind Project, February 26, 2018			
Contact Name/Title	**Agency Office**	**Email/Phone**	**Address**
Minnesota			
FEDERAL			
U.S. Army Corps of Engineers (USACE)			
Justin Berndt	St. Paul District	Justin.T.Berndt@usace.army.mil 651.290.5446	180 Fifth Street East, Suite 700, St. Paul, MN, 55101-1678
U.S. Department of Commerce (DOC)			
Pete Tenhula - Deputy Associate Administrator	DOC/NTIA/OSM HQ	202.482.1850	National Telecommunications & Information Administration, U.S. Department of Commerce, 1401 Constitution Ave., N.W., Washington, D.C., 20230
U.S. Fish and Wildlife Service (USFWS)			
Mags Rheude - Eagle and Wind Biologist	USFWS	Margaret_Rheude@fws.gov 612.725.3548, ext. 2202	Twin Cities Field Office, 4101 American Blvd. East Bloomington, MN. 55425-1665
STATE			
Minnesota			
Minnesota Department of Natural Resources (MNDNR)			
Kevin Mixon - Environmental Review Director	Region 4 (South Region)	kevin.mixon@state.mn.us 507.359.6073	261 Hwy 15 S, New Ulm, MN, 56073
Lisa Joyal - Endangered Species Environmental Review Coordinator	Ecological & Water Resources	lisa.joyal@state.mn.us 651.259.5109	500 Lafayette Road, St. Paul, MN, 55155
Cynthia Warzecha - Energy Project Planner		cynthia.warzecha@state.mn.us 651.259.5168	500 Lafayette Road, St. Paul, MN, 55155
Samanatha Bump - NHIS Review Specialist	Ecological & Water Resources	samantha.bump@state.mn.us 651.259.5091	500 Lafayette Road, St. Paul, MN, 55155
Melissa Doperalski - Environmental Assessment Ecologist	Ecological & Water Resources	melissa.doperaslski@state.mn.us 651.259.5738	500 Lafayette Road, St. Paul, MN, 55155
Brian Nyborg - Area Hydrologist	Ecological & Water Resources	507.831.2900, ext. 224	175 County Road 26, Windom, MN, 56101-1868
Lucas Youngsma - Area Hydrologist	Ecological & Water Resources	lucas.youngsma@state.mn.us 507.537.7258	1400 E Lyon, Marshall, MN, 56258
Minnesota State Historic Preservation Office (SHPO)			
Sarah Beimers - Manager of Government Programs & Compliance	State Historic Preservation Office	sarah.beimers@mnhs.org 651.259.3456	345 Kellogg Blvd. W., St. Paul, MN, 55102-1903
LOCAL			
COUNTY			
Pipestone County, MN			
Kyle Krier - Conservation & Zoning Administrator	Pipestone County	kyle.krier@co.pipestone.mn.us 507.825.1185	119 2nd Avenue SW, Suite #13, Pipestone, MN, 56164
Mary Ann DeGroot - County Recorder	Pipestone County Recorder's Office	maryann.degroot@co.pipestone.mn.us 507.825.1135	416 S. Hiawatha Ave., Pipestone, MN, 56164

Agency Contact List, Lake Benton II Wind Project, February 26, 2018			
Contact Name/Title	**Agency Office**	**Email/Phone**	**Address**
Gretchen LaBrune - County Deputy Recorder	Pipestone County Recorder's Office	507.825.1135	416 S. Hiawatha Ave., Pipestone, MN, 56164
Cathy Feste - Personnel Coordinator	Pipestone County	cathy.feste@co.pipestone.mn.us 507.825.1203	416 S. Hiawatha Ave., Pipestone, MN, 56164
CITY			
Rochelle VanDerwoude - City Clerk	Village of Ruthton	507.658.3902	501 Smith Avenue, Ruthton, MN, 56170
TRIBAL COORDINATION			
Steve Vance - Tribal Historic Preservation Officer	Cheyenne River Sioux Tribe		PO Box 590, Eagle Butte, SD, 57625
Bonnie St. John - Tribal Historic Preservation Officer	Crow Creek Sioux Tribe		PO Box 50, Fort Thompson, SD, 57339
Garrie Kills a Hundred - Tribal Historic Preservation Officer	Flandreau Santee Sioux Tribe		PO Box 283, Flandreau, SD, 57028-0283
Clair Green - Tribal Historic Preservation Officer	Lower Brule Sioux Tribe		PO Box 187, Lower Brule, SD, 57548
Trina Lone Hill - Tribal Historic Preservation Officer	Oglala Sioux Tribe		PO Box 108, Porcupine, SD, 57772
Russell Eagle Bear - Tribal Historic Preservation Officer	Rosebud Sioux Tribe		PO Box 809, Rosebud, SD, 57570
Duane Whipple - Tribal Historic Preservation Officer	Santee Sioux Nation		108 Spirit Lake Avenue, West, Niobara, NE, 68760-7207
Dianne Desrosiers - Tribal Historic Preservation Officer	Sisseton-Wahpeton Oyate		PO Box 907, Sisseton, SD, 57262
Kip Spotted Eagle -Tribal Historic Preservation Officer	Yankton Sioux Tribe		Box 1153 / 800 Main Avenue SW, Wagner, SD, 57380
William Bigday - Tribal Historic Preservation Officer	Crow Nation -		PO Box 159, Crow Agency, MT, 59022-0159
Teanna Limpy - Tribal Historic Preservation Officer	Northern Cheyenne Tribe		PO Box 128, Lame Deer, MT, 59043
Darrell "Curley" Youpee - Tribal Historic Preservation Officer	Fort Peck Assiniboine and Sioux Tribes		PO Box 1027, Poplar, MT, 59255-1027
Elgin Crows Breast - Tribal Historic Preservation Officer	Mandan, Hidasta & Arikara Nation		404 Frontage Road, New Town, ND, 58763
Dr. Erich Longie - Tribal Historic Preservation Officer	Spirit Lake Tribe of Fort Totten		PO Box 76, Fort Totten, ND, 58225

Agency Contact List, Lake Benton II Wind Project, February 26, 2018			
Contact Name/Title	**Agency Office**	**Email/Phone**	**Address**
Jon Eagle - Tribal Historic Preservation Officer	Standing Rock Sioux Tribe		PO Box D, Fort Yates, ND, 58538
Jeffrey Desjarlais Jr. - Tribal Historic Preservation Officer	Turtle Mountain Band of Chippewa		PO Box 900, Belcourt, ND, 58316
Cheyanne St. John - Tribal Historic Preservation Officer	Lower Sioux Indian Community		39527 Reservation Highway 1, Morton, MN, 56270
Amy Burnette - Tribal Historic Preservation Officer	Leech Lake Band of Ojibwe		115 6th Street, NW, Suite E, Cass Lake, MN, 56633
Noah White - Tribal Historic Preservation Officer	Prairie Island Indian Community		5636 Sturgeon Lake Road, Welch, MN, 55089
Kade Ferris - Tribal Historic Preservation Officer	Red Lake Band of Chippewa		PO Box 274, Red Lake, MN, 56671
Samantha Odegard - Tribal Historic Preservation Office Coordinator	Upper Sioux Community		P.O. Box 147, Granite Falls, MN, 56241
Cayla Olson - Tribal Historic Preservation Officer	White Earth Band of Minnesota Chippewa		PO Box 418, White Earth, MN, 56591
Michael Black Wolf - Tribal Historic Preservation Officer	Fort Belnap Indian Community		656 Agency Main Street, Harlem, MT, 59526
Lance Foster - Tribal Historic Preservation Officer	Iowa Tribe of Kansas and Nebraska		3345 B Thrasher Rd, White Cloud, KS, 66094
Virginia Richey - Tribal Historic Preservation Officer	Cheyenne and Araphao Tribes		100 Red Moon Circle, Concho, OK, 73022
David Grignon - Tribal Historic Preservation Officer	Menominee Indian Tribe of Wisconsin		W3426 Cty VV West, P.O. Box 910, Keshena, WI, 54135

APPENDIX C – Pre-Construction Sound Analysis

SOUND LEVEL ASSESSMENT REPORT

Lake Benton Wind II Project
Pipestone County, Minnesota

Prepared for:

Atwell, LLC
143 Union Boulevard, Suite 700
Lakewood, CO 80228

Prepared by:

Epsilon Associates, Inc.
3 Mill & Main Place, Suite 250
Maynard, MA 01754

February 16, 2018
Revision: May 1, 2018

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1.0 EXECUTIVE SUMMARY

The Lake Benton Wind II Project (the Project or LBWII) is a proposed wind power generation facility expected to consist of 44 wind turbines within an approximately 40 square mile region (Project Area) in Pipestone County, Minnesota. The Project is being developed by Lake Benton Power Partners II, LLC, an indirect, wholly-owned subsidiary of NextEra Energy Resources, LLC (NEER). Atwell, LLC (Atwell) retained to assist in the permitting of the Project has retained Epsilon Associates, Inc. (Epsilon) to conduct a pre-construction sound level assessment for the proposed wind turbines for this Project.

In general, this sound level assessment has been designed based on procedures identified in the Guidance for Large Wind Energy Conversion System, Noise Study Protocol and Report (LWECS Guidance) published by the Minnesota Department of Commerce, Energy Facility Permitting, dated October 8, 2012. The assessment included a sound monitoring program to determine existing sound levels in the vicinity of the Project, computer modeling to predict cumulative worst-case future L_{50} sound levels from the Project and existing non-NEER wind turbines, and a comparison of operational sound levels to regulatory limits. The analysis includes a total of 48 wind turbines (44 proposed + 4 alternates) of which five (5) are proposed to be GE 2.1-116 wind turbines and 43 are proposed to be GE 2.3-116 wind turbines. This Project is required to comply with Minnesota Pollution Control Agency (MPCA) State Noise Ordinance Standards, which are set forth in Section 4. For this analysis, all receptors with land use considered as Noise Area Classification 1 (NAC 1) were included in the modeling and evaluated as per Minn. Rule 7030.0040. The most restrictive of the noise limits is the nighttime L_{50} sound level for NAC 1 of 50 dBA.

The sound levels due to existing non-NEER wind turbines within the Project Area were combined with sound levels from the Project through modeling. These modeled wind turbine L_{50} sound levels are below the MPCA limit of 50 dBA. Under conditions resulting in ambient sound levels of 44 dBA or less, total sound levels (Project + existing non-NEER wind turbines within the Project Area + non-wind-turbine ambient) will meet the MPCA limit of 50 dBA. Short-term nighttime measurements showed non-wind-turbine ambient L_{50} broadband sound levels to be well below 44 dBA under low ground-level wind speeds and ranging from just below to above the cut-in wind speed at hub height. Non-wind-turbine ambient sound levels in the vicinity of the Project fluctuate due to sound sources such as ground level winds, vehicular traffic, and vegetation rustle, all of which can cause non-wind-turbine ambient sound levels to exceed the MPCA L_{50} nighttime limit of 50 dBA. Moreover, the highest predicted worst-case Project Only L_{50} sound level at a modeling receptor is 47 dBA and therefore meets the most restrictive Minnesota sound limit of 50 dBA.

2.0 INTRODUCTION

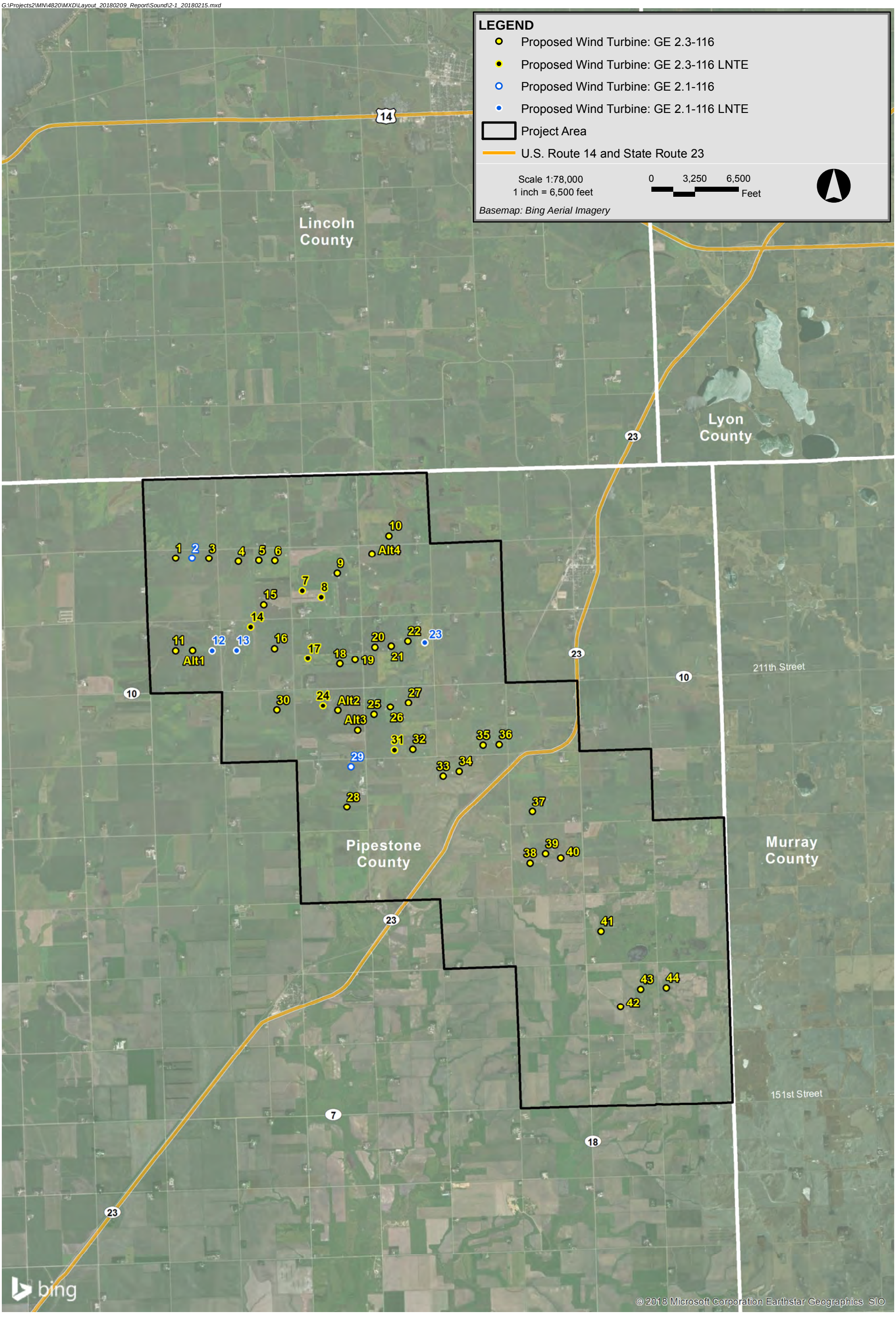
The proposed Project to be located in Pipestone County, Minnesota will consist of 44 wind turbines. The proposed wind turbines are a combination of GE 2.1 megawatt (MW) and GE 2.3 MW units with rotor diameters of 116 meters and hub heights of 80 and 90 meters, respectively. Three GE 2.1-116 units will be LNTE models and six GE 2.3-116 units will be LNTE models. No new substation is proposed for the Project. Figure 2-1 shows the locations of the 44 proposed and 4 alternate wind turbines over aerial imagery in Pipestone County.

A detailed discussion of sound from wind turbines is presented in a white paper prepared by the Renewable Energy Research Laboratory.[1] A few points are repeated herein. Wind turbine sound can originate from two different sources: mechanical sound from the interaction of turbine components, and aerodynamic sound produced by the flow of air over the rotor blades. Prior to the 1990's, both were significant contributors to wind turbine sound. However, recent advances in wind turbine design have greatly reduced the contribution of mechanical sound. Aerodynamic sound has also been reduced from modern wind turbines due to slower rotational speeds and changes in materials of construction. Aerodynamic sound, in general, is broadband (has contributions from a wide range of frequencies). It originates from encounters of the wind turbine blades with localized airflow inhomogeneities and wakes from other turbine blades and from airflow across the surface of the blades, particularly the front and trailing edges. Aerodynamic sound generally increases with increasing wind speed up to a certain point, then typically remains constant, even with higher wind speeds. However, sound levels in general also increase with increasing wind speed with or without the presence of wind turbines.

This report presents the findings of an ambient measurement program and a sound level modeling analysis for the Project. The LBWII wind turbines were modeled in Cadna/A using sound data from a GE technical report provided by Atwell and existing non-NEER wind turbines were also included in the analysis. The results of this analysis are found within this report.

[1] Renewable Energy Research Laboratory, Department of Mechanical and Industrial Engineering, University of Massachusetts at Amherst, Wind Turbine Acoustic Noise, June 2002, amended January 2006.

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Lake Benton Wind II Project **Pipestone County, Minnesota**

Epsilon Associates Inc.

Figure 2-1
Aerial Locus

3.0 SOUND METRICS

There are several ways in which sound levels are measured and quantified. All of them use the logarithmic decibel (dB) scale. The following information defines the sound level terminology used in this analysis.

The decibel scale is logarithmic to accommodate the wide range of sound intensities found in the environment. A property of the decibel scale is that the sound pressure levels of two or more separate sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total is only a 3-decibel increase (53 dB), which is equal to doubling in sound energy but not equal to a doubling in decibel quantity (100 dB). Thus, every 3-dB change in sound level represents a doubling or halving of sound energy. Relative to this characteristic, a change in sound levels of less than 3 dB is imperceptible to the human ear.

Another mathematical property of decibels is that if one source of sound is at least 10 dB louder than another source, then the total sound level is simply the sound level of the higher-level source. For example, a sound source at 60 dB plus another sound source at 47 dB is equal to 60 dB.

A sound level meter (SLM) that is used to measure sound is a standardized instrument.[2] It contains "weighting networks" (e.g., A-, C-, Z-weightings) to adjust the frequency response of the instrument. Frequencies, reported in Hertz (Hz), are detailed characterizations of sounds, often addressed in musical terms as "pitch" or "tone". The most commonly used weighting network is the A-weighting because it most closely approximates how the human ear responds to sound at various frequencies. The A-weighting network is the accepted scale used for community sound level measurements; therefore, sounds are frequently reported as detected with a sound level meter using this weighting. A-weighted sound levels emphasize middle frequency sounds (i.e., middle pitched – around 1,000 Hz), and de-emphasize low and high frequency sounds. These sound levels are reported in decibels designated as "dBA". Z-weighted sound levels are measured sound levels without any weighting curve and are otherwise referred to as "unweighted". Sound pressure levels for some common indoor and outdoor environments are shown in Figure 3-1.

Because the sounds in our environment vary with time they cannot simply be described with a single number. Two methods are used for describing variable sounds. These are exceedance levels and the equivalent level, both of which are derived from a large number of moment-to-moment A-weighted sound level measurements. Exceedance levels are values from the cumulative amplitude distribution of all of the sound levels observed during

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[2] *American National Standard Specification for Sound Level Meters*, ANSI S1.4-1983 (R2006), published by the Standards Secretariat of the Acoustical Society of America, Melville, NY.

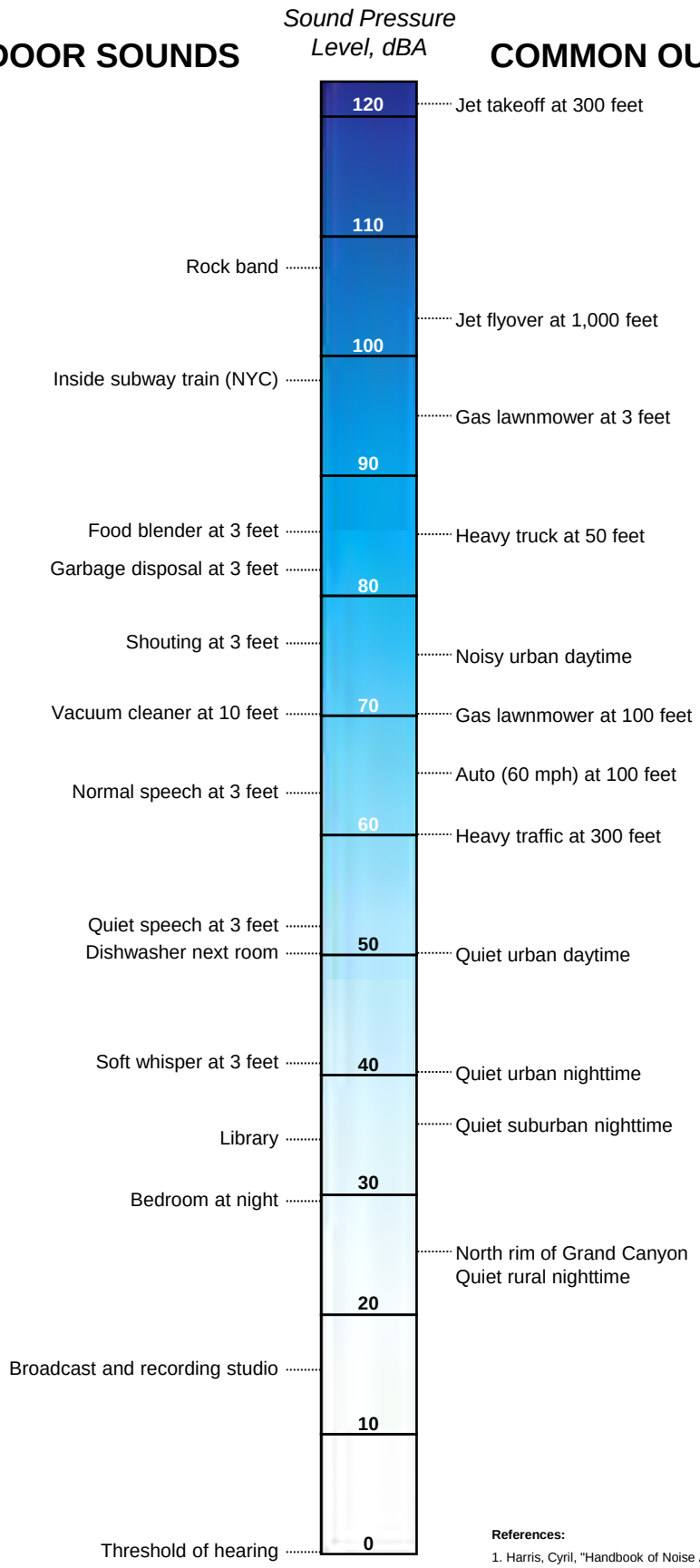
a measurement period. Exceedance levels are designated L_n, where n can have a value between 0 and 100 in terms of percentage. Several sound level metrics that are reported in community sound monitoring are described below.

- L_{10} is the sound level exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder sounds like those from passing motor vehicles.

- L_{50} is the sound level exceeded 50 percent of the time. It is the median level observed during the measurement period. The L_{50} is affected by occasional louder sounds like those from passing motor vehicles; however, it is often found comparable to the equivalent sound level under relatively steady sound level conditions.

- L_{90} is the sound level exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when there are no obvious nearby intermittent sound sources.

- L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (*i.e.,* the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is typically A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by loud sounds if there are fluctuating sound levels.



References:

1. Harris, Cyril, "Handbook of Noise Acoustical Measurements and Noise Control", p 1-10., 1998
2. "Controlling Noise", USAF, AFMC, AFDTC, Elgin AFB, Fact Sheet, August 1996
3. California Dept. of Trans., "Technical Noise Supplement", Oct, 1998

Figure 3-1

Common Sound Levels in the Environment

4.0 NOISE REGULATIONS

4.1 Federal Regulations

There are no federal community noise regulations applicable to this Project.

4.2 Minnesota State Regulations

The proposed Lake Benton Wind II Project within Pipestone County, MN is required to comply with MPCA's 7030.0040 sound standard, which states:

> **Subpart 1. Scope**. These standards describe the limiting levels of sound established on the basis of present knowledge for the preservation of public health and welfare. These standards are consistent with speech, sleep, annoyance, and hearing conservation requirements for receivers within areas grouped according to land activities by the noise area classification (NAC) system established in part 7030.0050. However, these standards do not, by themselves, identify the limiting levels of impulsive noise needed for the preservation of public health and welfare. Noise standards in subpart 2 apply to all sources.
>
> **Subpart 2. Noise Standards.**

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

Minn. Rule 7030.0020 defines daytime hours as 7:00AM to 10:00PM and nighttime hours from 10:00PM to 7:00AM. All daytime and nighttime limits are expressed in A-weighted decibels (dBA) and are applicable over the duration of an hour. These are to be measured using the fast response characteristic of the measurement instrumentation per Minn. Rule 7030.0060.

The above sound levels are total sound levels. Total sound levels include contribution from any sound sources in the environment, existing and Project-related. NAC 1[3] receptors are protected by the lowest sound level limits of the MPCA. Since wind turbines can operate

[3] NAC 1 is defined per Rule 7030.0050 as household units (including farm houses); hotels, models or other overnight lodging; mobile home parks or courts; other residential units; motion picture production; medical and other health services; correctional institutions; educational services; religious activities; cultural activities and nature exhibitions; entertainment assembly; camping and picnicking areas (designated); resorts and group camps; other cultural, entertainment, and recreational activities.

under conditions resulting in maximum sound power during both the day and at night, the Project would need to comply during the period with more stringent limits, nighttime. Furthermore, because wind turbine sound is generally steady during a relatively constant wind speed there would be minimal difference, i.e. < 5 dBA, between the L_{50} and L_{10} sound levels due to a wind turbine. As the L_{50} and L_{10} noise limits differ by 5 decibels, the L_{50} limit is more restrictive for a wind energy facility. Therefore, NAC 1 receptors have been evaluated against the L_{50} sound level limit of 50 dBA in this analysis.

5.0 EXISTING SOUND LEVELS

5.1 Overview

The Project is to be located in the northeast corner of Pipestone County, Minnesota, to the east and west of Highway 23. The Project is proposed to have 44 GE wind turbines, a portion of which will be 2.1 MW units, with the remainder 2.3 MW units.

The region is currently home to multiple existing wind energy facilities. Some wind turbines are owned and operated by NEER which will be decommissioned before construction of the Project ("existing NEER" wind turbines). Other existing wind turbines in the vicinity of the Project are not owned or operated by Lake Benton Wind II or another NEER subsidiary, and it is assumed that these wind turbines will remain operational. These wind turbines will be referred to throughout this report as "existing non-NEER" wind turbines and include the following wind energy facilities: McBeth Wind, Moraine I Wind, Moraine II Wind, Shane's Wind Machine, and Tholen Wind. Non-NEER wind turbines also exist outside the Project Area to the north.[4] Existing NEER and non-NEER wind turbine locations[5] within the Project Area and existing non-NEER wind turbine locations[6] outside the Project are shown in Figure 5-1 as an aerial locus with known wind energy facilities identified.

5.2 Sound Level Environment

An ambient sound level survey was conducted to characterize the current acoustical environment in the community surrounding and within the Project Area. Existing sound sources include: NEER and non-NEER operational wind turbines, vehicles on Highway 23 (including trucks) and on other local roads, wind, animals including: dogs, cows, and coyotes, some rustling vegetation, occasional distant aircraft, occasional trains, and birds.

5.3 Sound Level Measurement Locations

Sound level measurement locations were originally selected based on the LWECS Guidance document which requires at least seven (7) days of measurements ("long-term"). The document specifies that measurements be performed within the Project Area at no fewer than three locations including the "worst-case" receptor predicted by the sound level model. The worst-case modeling receptor is monitoring location LT1 as determined by modeling results[7] using a preliminary wind turbine layout. Under the current modeling,

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[4] Non-NEER wind turbines outside the Project area will be identified only as such and not as simply "existing non-NEER" wind turbines.

[5] Provided by Atwell

[6] Based on personal observations by Epsilon staff and aerial imagery

[7] Project Only

this location has a modeled Project Only broadband sound level equal to the worst-case modeled sound level at a residence. This layout is documented in a pre-construction sound level measurement protocol (the Protocol) that was submitted to the MN DOC on December 12, 2017. The layout is shown on Figure 1 of the Protocol which is provided as Appendix A of this report. As existing NEER wind turbines had not yet been decommissioned additional off-site measurement locations were necessary to capture future ambient sound levels without the contributions of these wind turbines while on-site locations would provide sound levels for current conditions. During the meeting on December 12, 2017, the DOC requested that additional measurements be performed close to State Highway 23 without existing wind turbine sound contribution, and an additional measurement location was added to the program to address this request.

Upon commencement of the program, the Epsilon field technician discovered operational wind turbines outside the Project Area that were not previously identified and were not owned or operated by LBWII or another NEER subsidiary. These field-identified wind turbines are shown in Figure 5-1. It was ascertained that no pre-determined long-term measurement location would be in absence of wind turbine sound contribution. Accordingly, additional measurements were performed at off-site locations that do not have existing wind turbine sound contribution. Similarly to the DOC-requested Hwy 23 location, three more short-term locations were utilized. Details of the long-term and short-term locations are described below.

5.3.1 Long-term Locations

The selection of the sound monitoring locations was intended to be representative of on-site and off-site receptors per the requirements of the LWECS Guidance document. Figure 5-2 shows the actual long-term measurement locations overlaid upon an aerial photograph of the surrounding area. Each measurement location is described below. The coordinates for the five long-term locations were obtained by Epsilon staff using Global Positioning System (GPS) instrumentation or satellite imagery and are presented in UTM NAD83 Zone 14N in Table 5-1. All distances shown in miles or are rounded to the nearest 10 feet. Photographs of the five locations are included in Figures 5-3 through 5-7, respectively.

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LEGEND

△ Existing NEER Wind Turbine Within Project Area

▲ Existing Non-NEER Wind Turbine Within Project Area

▲ Existing Non-NEER Wind Turbine Outside Project Area

Note: Locations based on personal observations by Epsilon staff and aerial imagery.

Project Area

Scale 1:78,000
1 inch = 6,500 feet

0 3,250 6,500 Feet

Basemap: Bing Aerial Imagery

Lincoln County

Lyon County

Pipestone County

Murray County

Shane's Wind Machine

Moraine II Wind

Tholen Wind

Moraine I Wind

McBeth Wind

211th Street

151st Street

14 23 10 7 18

bing

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Lake Benton Wind II Project Pipestone County, Minnesota

Epsilon Associates Inc.

Figure 5-1
Aerial Locus of Existing Wind Turbines

- Location LT1 – Modeling Receptor #824
  - Approximately 1,620 feet to the closest proposed wind turbine (#12), 3,690 feet to the closest existing NEER wind turbine, and 2.7 miles to the closest existing non-NEER wind turbine. This on-site location is representative of the worst-case modeled receptor. [8]
- Location LT2 – Modeling Receptor #718
  - Approximately 2,940 feet to the closest proposed wind turbine (#36), 1,820 feet to the closest existing NEER wind turbine, and 1,680 feet to the closest existing non-NEER wind turbine. This on-site location is representative of the residences around the center of the Project Area in the vicinity of Hwy 23.
- Location LT3 – Modeling Receptor #848
  - Approximately 3,670 feet to the closest proposed wind turbine (#42), 1,240 feet to the closest existing NEER wind turbine, and 1,390 feet to the closest existing non-NEER wind turbine. This on-site location is representative of the residences on the south end of the Project Area.
- Location LT4[9] – Modeling Receptor #867
  - Approximately 2.4 miles to the closest proposed wind turbine (#1). This off-site location was initially selected to be absent of wind turbine sound contribution, but based on the proximity of non-NEER wind turbines, these wind turbines influenced the measured sound levels.
- Location LT5 – Outside of the calculation area
  - Approximately 3.3 miles to the closest proposed wind turbine (#1). This off-site location was initially selected to be absent of wind turbine sound contribution, but based on the proximity of non-NEER wind turbines, these wind turbines influenced the measured sound levels.

[8] Based on preliminary modeling using the layout identified in the Protocol

[9] A different location was initially identified for LT4 in the Protocol submitted to the DOC. Siting constraints dictated the use of the alternate location.

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LEGEND

- Proposed Wind Turbine: GE 2.3-116
- Proposed Wind Turbine: GE 2.3-116 LNTE
- Proposed Wind Turbine: GE 2.1-116
- Proposed Wind Turbine: GE 2.1-116 LNTE
- Existing NEER Wind Turbine Within Project Area
- Existing Non-NEER Wind Turbine Within Project Area
- Existing Non-NEER Wind Turbine Outside Project Area

Note: Locations based on personal observations by Epsilon staff and aerial imagery.

- Short-Term Measurement Location
- Long-Term Measurement Location
- NEER Meteorological Tower
- Project Area
- 2 Miles from Proposed or Existing Wind Turbine Within Project Area

Scale 1:78,000
1 inch = 6,500 feet

0 3,250 6,500 Feet

Basemap: Bing Aerial Imagery

Lake Benton Wind II Project **Pipestone County, Minnesota**

Epsilon ASSOCIATES INC.

Figure 5-2
Sound Level Measurement Locations

Figure 5-3 Photo of Sound Level Measurement Location LT1 (facing north)



Figure 5-4 Photo of Sound Level Measurement Location LT2 (facing south)



Figure 5-5 Photo of Sound Level Measurement Location LT3 (facing east)



Figure 5-6 Photo of Sound Level Measurement Location LT4 (facing west)



Figure 5-7 Photo of Sound Level Measurement Location LT5 (facing south)



Table 5-1 GPS Coordinates – Long-term Sound Level Measurement Locations

Location	Coordinates UTM NAD83 Zone 14N	
	X (m)	Y (m)
LT1	723588.30	4894068.13
LT2	730676.58	4891268.22
LT3	732896.73	4884517.96
LT4	721640.00	4898912.00
LT5	719945.81	4900480.40

5.3.2 Short-term Locations

A total of four (4) short-term measurement locations were utilized for the program based on MN DOC comments on the Protocol, input from Atwell, and/or in-field determinations of the soundscape of the area. The specific locations were field-identified by the Epsilon engineer. Figure 5-2 shows the actual short-term measurement locations with respect to the Project Area. Each measurement location is described herein. The coordinates for the four short-term locations were obtained by Epsilon staff using field notes and satellite imagery

and are presented in UTM NAD83 Zone 14N in Table 5-2. Photographs of the four locations are included in Figures 5-8 through 5-11, respectively.

- Location ST1 – Northwest corner road edge at intersection of Hwy 23 and Co Hwy 8
  - Over 2 miles from an existing or proposed wind turbine in the Project Area. This location is representative of receptors in close vicinity to Hwy 23 and absent of wind turbine sound contribution.
- Location ST2 – Southwest corner road edge at intersection of 190th Ave and Co Hwy 89
  - Over 2 miles from an existing or proposed wind turbine in the Project Area. This location is representative of receptors northeast of the Project and absent of wind turbine sound contribution.
- Location ST3 – Southeast corner road edge at intersection of 201st St and 110th Ave
  - Over 2 miles from an existing or proposed wind turbine in the Project Area. This location is representative of receptors west of Hwy 23 that are a significant distance from road and absent of wind turbine sound contribution.
- Location ST4 – North edge of Co Hwy 6, approximately 0.55 miles west of Co Hwy 18
  - Over 2 miles from an existing or proposed wind turbine in the Project Area. This location is representative of receptors east of Hwy 23 that are a significant distance from road and absent of wind turbine sound contribution.

Table 5-2 GPS Coordinates – Short-term Sound Level Measurement Locations

Location	Coordinates UTM NAD83 Zone 14N	
	X (m)	Y (m)
ST1	726479.71	4886364.17
ST2	733110.70	4894638.17
ST3	720372.71	4891033.17
ST4	731123.70	4880072.17

Figure 5-8 Photo of Sound Level Measurement Location ST1 (facing east)



Figure 5-9 Photo of Sound Level Measurement Location ST2 (facing west)



Figure 5-10 Photo of Sound Level Measurement Location ST3 (facing west)



Figure 5-11 Photo of Sound Level Measurement Location ST4 (facing west)



5.4 Sound Measurement Methodology

5.4.1 Long-term Measurement Methodology

Continuous programmable unattended sound level meters were placed at on-site Locations LT1, LT2, and LT3. These monitors continuously measured sound levels from Tuesday, December 12, 2017 to Wednesday, December 20, 2017. Long-term measurement equipment was also placed at off-site Locations LT4 and LT5. These monitors continuously measured sound levels from Wednesday, December 13, 2017 to Wednesday, December 20, 2017. Sound levels were measured at a height of approximately five feet above the ground at locations where there were no large reflective surfaces to affect the measured levels.

In addition to the collection of sound level data, ground-level wind speeds were continuously measured and logged at each location. A NEER on-site meteorological tower located approximately 0.9 miles south from proposed wind turbine #42 also measured and logged wind speeds during the sound level measurement period. The location of the on-site met tower is identified in Figure 5-2. Meteorological data collected during the measurement period at the Pipestone Municipal Airport National Weather Service (NWS) station in Pipestone, MN were also archived from the National Centers for Environmental Information (NCEI). These data are included in Appendix B and were used to determine hourly precipitation periods during the measurement program.

At Location LT1 a continuous programmable unattended sound level meter was placed on the property at 2184 130th Ave in Ruthton. This measurement location is an on-site residence with pending participation that has a modeled Project Only broadband sound level equal to the worst-case modeled sound level at a residence. The sound level meter continuously measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics from 7:00 PM Tuesday, December 12 until 10:00 AM Wednesday, December 20 for a total of 183 hours.

At Location LT2 a continuous programmable unattended sound level meter was placed on the property at 2006 201st St in Ruthton. This measurement location is an on-site participating residence and is representative of residences around the center of the Project near Hwy 23. The sound level meter continuously measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics from 5:00 PM Tuesday, December 12 until 12:00 PM Wednesday, December 20 for a total of 187 hours.

At Location LT3 a continuous programmable unattended sound level meter was placed on the property at 1863 161st St in Woodstock. This measurement location is an on-site non-participating residence and is representative of residences around the south end of the Project. The sound level meter continuously measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics from 6:00 PM Tuesday, December 12 until 1:00 PM Wednesday, December 20 for a total of 187 hours

At Location LT4 a continuous programmable unattended sound level meter was placed on the property at 2177 County Rd 117 in Lake Benton. This measurement location is an off-site non-participating residence. The sound level meter continuously measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics from 11:00 AM Wednesday, December 13 until 2:00 PM Wednesday, December 20 for a total of 171 hours.

At Location LT5 a continuous programmable unattended sound level meter was placed on the property at 2017 County Hwy 9 in Lake Benton. This measurement location is an off-site non-participating residence. The sound level meter continuously measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics from 9:00 AM Wednesday, December 13 until 2:00 PM Wednesday, December 20 for a total of 173 hours.

In addition to A-weighted and Z-weighted sound levels, broadband equivalent C-weighted sound level data (LC_{eq}) were also collected at each location. Sound observations were made during daytime hours (8:00 AM - 2:30 PM) and nighttime hours (10:00 PM - 11:59 PM) on December 13 at all five locations. An Epsilon engineer checked on the integrity of the long-term monitoring equipment during the daytime observations.

5.4.2 Short-term Measurement Methodology

In addition to the long-term data, short-term sound level measurements were made at Locations ST1, ST2, ST3, and ST4 at publicly accessible locations. One daytime and one nighttime sound level measurement, each 20-minutes in duration, was taken at each location during conditions when there was no precipitation and ground-level wind speeds were less than 11 mph (5 m/s) as measured by hand-held meteorological equipment. Sound observations were made during both periods at each location by the Epsilon engineer.

Sound levels were measured at a height of approximately five feet above the ground at locations where there were no large reflective surfaces to affect the measured levels. Below is a description of the measurement program for each location.

5.4.2.1 Location ST1

Short-term measurements were performed on the road edge at the northwest corner of Hwy 23 and County Hwy 8. A tripod-mounted sound level meter measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics for 20 minutes starting at 1:42 AM for the nighttime period and at 9:02 AM for the daytime period on Thursday, December 14. Broadband equivalent C-weighted sound level data (LC_{eq}) were also collected.

5.4.2.2 Location ST2

Short-term measurements were performed on the road edge at the southwest corner of 190th Ave and County Hwy 89. A tripod-mounted sound level meter measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics for 20 minutes starting at 12:58 AM for the nighttime period and at 9:36 AM for the daytime period on Thursday, December 14. Broadband equivalent C-weighted sound level data (LC_{eq}) were also collected.

5.4.2.3 Location ST3

Short-term measurements were performed on the road edge at the southeast corner of 201st St and 110th Ave. A tripod-mounted sound level meter measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics for 20 minutes starting at 12:12 AM for the nighttime period and at 7:44 AM for the daytime period on Thursday, December 14. Broadband equivalent C-weighted sound level data (LC_{eq}) were also collected.

5.4.2.4 Location ST4

Short-term measurements were performed on the northern road edge along County Hwy 6 approximately 0.55 miles west of County Hwy 18. A tripod-mounted sound level meter measured and stored A-weighted broadband and Z-weighted one-third octave-band sound level statistics for 20 minutes starting at 2:22 AM for the nighttime period and at 8:27 AM for the daytime period on Thursday, December 14. Broadband equivalent C-weighted sound level data (LC_{eq}) were also collected.

5.5 Measurement Equipment

5.5.1 Sound Level Equipment

Five Larson Davis (LD) model 831 sound level meters, equipped with PCB Piezotronics Type 1 preamplifiers, PCB 377B20 or 377C20 half-inch microphones, and environmental protection kits were used to collect continuous broadband A-weighted (dBA), broadband C-weighted equivalent (LC_{eq}), and Z-weighted one-third octave-band sound pressure level data at Locations LT1, LT2, LT3, LT4, and LT5. Each microphone was tripod-mounted at a height of five feet above ground with a 7-inch diameter windscreen. The meters utilized fast response and were set to log data every hour along with a one-minute time history for the following A-weighted parameters: L_1, L_{10}, L_{50}, L_{90}, L_{max}, L_{min}, and L_{eq}.

One LD model 831 meter was used to collect short-term broadband A-weighted, LC_{eq}, and Z-weighted one-third octave-band sound pressure level data at Locations ST1, ST2, ST3, and ST4 for 20 minutes during daytime and nighttime hours. This meter was tripod-mounted at a height of five feet above ground with a 7-inch diameter windscreen. The meter utilized fast response and was set to log data every 20 minutes along with a one-second time history for the same A-weighted parameters as the long-term meters.

All meters meet Type 1 ANSI S1.4-1983 (R2006) standards for sound level meters and were calibrated and certified as accurate to standards set by the National Institute of Standards and Technology. These calibrations were conducted by an independent laboratory within the prior 12 months of the measurement program. Additionally, all sound level measurement equipment was calibrated in the field before and after the surveys with the manufacturer's acoustical calibrator which meets the standards of IEC 942 Class 1L and ANSI/ASA S1.40-2006 (R2016).

5.5.2 Meteorological Equipment

Wind speed can have a strong influence on ambient sound levels. In order to understand how the existing sound levels are influenced by wind speed and as per the LWECS Guidance, continuous wind speed data were recorded at each long-term location by Epsilon. A HOBO H21-002 micro-weather station (manufactured by Onset Computer Corporation) was used to continuously measure the wind speed. The wind sensor was mounted at a height of approximately five feet above ground level and data were logged every hour to be synced with the sound level measurements. This sensor has a measurement range of 0 to 45 m/s (100 mph) and an accuracy of $\pm$1.1 m/s (2.4 mph). The starting threshold is ≤1.0 m/s (2.2 mph). Wind direction data were additionally collected at Location LT1. The wind direction measurement range is 0 to 358 degrees (2-degree dead band), with an accuracy of $\pm$5 degrees. For the short-term measurements where weather station utilization was not practical, wind speeds were measured with a hand-held Davis Instruments TurboMeter electronic wind speed indicator.

In addition to Epsilon's portable weather stations, Lake Benton Wind II's on-site meteorological tower measured and logged wind speeds at a height of 49.2 meters above ground level every 10 minutes. These data were scaled to a height of 90 meters using a site-specific shear factor, provided by NEER, to represent hub height wind speeds. The 10-minute data were averaged into hourly values to correspond with the sound data. Wind shear is the change of wind speed as a function of height above ground. This relationship is typically expressed as a power law of the form:

$$U_z = U_r(Z/Z_r)^p$$

Where: U_z = wind speed at height Z (in this case 90 meters)
U_r = wind speed at height Z_r (in this case 49.2 meters)
p = wind shear coefficient (in this case 0.161)

The location of the meteorological tower is approximately 0.9 miles south of proposed wind turbine #42 as was shown in Figure 5-2.

Meteorological data collected during the measurement period at the Pipestone Municipal Airport National Weather Service (NWS) station in Pipestone, MN were also archived from the National Centers for Environmental Information (NCEI) and are included in Appendix B.

5.6 Measured and Calculated Sound Levels

A brief summary of the measured (A-weighted) and measured/calculated (C-weighted) sound levels and sound sources at each long-term and short-term location is provided in this section. Several weather events were notable during the approximately 7-day measurement program, including 11 hours of precipitation, as determined from the NCEI data. These periods were excluded from the analysis as per the LWECS Guidance but included in the graphical presentations in this section. Short-term measurements were performed during dry periods. Snow cover was either minimal or nonexistent during the entire measurement program. Although there are existing wind turbines in the Project Area, this was a pre-construction program for LBWII and Epsilon interprets subsection #29 in the LWECS Guidance to pertain to a post-construction evaluation; therefore, no comparison of measured sound levels to the Minnesota limits is provided in this report.

5.6.1 Long-term Sound Levels

5.6.1.1 Location LT1

Based on personal observations, sound levels at Location LT1 were influenced by existing NEER wind turbines, occasional distant aircraft and train whistles, wind through vegetation, and vehicles on local roads and at the property (active farm). The range of A-weighted sound levels from the continuous measurements, neglecting periods of precipitation (6% of measurements) and 1 hour that exceeded 11 mph wind speeds (1% of measurements), are summarized below. A complete set of the measured sound levels and meteorological considerations are presented graphically in Figure 5-12 (A-weighted sound levels) and Figure 5-13 (C-weighted sound levels) as per the LWECS Guidance. The sound levels at this location are primarily controlled by wind conditions in the area and existing wind turbines.

- The L_{10} A-weighted sound levels ranged from 22 to 64 dBA;
- The L_{50} A-weighted sound levels ranged from 19 to 61 dBA.

In addition to broadband sound levels, one-third octave-band sound levels were collected at this location and are presented in this report. One-third octave-band data from an hourly period during representative wind speed conditions, interpreted by Epsilon as low ground-level wind speed and high hub-height wind speed, are presented for this location in Figure

5-14 for the worst-case modeled receptor[10] per the LWECS Guidance. Z-weighted, A-weighted, and C-weighted one-third octave-band frequency levels are included in the figure.

5.6.1.2 Location LT2

Based on personal observations, sound levels at Location LT2 were influenced by vehicles on Hwy 23, existing NEER and existing non-NEER wind turbines, and wind through vegetation. The range of A-weighted sound levels from the continuous measurements, neglecting periods of precipitation (6% of measurements), are summarized below. Ground level wind speeds did not exceed 11 mph at this location during the monitoring period. A complete set of the measured sound levels and meteorological considerations are presented graphically in Figure 5-15 (A-weighted sound levels) and Figure 5-16 (C-weighted sound levels) as per the LWECS Guidance. The sound levels at this location are primarily controlled by vehicles on Hwy 23 and existing wind turbines.

- The L_{10} A-weighted sound levels ranged from 36 to 67 dBA;
- The L_{50} A-weighted sound levels ranged from 26 to 64 dBA.

5.6.1.3 Location LT3

Based on personal observations, sound levels at Location LT3 were influenced by existing NEER and existing non-NEER wind turbines, and wind. The range of A-weighted sound levels from the continuous measurements, neglecting periods of precipitation (6% of measurements) and 19 hours that exceeded 11 mph wind speeds (10% of measurements), are summarized below. A complete set of the measured sound levels and meteorological considerations are presented graphically in Figure 5-17 (A-weighted sound levels) and Figure 5-18 (C-weighted sound levels) as per the LWECS Guidance. The sound levels at this location are primarily controlled by existing wind turbines.

- The L_{10} A-weighted sound levels ranged from 33 to 60 dBA;
- The L_{50} A-weighted sound levels ranged from 28 to 55 dBA.

5.6.1.4 Location LT4

Based on personal observations, sound levels at Location LT4 were influenced by wind, wind through vegetation, and existing non-NEER wind turbines outside the Project Area that were not identified prior to the measurement program. The range of A-weighted sound levels from the continuous measurements, neglecting periods of precipitation (6% of measurements) and 7 hours that exceeded 11 mph wind speeds (4% of measurements), are

[10] As identified in the Protocol (Appendix A)

summarized below. A complete set of the measured sound levels and meteorological considerations are presented graphically in Figure 5-19 (A-weighted sound levels) and Figure 5-20 (C-weighted sound levels) as per the LWECS Guidance. The sound levels at this location are primarily controlled by wind conditions in the area and existing wind turbines.

- The L_{10} A-weighted sound levels ranged from 21 to 56 dBA;
- The L_{50} A-weighted sound levels ranged from 17 to 52 dBA.

5.6.1.5 Location LT5

Based on personal observations, sound levels at Location LT5 were influenced by existing non-NEER wind turbines outside the Project Area that were not identified prior to the measurement program, wind through vegetation, some birds, occasional vehicles on Co Hwy 9, and an occasional distant train whistle. The range of A-weighted sound levels from the continuous measurements, neglecting periods of precipitation (6% of measurements), are summarized below. Ground level wind speeds did not exceed 11 mph at this location during the monitoring period. A complete set of the measured sound levels and meteorological considerations are presented graphically in Figure 5-21 (A-weighted sound levels) and Figure 5-22 (C-weighted sound levels) as per the LWECS Guidance. The sound levels at this location are primarily controlled by wind conditions in the area and existing wind turbines.

- The L_{10} A-weighted sound levels ranged from 18 to 58 dBA;
- The L_{50} A-weighted sound levels ranged from 17 to 54 dBA.

In addition to broadband sound levels, one-third octave-band sound levels were collected at this off-site location and are presented in this report per the LWECS Guidance. One-third octave-band data from an hourly period during representative wind speed conditions, interpreted by Epsilon as low ground-level wind speed and high hub-height wind speed, are presented in Figure 5-23 for this location. Z-weighted, A-weighted, and C-weighted one-third octave-band frequency levels are included in the figure.

Figure 5-12: Measured Hourly A-weighted Sound Pressure Levels (dBA) versus Met Data
Location LT1

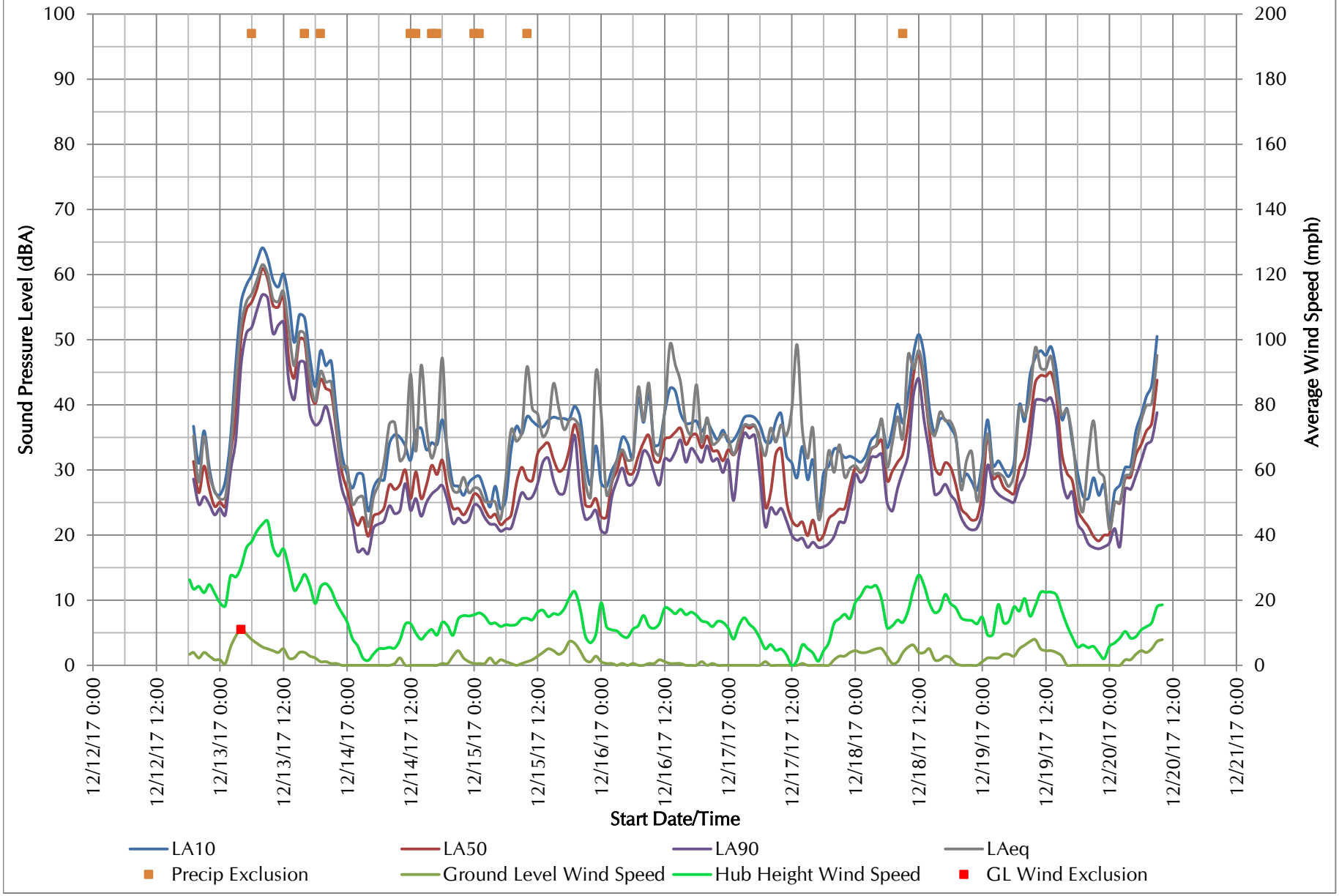


Figure 5-13: Measured / Calculated Hourly C-weighted Sound Pressure Levels (dBC) versus Met Data
Location LT1

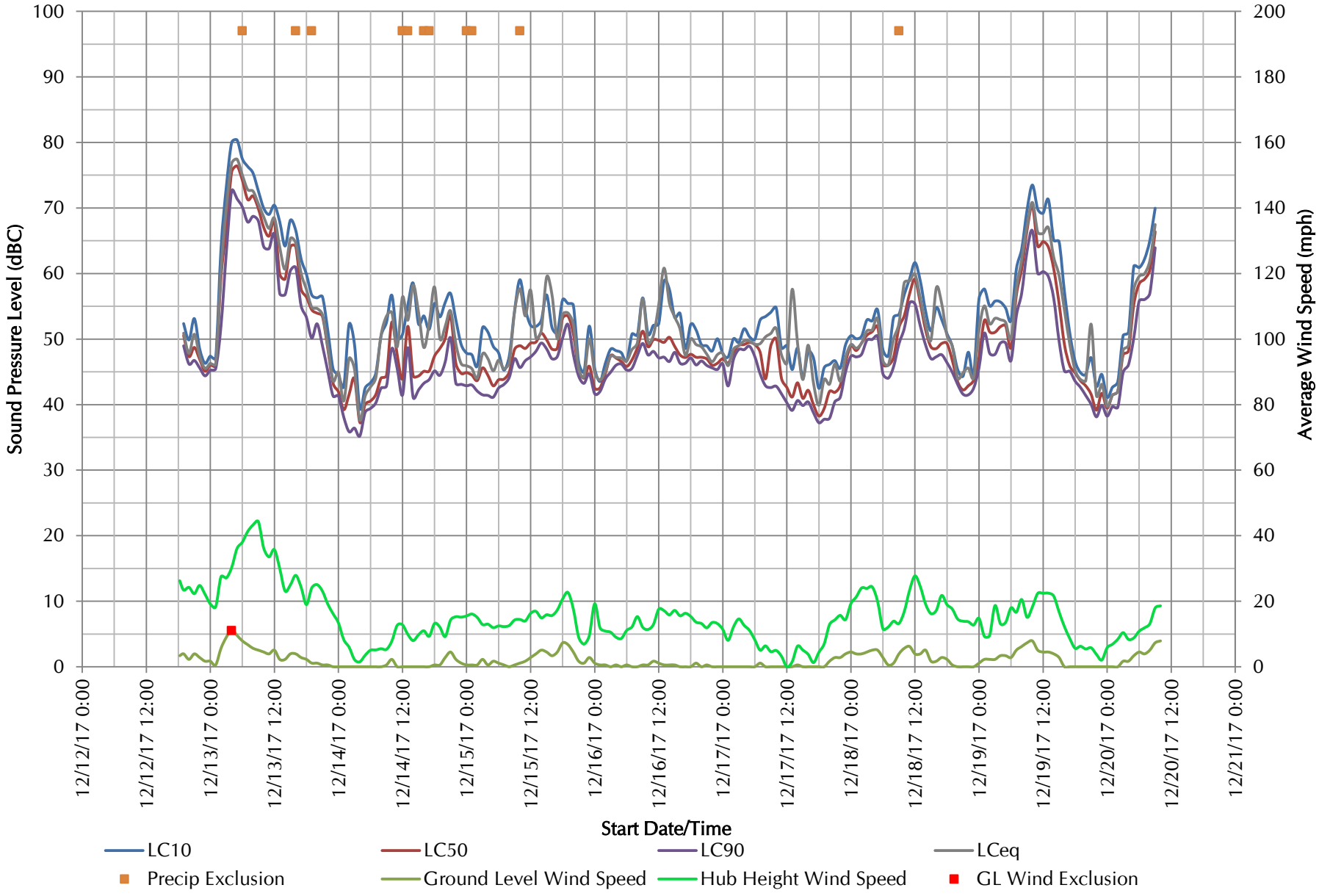


Figure 5-14: Measured One-Third Octave Band Sound Levels During A Representative Hub Height Wind Speed Period - Location LT1

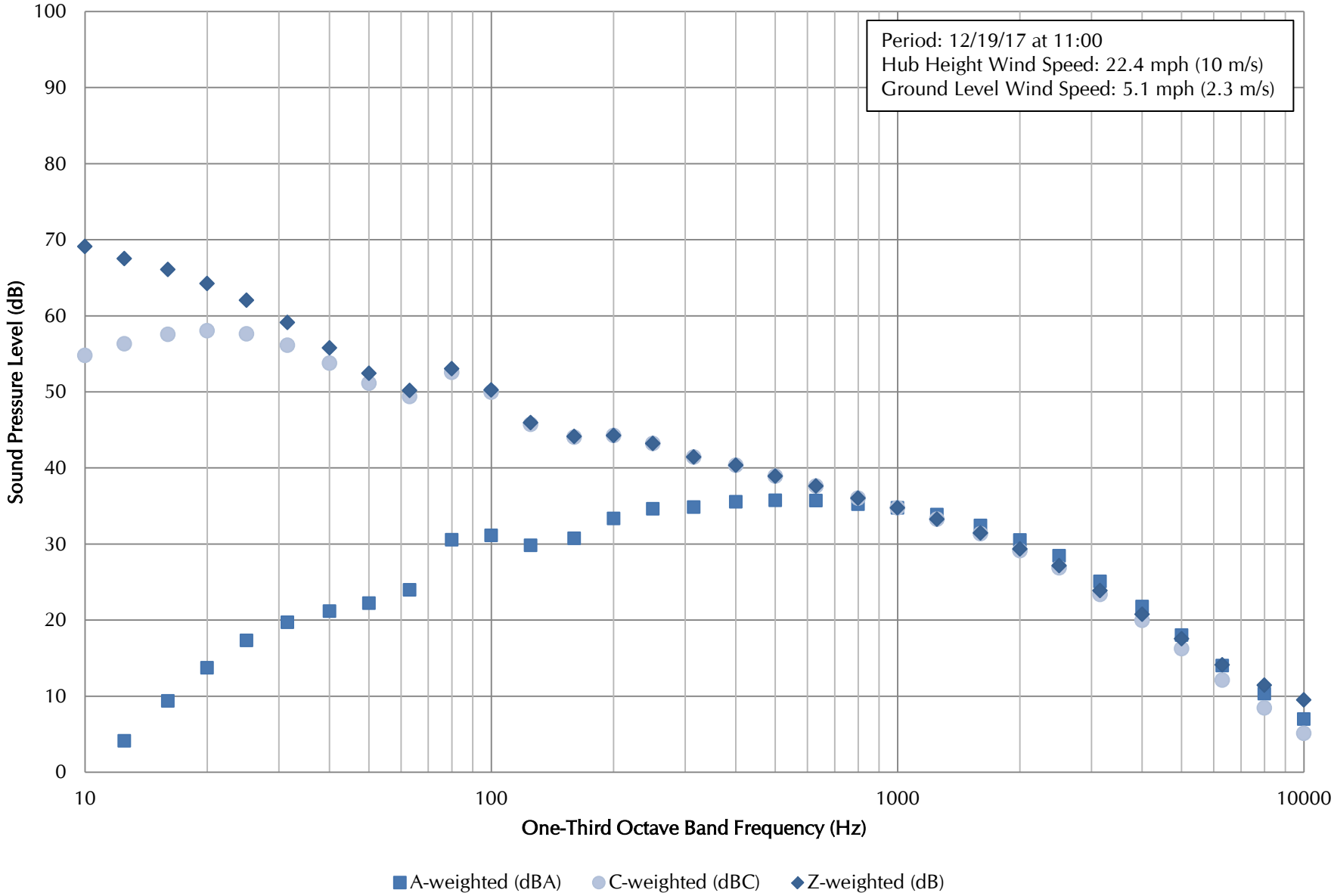


Figure 5-15: Measured Hourly A-weighted Sound Pressure Levels (dBA) versus Met Data
Location LT2

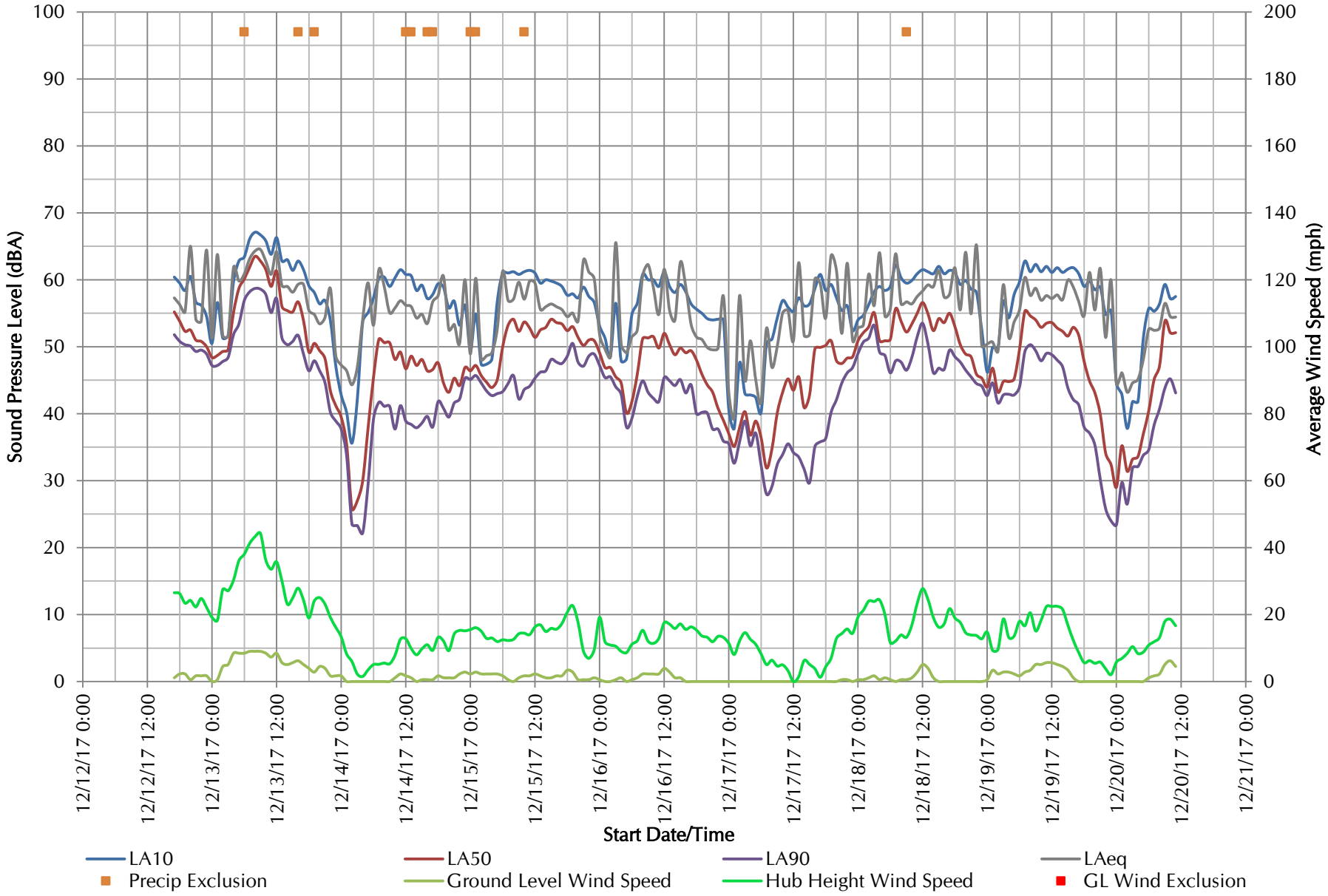


Figure 5-16: Measured / Calculated Hourly C-weighted Sound Pressure Levels (dBC) versus Met Data
Location LT2

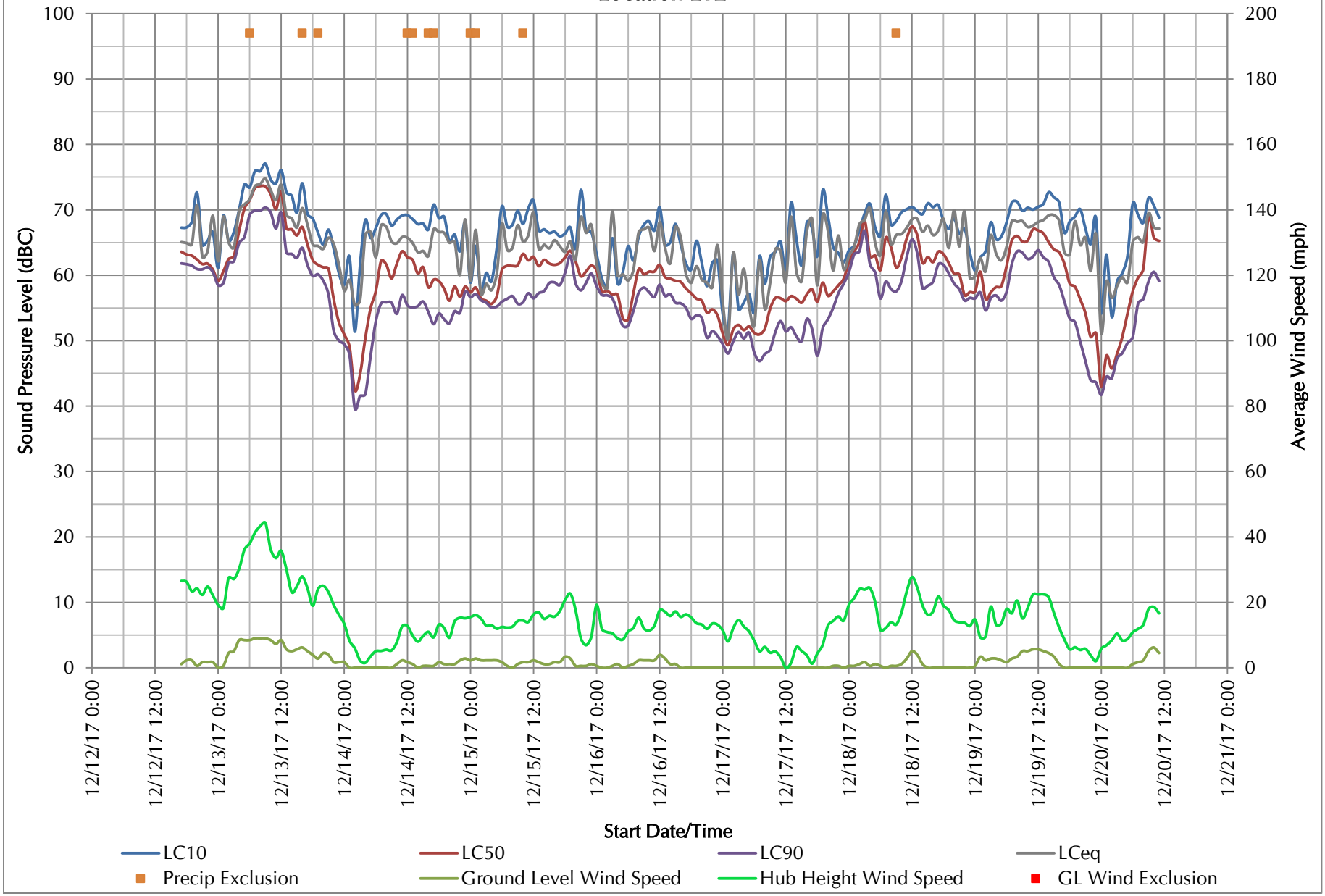


Figure 5-17: Measured Hourly A-weighted Sound Pressure Levels (dBA) versus Met Data
Location LT3

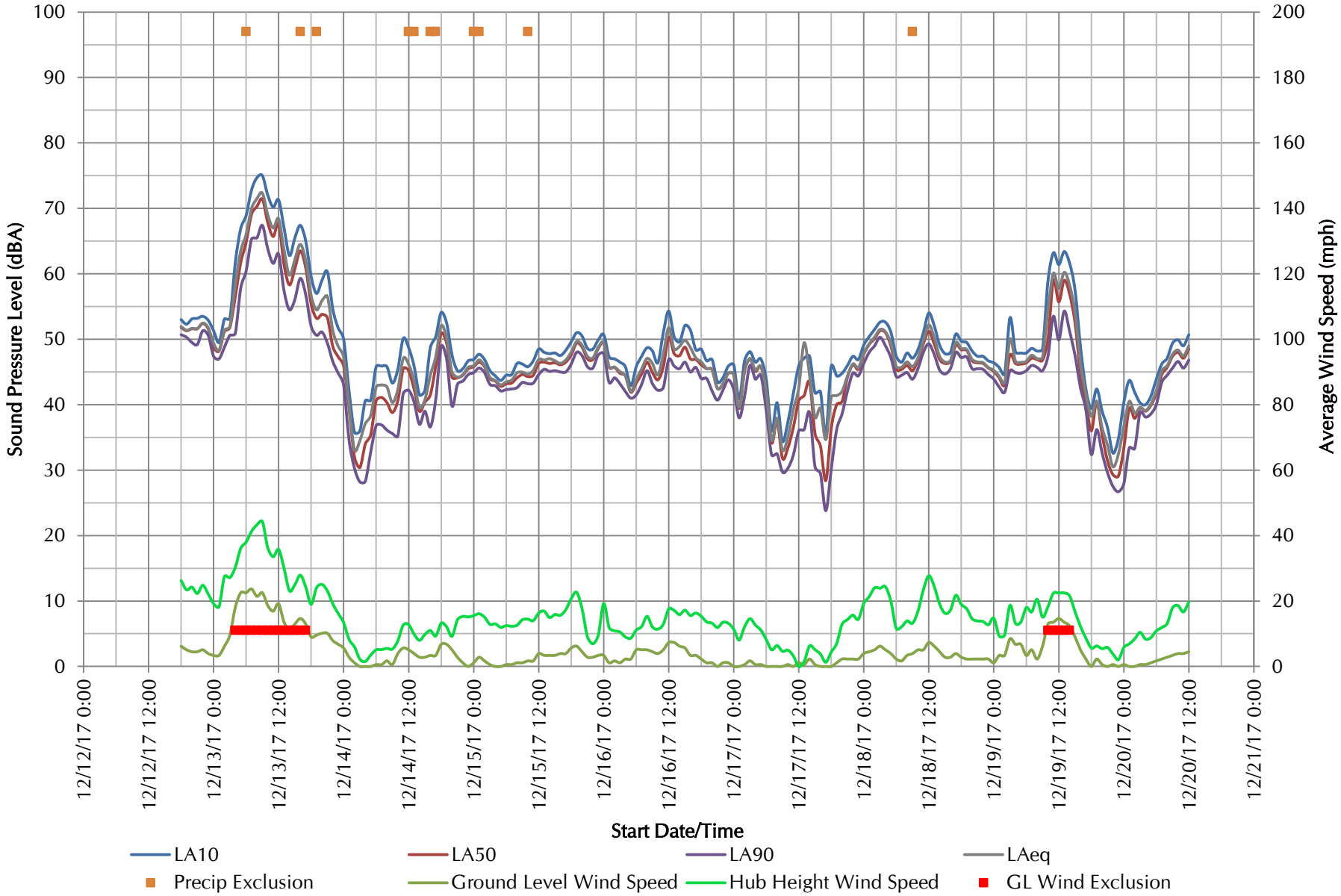


Figure 5-18: Measured / Calculated Hourly C-weighted Sound Pressure Levels (dBC) versus Met Data
Location LT3

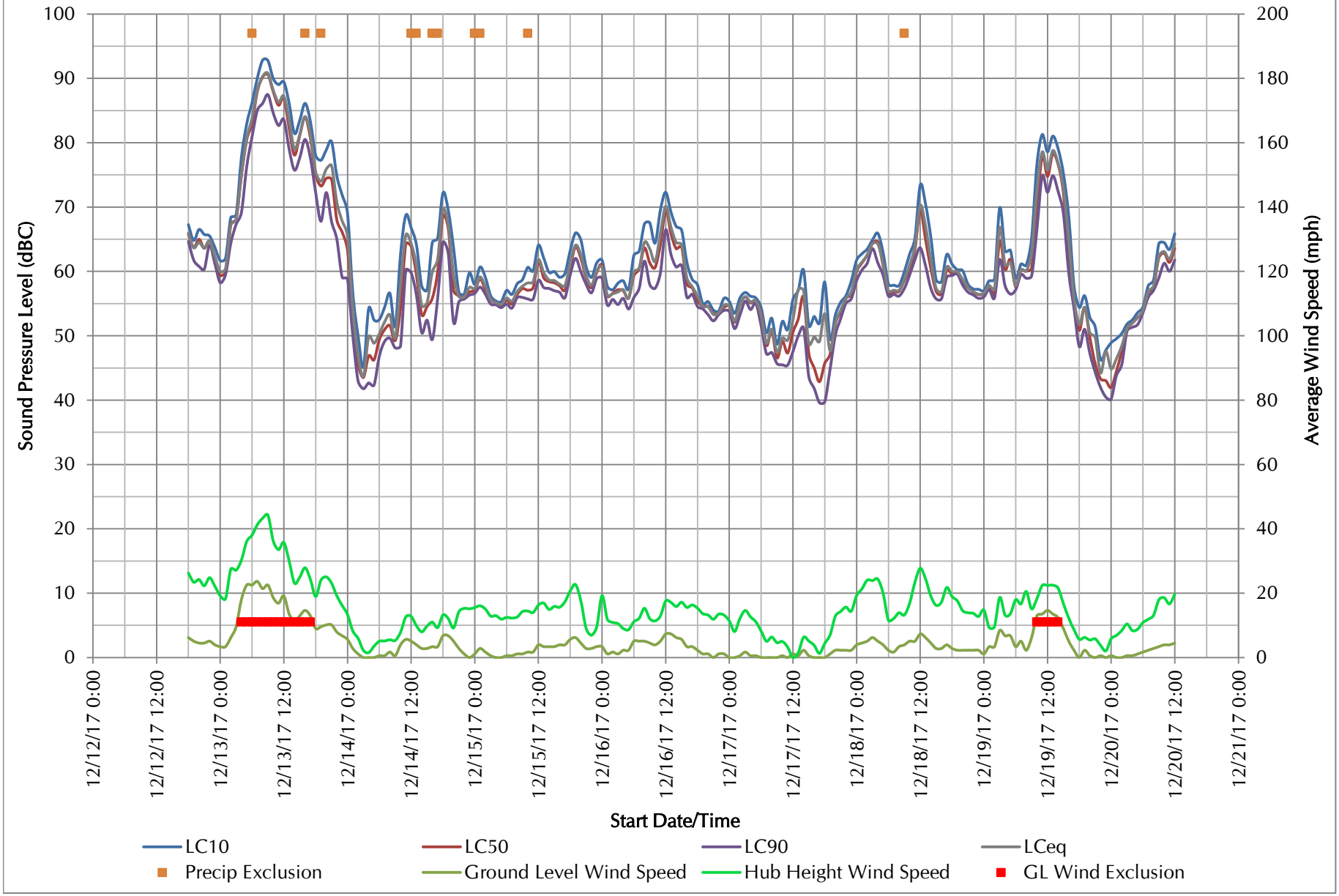


Figure 5-19: Measured Hourly A-weighted Sound Pressure Levels (dBA) versus Met Data
Location LT4

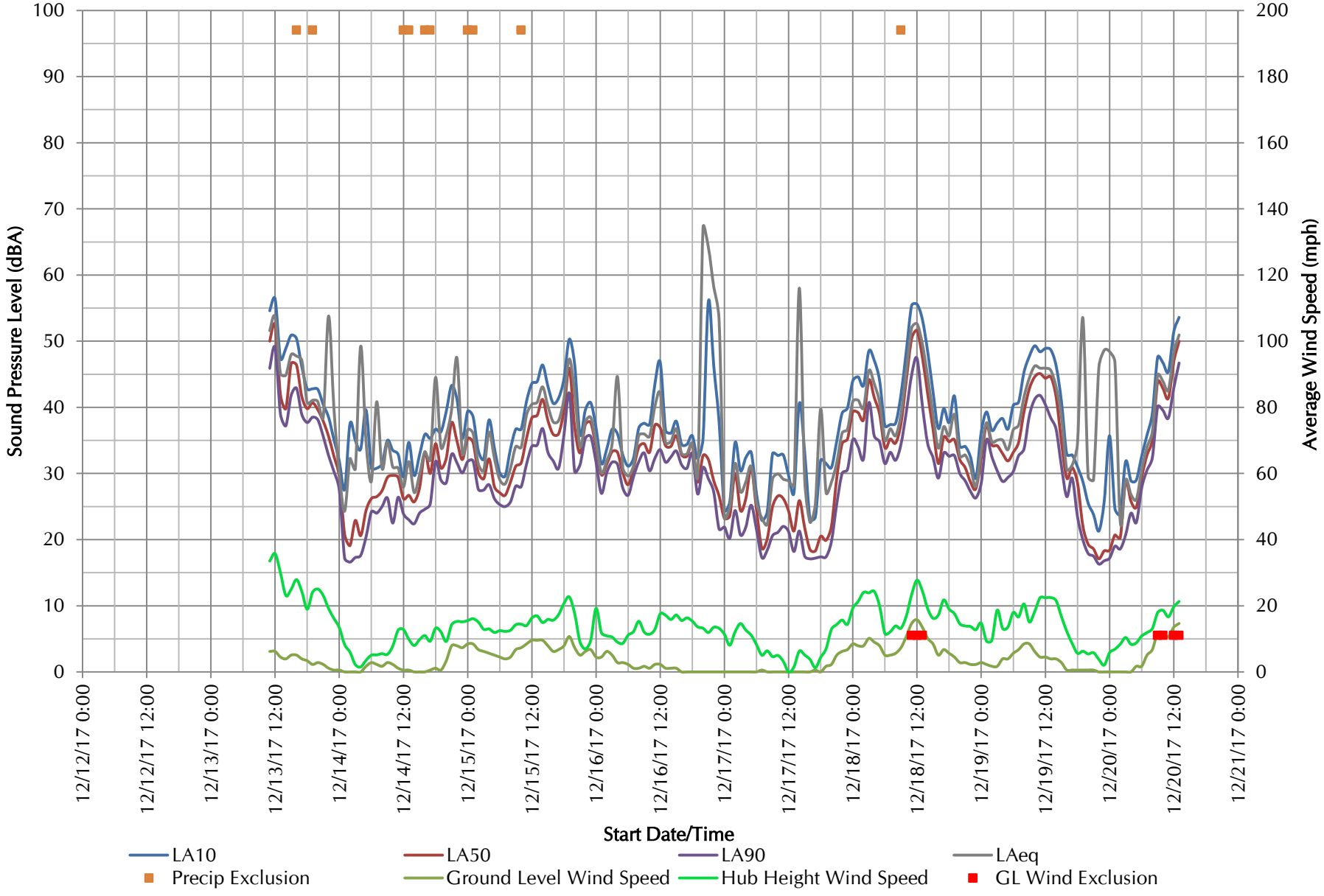


Figure 5-20: Measured / Calculated Hourly C-Weighted Sound Pressure Levels (dBC) versus Met Data
Location LT4

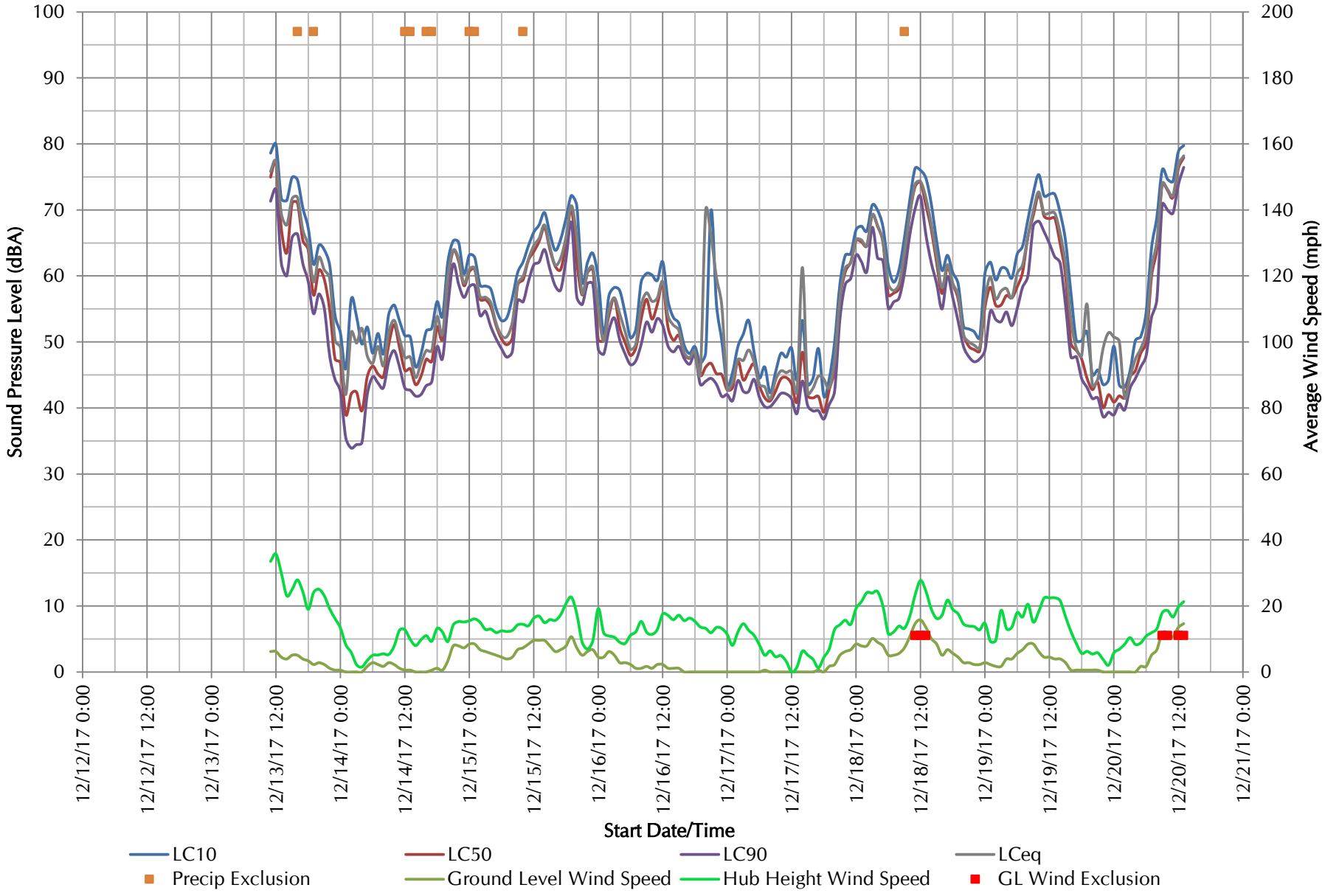


Figure 5-21: Measured Hourly A-weighted Sound Pressure Levels (dBA) versus Met Data
Location LT5

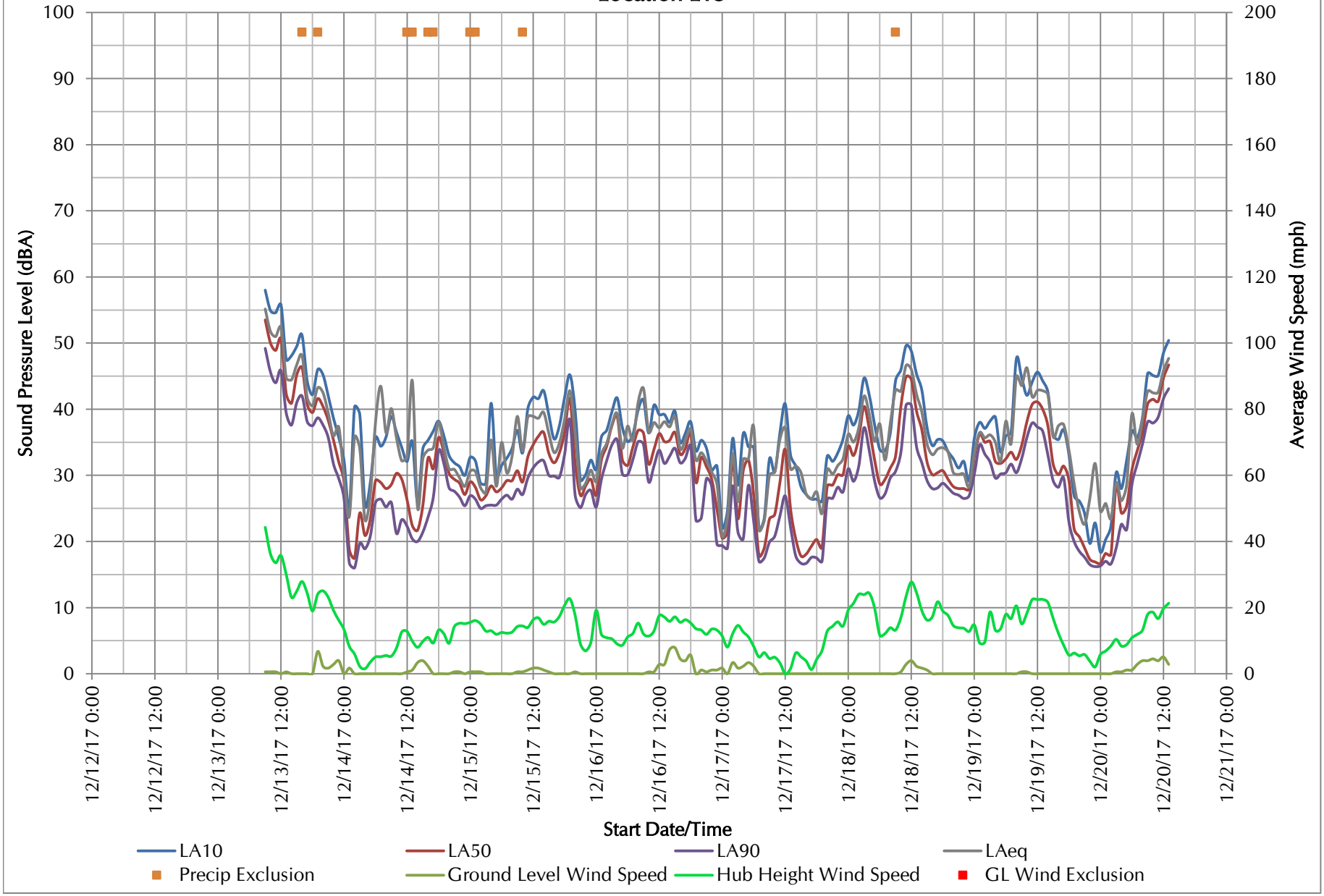


Figure 5-22: Measured / Calculated Hourly C-weighted Sound Pressure Levels (dBC) versus Met Data
Location LT5

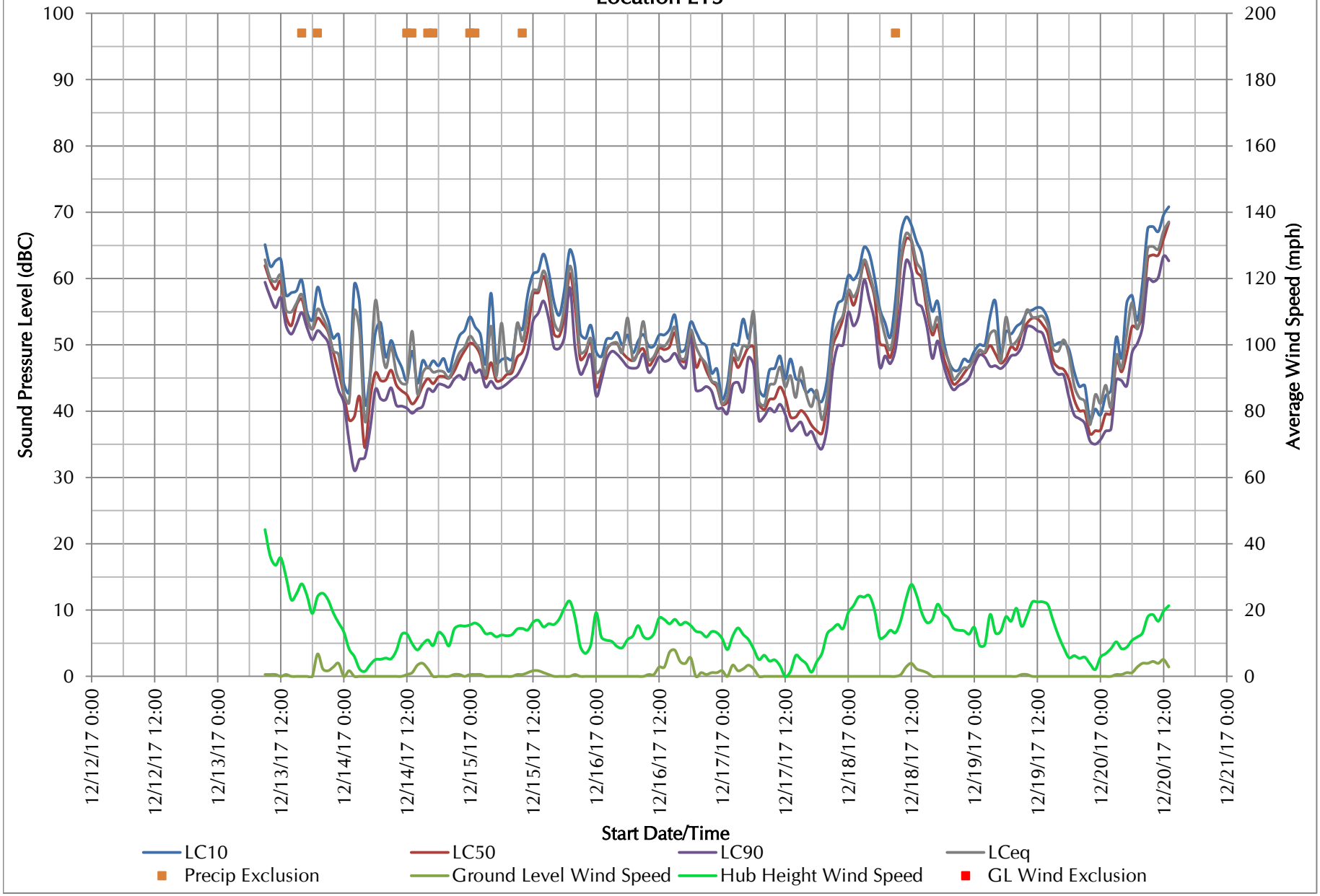
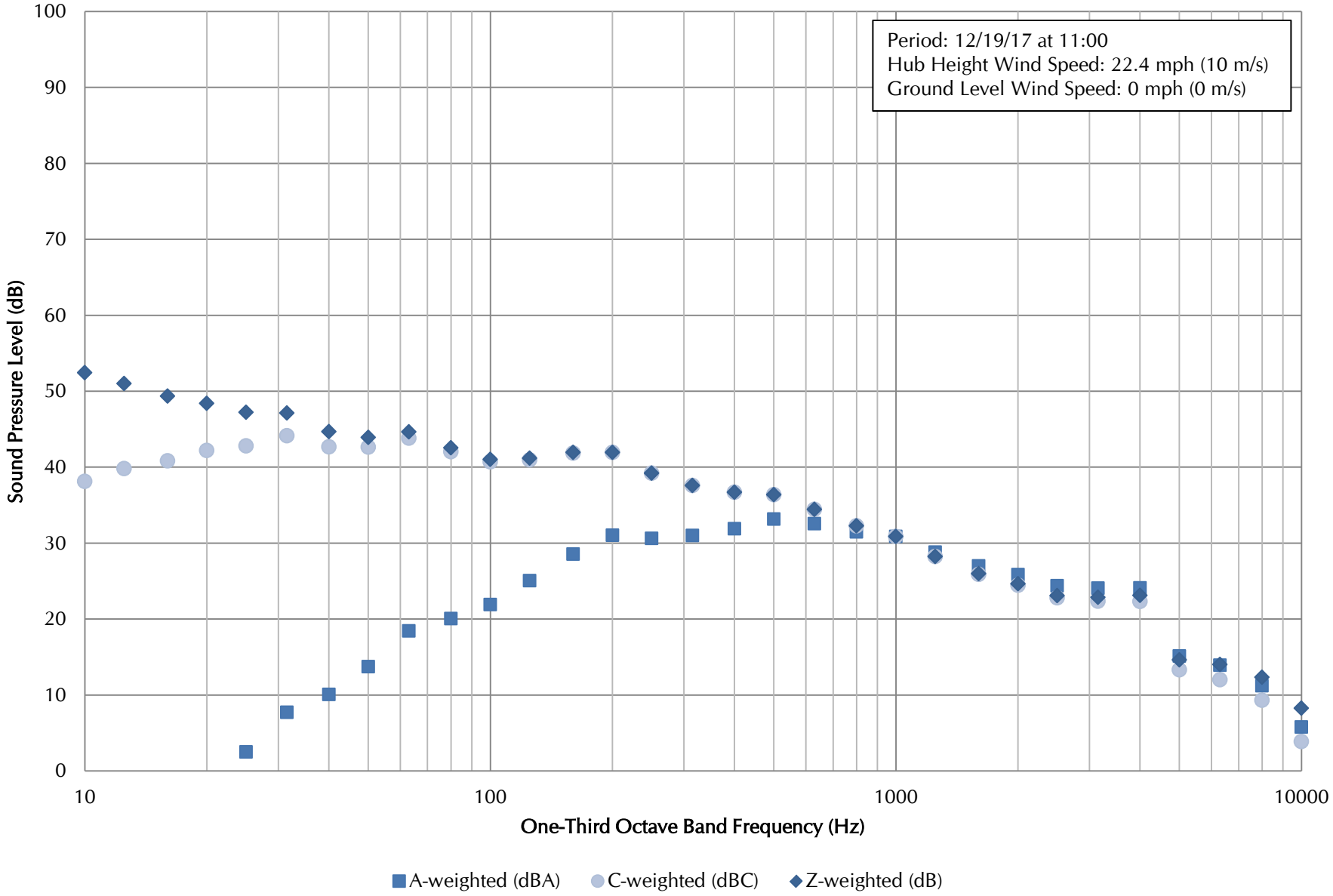


Figure 5-23: Measured One-Third Octave Band Sound Levels During A Representative Hub Height Wind Speed Period - Location LT5



5.6.2 Short-term Sound Levels

Short-term sound levels were measured during the nighttime and daytime on December 14, 2017. Ground-level wind speeds ranged from 4 to 7 mph (1.8 to 3.1 m/s) in the NNE direction during the nighttime measurements and were approximately 3 mph (1.3 m/s) in the SW direction during the daytime measurements. Hourly hub-height wind speeds, scaled from NEER met tower data, were approximately 6.0 to 13.4 mph (2.7 to 6.0 m/s) during the nighttime measurements which corresponds to conditions when wind turbines are just below to above the cut-in wind speed. Hourly hub-height wind speeds were approximately 5.1 to 5.5 mph (2.3 to 2.5 m/s) during the daytime measurements. This corresponds to conditions when wind turbines are below cut-in.

5.6.2.1 Location ST1

Sound levels at Location ST1 were influenced by vehicles on Hwy 23 (including trucks) and Co Hwy 8, wind through vegetation, distant livestock, and distant aircraft. Select results of the 20-minute measurements are shown below and additional details are presented in Appendix C.

- The L_{10} A-weighted sound levels were 66 dBA and 47 dBA for the daytime and nighttime measurements, respectively;
- The L_{50} A-weighted sound levels were 53 dBA and 30 dBA for the daytime and nighttime measurements, respectively.

5.6.2.2 Location ST2

Sound levels at Location ST2 were influenced by vehicles on Hwy 23 (including trucks), wind, some birds, and distant aircraft. Select results of the 20-minute measurements are shown below and additional details are presented in Appendix C.

- The L_{10} A-weighted sound levels were 39 dBA and 31 dBA for the daytime and nighttime measurements, respectively;
- The L_{50} A-weighted sound levels were 36 dBA and 24 dBA for the daytime and nighttime measurements, respectively.

5.6.2.3 Location ST3

Sound levels at Location ST3 were influenced by infrequent distant vehicles and rare vehicle on local roads, some birds and dogs barking, and distant aircraft. Select results of the 20-minute measurements are shown below and additional details are presented in Appendix C.

- The L_{10} A-weighted sound levels were 35 dBA and 31 dBA for the daytime and nighttime measurements, respectively;

- The L_{50} A-weighted sound levels were 28 dBA and 26 dBA for the daytime and nighttime measurements, respectively.

5.6.2.4 Location ST4

Sound levels at Location ST1 were influenced by distant vehicles on Hwy 23 (including trucks) and occasional vehicle on Co Hwy 6, distant livestock and coyotes, distant train (cars and whistle), and distant aircraft. After measurements were collected at this location, it was realized that there were existing non-NEER wind turbines approximately 1 mile south of the measurement location. These wind turbines were not identified prior to the measurement program and are outside the Project Area. No sound from these wind turbines was audible during the nighttime or daytime measurement short-term measurement, and therefore, is still representative of non-wind-turbine ambient sound. Select results of the 20-minute measurements are shown below and additional details are presented in Appendix C.

- The L_{10} A-weighted sound levels were 45 dBA and 25 dBA for the daytime and nighttime measurements, respectively;

- The L_{50} A-weighted sound levels were 40 dBA and 22 dBA for the daytime and nighttime measurements, respectively.

6.0 MODELED SOUND LEVELS

6.1 Wind Turbines and Operating Conditions

6.1.1 Project Wind Turbines

The sound level analysis for the Project conservatively includes 48 wind turbines, of which four (4) are considered alternate locations. Of these 48 wind turbines, 37 wind turbines are GE 2.3-116 units, six (6) are GE 2.3-116 Low Noise Trailing Edge (LNTE) units, two (2) are GE 2.1-116 units, and three (3) are GE 2.1-116 LNTE units. All 43 GE 2.3-116 wind turbines have a hub height of 90 meters and a rotor diameter of 116 meters. All five (5) GE 2.1-116 wind turbines have a hub height of 80 meters and a rotor diameter of 116 meters. A technical report from GE[11] was provided by Atwell which documented the expected sound power levels associated with the GE 2.3-116 wind turbine. Sound levels for the GE 2.3-116 wind turbines have been assumed for the GE 2.1-116 model in this analysis based on direction from NEER. These sound power levels are defined as "calculated apparent" by the turbine manufacturer and therefore do not include any uncertainty factor.

A similar technical report from GE[12] was provided by Atwell that documented the expected sound power levels associated with the GE 2.3-116 LNTE wind turbine. As no sound level for the GE 2.1-116 LNTE wind turbines have been provided, the same approach used for assigning sound power levels to the GE 2.1-116 wind turbines was applied in this case based on NEER's direction. These sound power levels are defined as "calculated apparent" by the turbine manufacturer and therefore do not include any uncertainty factor.

6.1.2 Existing Non-NEER Wind Turbines

As discussed in Section 5, the Project Area currently contains NEER and non-NEER wind turbines. The NEER wind turbines will be decommissioned before construction of the Project, however the non-NEER wind turbines are assumed to remain as operational. To predict the future wind turbine sound levels in the vicinity of the Project, a cumulative modeling analysis was conducted which included the sound level contribution from these existing non-NEER turbines. Coordinates and descriptions for these turbines were provided by Atwell. Wind turbines of McBeth Wind, Moraine I Wind, Moraine II Wind, Shane's Wind Machine, and Tholen Wind make up a total of 27 existing non-NEER wind turbines within the Project Area that were included in the model. Atwell provided guidance on which wind turbine types to model for these existing wind turbines. Of the 27 wind

11 General Electric Company, Technical Documentation Wind Turbine Generator Systems 2.3-116 – 50 Hz and 60 Hz Product Acoustic Specifications, 2015.

12 General Electric Company, Technical Documentation Wind Turbine Generator Systems 2.3-116 with LNTE 50 Hz and 60 Hz Product Acoustic Specifications, 2015.

turbines, 18[13] were assumed to be GE 1.5-70.5 units and 9[14] were assumed to be Vestas V82-1.65 units. The GE 1.5-70.5 wind turbines have a hub height of 65 meters and a rotor diameter of 70.5 meters. The V82-1.65 wind turbines have a hub height of 70 meters and a rotor diameter of 82 meters. Sound power level data for both wind turbine types were available to Epsilon in the WindPRO WTG Catalog. WindPRO is a software suite developed by EMD International A/S and is used for assessing potential environmental impacts from wind turbines. Broadband and octave-band A-weighted sound power levels were available for the GE 1.5-70.5 unit at 10 m/s wind speeds measured at 10 meters. These data are provided in Table 6-1. Only broadband sound power levels were available for the V82-1.65 unit. The maximum available sound power level for the 70 meter hub height was at 95% of rated power for the Vestas unit and is provided in Table 6-1.

Table 6-1 Modeled Existing Non-NEER Wind Turbine Sound Power Levels

		Sound Power Levels per Octave-Band Center Frequency [Hz]								
Turbine Model	Broadband dBA	31.5 dBA	63 dBA	125 dBA	250 dBA	500 dBA	1k dBA	2k dBA	4k dBA	8k dBA
GE 1.5-70.5	103.9	-	87.1	93.4	97.3	97.5	98.5	94.5	89.2	76.8
V82-1.65	103.3	-	-	-	-	-	-	-	-	-

Note: Above sound levels do not include an uncertainty factor.

6.1.3 All Wind Turbines within the Project Area (Project + Existing Non-NEER)

A sound level model was generated to predict future wind turbine related sound levels in the community produced by combining the proposed Project and the existing non-NEER wind turbines without the existing NEER wind turbines that will be decommissioned. This modeling scenario therefore included a total of 75 wind turbines (48 Project-related, 27 existing non-NEER) as described in the previous two subsections.

6.2 Modeling Methodology

The sound impacts associated with the proposed wind turbines were predicted using the Cadna/A sound level calculation software developed by DataKustik GmbH. This software uses the ISO 9613-2 international standard for sound propagation (Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation). The benefits of this software are a more refined set of computations due to the inclusion of topography, ground attenuation, multiple building reflections (if applicable), drop-off with distance, and atmospheric absorption. The Cadna/A software allows for octave band calculation of sound from multiple sources as well as computation of diffraction.

[13] McBeth Wind, Shane's Wind Machine, Tholen Wind

[14] Moraine I Wind, Moraine II Wind

Inputs and significant parameters employed in the model are described below:

- *Project Layout:* A Project layout dated February 9, 2018 was provided by Atwell. The 44 proposed wind turbines and 4 proposed alternates were conservatively input into the model. It is Epsilon's understanding based on input from NEER, that this Project will not result in any new significant sound sources at the points of interconnects. The proposed wind turbines are identified in Figure 6-1 and location coordinates are provided in Appendix D.

- *Existing Non-NEER Wind Turbine Locations:* Coordinate locations of the existing non-NEER wind turbines within the Project Area were provided by Atwell on December 11, 2017. These wind turbines are shown in Figure 6-1. Respective wind energy facilities were identified in the earlier Figure 5-1.

- *Parcel Participation:* A dataset containing participation status information for property parcels in the proximity of the Project was provided by Atwell on January 16, 2018. Parcels identified as "LSE" within the dataset are participating and are indicated as such on Figure 6-1. Parcels not identified as "LSE" but contain proposed wind turbines have been assigned a "participation pending" status. Additionally, any parcel within or partially within 5 rotor diameters in the prevailing wind direction(s) and 3 rotor diameters in non-prevailing wind directions (5 by 3 setback) must be a participating parcel for the Project. This 5 by 3 setback data layer was provided by Atwell and is shown on Figure 6-1. Any non-"LSE" parcel that is within or partially within the 5 by 3 setback has been assigned a "participation pending" status. Participation status used throughout this analysis is shown in Figure 6-1.

- *Modeling Receptor Locations:* A modeling receptor dataset dated November 21, 2017 was provided by Atwell. Receptors within 2 miles of the Project Area (234) were input into the Cadna/A model. These modeling receptors were modeled as discrete points at a height of 1.5 meters above ground level to mimic the ears of a typical standing person. Participation status for each modeling receptor was assigned based on the data presented in Figure 6-1. All modeling receptors are identified in Figure 6-2 and are distinguished as either participating, participation pending, or non-participating.

- *Terrain Elevation:* Elevation contours for the modeling domain were directly imported into Cadna/A which allowed for consideration of terrain shielding where appropriate. The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey.

- *Source Sound Levels:* Sound power levels used in the modeling were described in Section 6.1. Documentation from GE provided levels that represent "worst-case" operational sound level emissions for the Project's proposed wind turbines. The WindPRO software package provided sound levels for the existing non-NEER wind turbines to represent "worst-case" emissions.

- *Uncertainty factor:* No uncertainty factor was provided by the wind turbine manufacturers; however, based on experience with other wind turbine manufacturers and wind turbine sound modeling, an uncertainty factor of 2.0 dBA was assumed and added to the sound power level for each modeled wind turbine (Project and existing non-NEER).

- *Meteorological Conditions:* A temperature of 10ºC (50ºF) and a relative humidity of 70% was assumed in the model.

- *Ground Attenuation:* Spectral ground absorption was calculated using a G-factor of 0.5 which corresponds to "mixed ground" consisting of both hard and porous ground cover. This method yields more conservative results (i.e., higher sound levels) as the vast majority of the area is actually agricultural.

Octave band sound power levels corresponding to the highest available wind turbine broadband sound power level for each wind turbine type including uncertainty were input into Cadna/A[15] to model wind turbine generated L_{eq} sound pressure levels during conditions when worst-case sound power levels are expected. These calculations were performed for Project plus existing non-NEER wind turbines, Project wind turbines only, and existing non-NEER wind turbines only. Sound pressure levels were modeled at 234 receptors within 2 miles of the Project Area. In addition to modeling at discrete points, sound levels were also modeled throughout a large grid of points, each spaced 20 meters apart to allow for the generation of sound level isolines in each modeling scenario.

Several modeling assumptions inherent in the ISO 9613-2 calculation methodology, or selected as conditional inputs by Epsilon, were implemented in the Cadna/A model to ensure conservative results (i.e., higher sound levels), and are described below:

- All modeled sources were assumed to be operating simultaneously and at the design wind speed corresponding to the greatest sound level impacts.

[15] The one exception to this approach was for the Vestas wind turbine where only a broadband sound level was available.

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LEGEND

- Proposed Wind Turbine: GE 2.3-116
- Proposed Wind Turbine: GE 2.3-116 LNTE
- Proposed Wind Turbine: GE 2.1-116
- Proposed Wind Turbine: GE 2.1-116 LNTE
- Existing Non-NEER Wind Turbine Within Project Area
- Project Area
- 5 by 3 Setback for Proposed Wind Turbine
- Participating Parcel
- Participation Pending Parcel
- Non-Participating Parcel

Scale 1:78,000
1 inch = 6,500 feet

0 3,250 6,500 Feet

Basemap: Bing Aerial Imagery

Lincoln County

Lyon County

Murray County

Pipestone County

211th Street

151st Street

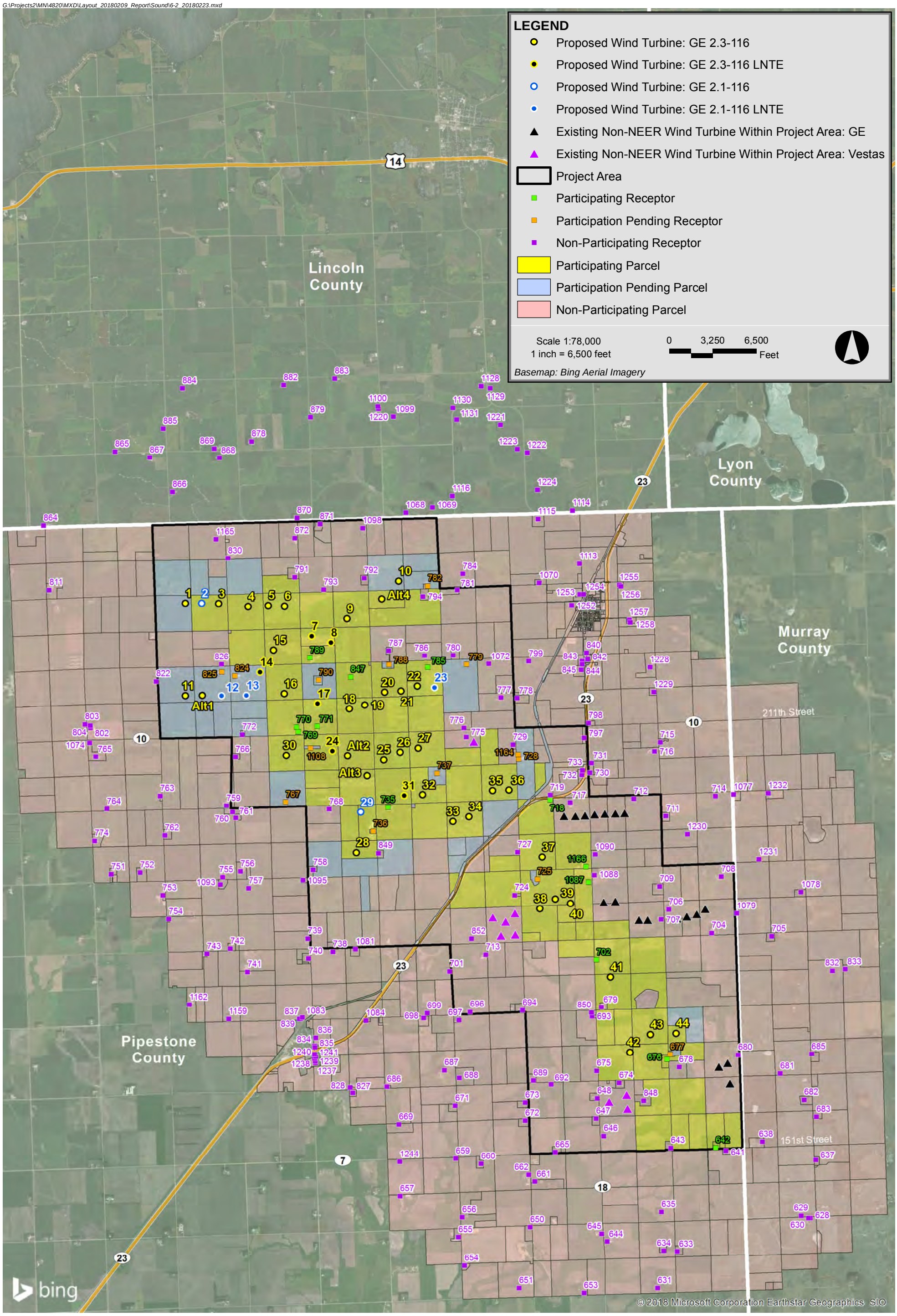
bing

© 2018 Microsoft Corporation Earthstar Geographics SIO

Lake Benton Wind II Project Pipestone County, Minnesota

Figure 6-1
Participation Status

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Lake Benton Wind II Project **Pipestone County, Minnesota**

Epsilon Associates Inc.

Figure 6-2
Sound Level Modeling Locations

- As per ISO 9613-2, the model assumed favorable conditions for sound propagation, corresponding to a moderate, well-developed ground-based temperature inversion, as might occur on a calm, clear night or equivalently downwind propagation.

- Meteorological conditions assumed in the model (T = 10°C/RH = 70%) were selected to minimize atmospheric attenuation in the 500 Hz and 1 kHz octave bands where the human ear is most sensitive.

- No additional attenuation due to tree shielding, air turbulence, or wind shadow effects was considered in the model.

6.3 Sound Level Modeling Results

All modeled sound levels, as output from Cadna/A are A-weighted equivalent sound levels (L_{eq}, dBA). Based on Epsilon's experience in conducting post-construction sound level measurement programs for wind energy facilities, the equivalent sound level has been comparable to the median (L_{50}, dBA) sound level when the wind turbine sound was prevalent and steady under ideal wind and operational conditions.[16] Therefore, the modeled sound levels may be considered as L_{50} sound levels and directly compared to the Minnesota L_{50} limit.

6.3.1 Project + Existing Non-NEER Results

Table E-1 in Appendix E shows the predicted "Project + existing non-NEER" broadband (dBA) sound levels at the 234 Noise Area Classification 1 receptors modeled within 2 miles of the Project Area. These broadband L_{50} sound levels range from 25 to 49 dBA and represent the worst-case future L_{50} sound levels produced solely by wind turbines in the vicinity of the Project following LBWII construction. The maximum modeled sound level of 49 dBA is at non-participating receptors #775, #717, #706, and #707. In addition to these discrete modeling points, sound level isolines generated from the modeling grid are presented in Figure 6-3. The sound levels presented in the tables and in the figure do not include any contribution from other existing sound sources in the area.

6.3.2 Project Only Results

Table E-2 in Appendix E shows the predicted "Project Only" broadband (dBA) sound levels at the 234 Noise Area Classification 1 receptors modeled within 2 miles of the Project Area. These broadband L_{50} sound levels range from 23 to 47 dBA and represent the worst-case future L_{50} sound levels produced solely by the Project. The maximum modeled sound level of 47 dBA is at a participating receptor (#735). The maximum sound level at a non-participating receptor (#826) is 45 dBA. In addition to these discrete modeling points,

[16] Within 0.4 decibels.

sound level isolines generated from the modeling grid are presented in Figure 6-4. The sound levels presented in the tables and in the figure do not include any contribution from existing sound sources in the area.

6.3.3 Existing Non-NEER Only Results

Table E-3 in Appendix E shows the modeled existing non-NEER wind turbine broadband (dBA) sound levels at the 234 Noise Area Classification 1 receptors within 2 miles of the Project Area. These broadband L_{50} sound levels range from 7 to 48 dBA. The maximum L_{50} sound level of 48 dBA is predicted at four (4) non-participating receptors (#706, #775, #707, #717) which result from existing non-NEER wind turbines only. These sound levels significantly contribute to the Project + existing non-NEER wind turbine sound levels discussed in section 6.3.1. In addition to discrete modeling points, sound level isolines generated from the modeling grid are presented in Figure 6-5. The sound levels presented in the tables and in the figure do not include any contribution from other existing sound sources in the area (i.e., existing NEER wind turbines) nor from the Project.

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LEGEND

- Proposed Wind Turbine: GE 2.3-116
- Proposed Wind Turbine: GE 2.3-116 LNTE
- Proposed Wind Turbine: GE 2.1-116
- Proposed Wind Turbine: GE 2.1-116 LNTE
- Existing Non-NEER Wind Turbine Within Project Area: GE
- Existing Non-NEER Wind Turbine Within Project Area: Vestas
- Project Area
- Participating Receptor
- Participation Pending Receptor
- Non-Participating Receptor
- Participating Parcel
- Participation Pending Parcel
- Non-Participating Parcel

Project and Existing Non-NEER L_{50} Sound Level Modeling Results (dBA)

35 45 55

40 50

Scale 1:66,000
1 inch = 5,500 feet

0 2,750 5,500 Feet

Basemap: Bing Aerial Imagery

Lincoln County

Lyon County

Murray County

Pipestone County

211th Street

151st Street

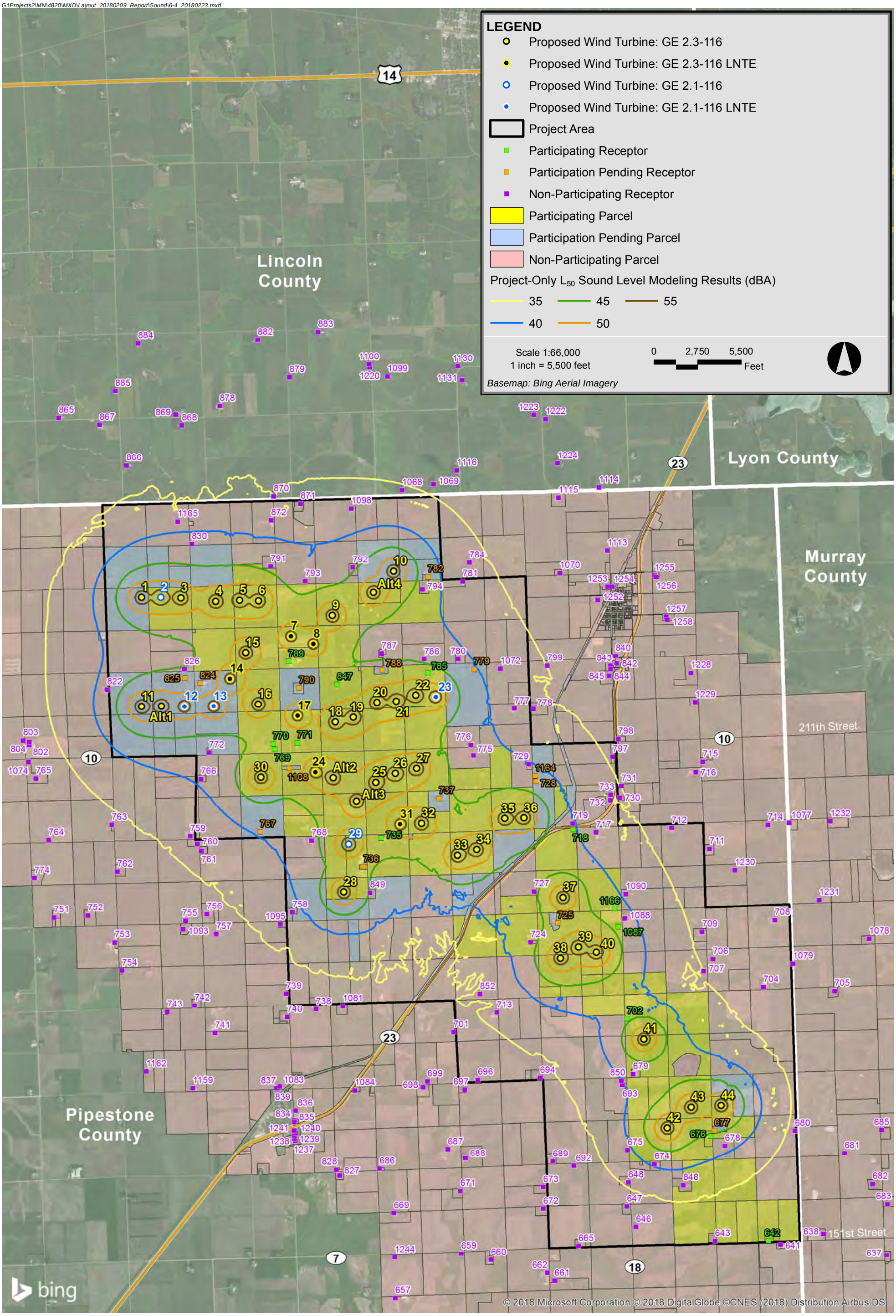
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Lake Benton Wind II Project Pipestone County, Minnesota

Figure 6-3

Project and Existing Non-NEER L_{50} Sound Level Modeling Results

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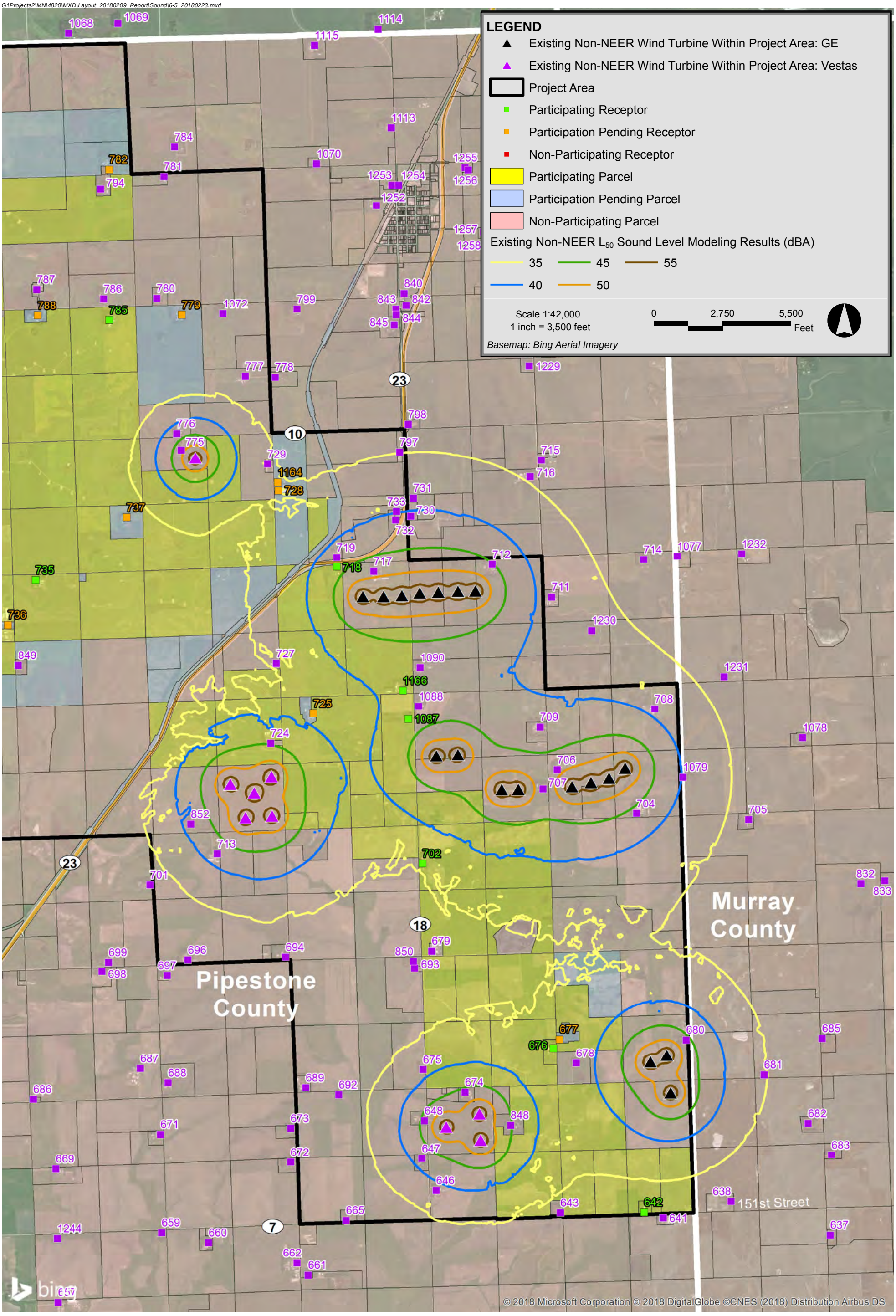
Lake Benton Wind II Project **Pipestone County, Minnesota**

Epsilon Associates Inc.

Figure 6-4

Project-Only L_{50} Sound Level Modeling Results

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Lake Benton Wind II Project **Pipestone County, Minnesota**

Figure 6-5

Existing Non-NEER L_{50} Sound Level Modeling Results

7.0 EVALUATION OF SOUND LEVELS

The proposed Lake Benton Wind II Project within Pipestone County, MN is required to comply with the sound level requirements in Minn. R. Ch. 7030 for Noise Pollution Control. NAC 1 (primarily residential) receptors are protected by the lowest sound level limits of the MPCA. Since wind turbines can operate under conditions resulting in maximum sound power, during both the day and at night, the Project would need to comply during the period with more stringent limits, nighttime. Furthermore, because wind turbine sound is generally steady, the L_{50} (median) sound level is more likely to be affected by wind turbine sound than the L_{10} which is controlled more by unsteady sound. The L_{50} limit is also more restrictive than the L_{10} limit. Therefore, NAC 1 receptors have been evaluated against the L_{50} sound level limit of 50 dBA in this analysis. This is a total sound level limit which includes sound from the Project and existing sound sources. The LWECS Guidance does provide guidance on the types of events to be excluded from the evaluation with respect to sound sources and meteorological conditions.

The predicted worst-case sound level from the combination of the Project wind turbines and the existing non-NEER wind turbines (Project + Non-NEER) is below the 50 dBA limit at all modeled NAC 1 receptors. Appendix F provides the modeling results sorted by sound level from high to low. A review of Table F-1 shows the highest L_{50} sound level to be 49 dBA at receptors #775, #717, #706, and #707. These are at non-participating receptors. Accordingly, total sound levels (Project + existing non-NEER wind turbines + non-wind-turbine ambient) will meet the Minnesota limit of 50 dBA when non-wind-turbine ambient sound levels are less than or equal to 44 dBA.[17] Short-term nighttime measurements showed non-wind-turbine ambient L_{50} (dBA) sound levels to be well below 44 dBA under low ground-level wind speeds and ranging from just below to above the cut-in wind speed at hub height. Non-wind-turbine ambient sound levels in the Project Area fluctuate due to sound sources such as ground-level winds, vehicular traffic, and vegetation rustle, all of which can cause non-wind-turbine ambient sound levels to exceed the MPCA L_{50} nighttime limit of 50 dBA.

In all four instances where the modeled wind turbine L_{50} sound level (Project + Existing Non-NEER) is 49 dBA (#775, #717, #706, and #707), the primary sound source is an existing Non-NEER wind turbine. In addition, in each case this wind turbine is on the parcel with the modeling receptor. The next highest non-participating residence is receptor #674 which is modeled to be 47 dBA; this is several decibels below the MPCA L_{50} nighttime limit.

[17] The maximum modeled Project + Non-NEER L50 sound level is 49.3 dBA at receptor #775. 49.3 dBA + 44.0 dBA = 50.4 dBA. 50.4 dBA rounds to the whole decibel value of 50 dBA.

Moreover, the highest predicted worst-case Project Only L_{50} sound level at a modeling receptor is 47 dBA, and, therefore, is below the most restrictive MPCA sound limit of 50 dBA. This is at receptor #735 which is participating. The highest modeled Project Only L_{50} sound level at a non-participant is 45 dBA (receptor #826). Project Only sound levels sorted from high to low are presented in Table F-2 of Appendix F.

The highest modeled L_{50} sound level from the existing non-NEER wind turbines at a modeling receptor is 48 dBA (receptor #775). This sound level is not attributable to the Project.

8.0 LOW FREQUENCY AND INFRASOUND

An evaluation of low frequency (LF) and infrasound levels from a wind energy center at receptors is not required by the State of Minnesota. However, a discussion of LF and infrasound, as it pertains to wind turbines, is provided below for informational purposes.

Low frequency (LF) and infrasound are present in the environment due to other sources besides wind turbines. For example, refrigerators, air conditioners, and televisions generate infrasound and low frequency sound. The frequency range of low frequency sound is generally from 20 Hz to 200 Hz, and the range below 20 Hz is often described as "*infrasound*". However, audibility can extend to frequencies below 20 Hz if the energy is high enough. Since there is no sharp change in hearing at 20 Hz, the division between "low-frequency sound" and "infrasound" should only be considered "practical and conventional." The threshold of hearing is standardized for frequencies down to 20 Hz.[18] Based on extensive research and data, Watanabe and Moeller have proposed normal hearing thresholds for frequencies below 20 Hz.[19] These sound levels are so high that infrasound is generally considered inaudible. For example, the sound level at 8 Hz would need to be 100 dB to be audible.

A detailed infrasound and low frequency noise measurement program of wind turbines was conducted from 2013-2015 by the Ministry for the Environment, Climate and Energy of the Federal State of Baden-Wuerttemberg, Germany.[20] The conclusions of the German study were:

> *"Infrasound and low-frequency noise are an everyday part of our technical and natural environment. Compared with other technical and natural sources, the level of infrasound caused by wind turbines is low. Already at a distance of 150 m (~500 ft), it is well below the human limits of perception. Accordingly, it is even lower at the usual distances from residential areas. Effects on health caused by infrasound below the perception thresholds have not been scientifically proven. Together with the health authorities, we in Baden-Württemberg have come to the conclusion that adverse effects relating to infrasound from wind turbines cannot be expected on the basis of the evidence at hand."*

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[18] Acoustics - Normal equal-loudness-level contours, International Standard ISO 226:2003, International Organization for Standardization, Geneva, Switzerland, (2003).

[19] T. Watanabe, and H. Moeller, "Low Frequency Hearing Thresholds in Pressure Field and in Free Field", J. Low Frequency Noise and Vibration, 9(3), 106-115, (1990).

[20] *Low frequency noise incl. infrasound from wind turbines and other sources*, LUBW, Baden-Wuerttemberg, Germany, September 2016.

The Massachusetts Department of Environmental Protection (MA DEP) and the Massachusetts Department of Public Health commissioned an expert panel who found that: "Claims infrasound from wind turbines directly impacts the vestibular system have not been demonstrated scientifically. Available evidence shows that the infrasound levels near wind turbines cannot impact the vestibular system."[21]

Health Canada, in collaboration with Statistics Canada, conducted one of the most extensive studies to understand the impacts of wind turbine noise to-date.[22] A cross-section epidemiological study was carried out in 2013 in the provinces of Ontario and Prince Edward Island on randomly selected participants living near and far from operating wind turbines. Many peer-reviewed publications have been written based on the Health Canada research, including an analysis of low frequency and infrasound data. For example, Keith et al concluded that there was no advantage of using C-weighting to measure low frequency sound since the relationship between A-weighting and C-weighting are so highly correlated.[23] In other words, acceptable A-weighted limits also eliminate low frequency and infrasound impacts.

Low frequency and infrasound has also been studied extensively in Japan. Tachibana et al conducted extensive measurements of 34 wind farms nationwide and concluded that infrasound from wind turbines is not audible/sensible, and that wind turbine noise is not a problem in the infrasound region.[24]

As noted in the 2011 NARUC report, "the widespread belief that wind turbines produce elevated or even harmful levels of low frequency and infrasonic sound is utterly untrue as proven repeatedly and independently by numerous investigators."[25]

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21 *Wind Turbine Health Impact Study: Review of Independent Expert Panel,* Massachusetts Department of Environmental Protection and Massachusetts Department of Public Health, January 2012.

22 Health Canada website: http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php

23 *Wind turbine sound pressure level calculations at dwellings,* S. E. Keith et al, J. Acoustical Society of America, 139(3), March 2016.

24 *Nationwide field measurements of wind turbine noise in Japan,* H. Tachibana et al, Noise Control Engineering Journal, 62(2), March-April 2014.

25 Assessing Sound Emissions from Proposed Wind Farms & Measuring the Performance of Completed Projects, NARUC, prepared by Hessler Associates, Inc., October 2011.

9.0 CONCLUSIONS

A comprehensive sound level modeling assessment was conducted for the Lake Benton Wind II Project. In addition, ambient sound levels were measured to characterize the existing background sound levels within the area. When Project sound levels are combined with modeled sound levels from existing non-NEER wind turbines within the Project Area, sound levels are below the MPCA nighttime residential limit of 50 dBA. Under conditions resulting in ambient sound levels of 44 dBA or less, total sound levels (Project + existing non-NEER wind turbines within the Project Area + non-wind-turbine ambient) will meet the limit of 50 dBA. Short-term nighttime measurements showed non-wind-turbine ambient L_{50} (dBA) sound levels to be well below 44 dBA under low ground-level wind speeds and ranging from just below to above the cut-in wind speed at hub height. Non-wind-turbine ambient sound levels in the Project Area fluctuate due to sound sources such as ground-level winds, vehicular traffic, and vegetation rustle, all of which can cause non-wind-turbine ambient sound levels to exceed the MPCA L_{50} nighttime limit of 50 dBA. Moreover, the highest predicted worst-case Project Only L_{50} sound level at a modeling receptor is 47 dBA, and, therefore, is below the most restrictive MPCA sound limit of 50 dBA.

Appendix A
LBWII Sound Level Measurement Protocol

Lake Benton II Wind Project
Pipestone County, MN

Sound Level Measurement Protocol

December 6, 2017

Introduction

This protocol describes the methodology involved in measuring the ambient sound levels for the Lake Benton II Wind ("LBIIW"). LBIIW will be a wind power generation facility consisting of 44 wind turbines located within Pipestone County, Minnesota. The proposed wind turbines will be a combination of GE 2.1-116, and GE 2.3-116 units. The GE 2.1-116 wind turbines have a hub height of 80 meters and a rotor diameter of 116 meters. The GE 2.3-116 wind turbines have a hub height of 90 meters and a rotor diameter of 116 meters. As part of this effort, Epsilon will conduct a sound level measurement program to document existing ambient sound levels in the vicinity of the LBIIW Project.

The purpose of this protocol is to describe the measurement methodology, identify acoustical and meteorological equipment proposed, and provide a schedule. Procedures identified in the Guidance for Large Wind Energy Conversion System, Noise Study Protocol and Report ("LWECS Guidance") published by the Minnesota Department of Commerce ("DOC"), Energy Facility Permitting, dated October 8, 2012 were used in the development of this measurement protocol.

Sound Level Measurement Methodology

Broadband A-weighted (dBA) and one-third octave-band (dB) sound levels will be measured at 5 locations in Pipestone and Lincoln Counties to collect pre-construction sound level data. Per the LWECS Guidance document, one (1) location has been selected to represent the receptor with the worst-case modeled sound level based on a preliminary modeling analysis. The document also advises sound level measurements at locations within the Project area when wind turbines are either not constructed or not operating to represent ambient sound level conditions. The Lake Benton II Project area is unique in that an operational wind energy facility owned by Lake Benton I, LLC, an indirect subsidiary of NextEra Energy Resource, LLC (NEER), and is located within the Lake Benton II Project boundary. These wind turbines will be decommissioned prior to construction of the new Project, but are currently operational. No shutdowns of this facility are planned for this measurement program. In addition, wind turbines associated with other wind energy facilities are located within the Project boundary. These facilities are not owned or operated by a NEER affiliate or subsidiary. They are assumed to be

currently operational. Figure 1 identifies existing NEER-subsidiary and non-NEER wind turbines. The locations of non-NEER wind turbines are based on aerial imagery. The layout showing proposed wind turbine locations for the LBIIW Project are also identified in the figure.

Based on the LWCES Guidance, three (3) measurement locations within the Project area were selected based on proximity to local roadways, other measurement locations, existing wind turbines, and modeled sound levels. Sound levels at these locations will not be representative of a no-build case because the sound levels due to the operation of wind turbines will be reduced due to the decommissioning of existing NEER wind turbines; therefore, two (2) offsite measurement locations were selected based on aerial imagery to be representative of the Project area without wind turbine sound contribution. These locations are at least 2 miles from any existing operational wind turbines. The proposed locations are within NEER's decommissioned Buffalo Ridge project area as shown in Figure 1.

The five (5) proposed measurement locations and five (5) alternate locations in Pipestone and Lincoln Counties are shown in Figure 1 and briefly described below. All monitoring locations are proposed to be at a residence (exterior) with some on participating and others on non-participating parcels. Non-participating homeowners may be unwilling to grant permission at a particular location; if permission is not granted, measurements will be conducted at an alternate location when practical. In addition, the alternate location may be selected if site conditions realized during setup warrant relocation. At the time of this Protocol, permission has not been obtained at the measurement locations. Additional alternative locations may be selected and/or the number of measurement locations reduced if permission cannot be obtained prior to the commencement of the measurement program.

- **Location 1:** Lake Benton II Project Area – Non-participating
  - Residence of Cary R Alderson (LBN1396) – highest modeled sound level
- **Location 1-Alt:** Lake Benton II Project Area – Participating
  - Residence of Devin Schulze (LBN1241) – 2nd highest modeled sound level
- **Location 2:** Lake Benton II Project Area – Participating
  - Residence of Michale T & Juliaann M Nelson (LBN1283)
- **Location 2-Alt:** Lake Benton II Project Area – Participating
  - Residence of Erickson Revocable Living TR (LBN1237)
- **Location 3:** Lake Benton II Project Area – Non-participating
  - Residence of Aaron & Melissa Burnett (LBN1609)
- **Location 3-Alt:** Lake Benton II Project Area – Participating
  - Residence of Lloyd & Carolyn Erpelding (LBN1645)
- **Location 4:** Buffalo Ridge Project Area – Non-participating

- Residence of unknown ownership

- **Location 4-Alt:** Buffalo Ridge Project Area – Non-participating
  - Residence of Nibbe/John H & Pamela K (BFR1200)
- **Location 5:** Buffalo Ridge Project Area – Non-participating
  - Residence of unknown ownership
- **Location 5-Alt:** Buffalo Ridge Project Area – Non-participating
  - Residence of unknown ownership

Measurement Equipment

The sound level measurements will be made using Larson Davis (LD) model 831 sound level meters (or equivalent). The model meets "Type 1 Precision" requirements set forth in American National Standards Institute (ANSI) S1.4-1983 standard for sound level meters. The meters will log values of various broadband A-weighted (dBA) sound level measurement parameters including the L_{eq}, L_{max}, L_{10}, L_{50}, and L_{90}, and will be programmed to log this statistical data on an hourly basis. The LWECS Guidance also requires C-weighted data collection. This will be calculated through post-processing analysis since simultaneous A-weighted and C-weighted collection is not possible with commonly available commercial instrumentation. One-minute time history data will be collected by the meters. The microphones will be tripod-mounted at a height of 1.5 meters (5 feet) above ground. A 7-inch windscreen will be placed on all microphones.

The measurement equipment will be calibrated in the field before and after the survey with the manufacturer's acoustical calibrator which meets the standards of IEC 942 Class 1L and ANSI S1.40-1984. All calibrations will be within ±1.0 dB from the most recent calibration otherwise the data collected during that period will be discarded. The meters are calibrated and certified as accurate to standards set by the National Institute of Standards and Technology by an independent laboratory within the past 12 months.

Since this is a wind turbine project, the wind speed during the noise study is significant. The ground-level wind speed has a direct influence on the ambient sound levels. Ground-level wind speed data will be continuously measured at all sound level monitoring locations for the duration of the study per the LWECS Guidance. A HOBO H21-002 micro-weather station with a tripod and data logger will be used at the monitoring locations. The wind sensors will be mounted at microphone height (1.5 meters) and log data every hour. This wind instrument has a measurement range of 0 to 45 m/s (100 mph) and an accuracy of ±1.1 m/s (2.4 mph). The starting threshold is ≤1 m/s (2.2 mph).

Additional meteorological parameters, e.g. temperature, precipitation, etc. will either be collected through additional instrumentation deployed by Epsilon or will be downloaded from the closest National Weather Service station.

In order to allow for the characterization of background sound levels during different wind regimes which may be useful once the wind energy facility is operational it would be necessary to know the wind speeds at higher heights (hub height, if possible) during the background sound level measurement program. If these data are available during the program, they will be incorporated into the report.

Summary

Measuring sound for the LBIIW is more complex than a greenfield development as there are the existing 137 Zond operating turbines associated with LBIIW as well as 27 presumably operating other non-NEER turbines in close proximity to the planned project. Thus, taking ambient sound readings in the vicinity of where planned turbines are located will result in data that cannot possibly be representative of the ambient noise at the time the new facility is operating. As such, the protocol includes taking samples in the project area as well as in a decommissioned project area as that area has a similar landscape to the proposed project and does not include operating turbines. We would like to confirm this approach is consistent with the DOC's guidance which appears to allow for on-site and off-site locations for sampling.

Schedule

The sound level measurement program is planned to commence on Tuesday, December, 12, 2017. All equipment is expected to be operating no later than Wednesday, December 13. Following the approach outlined in the guidance document, the sound level measurement program will run for at least one week. The equipment will not be staffed continuously; however, observations will be made three times during the program (see below). The field technician will leave the site on December 13 or December 14 and return on Wednesday, December 20. Continuous A-weighted measurements (24 hours/day) will be made concurrently at all monitoring locations over an approximately 7-day period. The observation periods will be as follows:

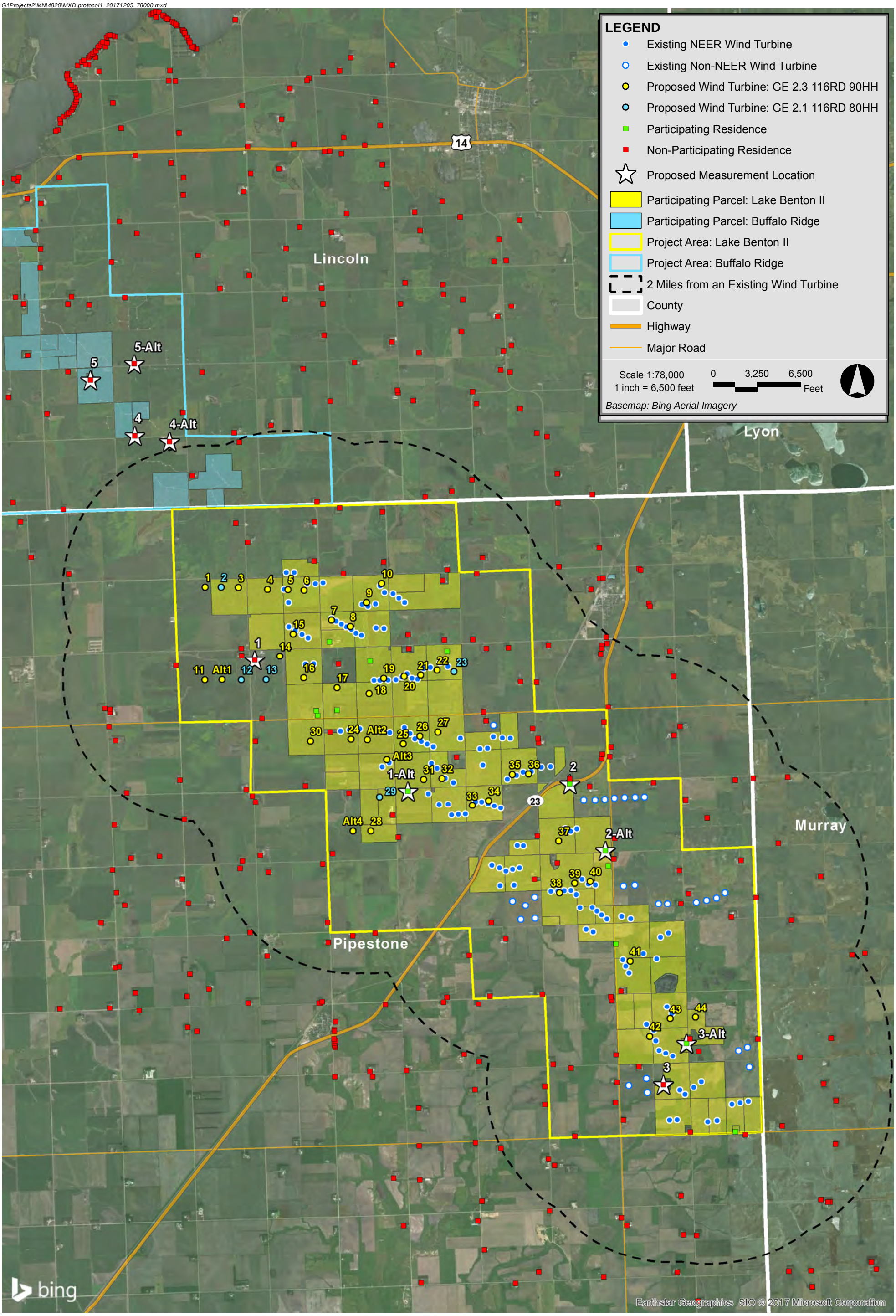
- Upon deployment (daytime),
- During the 1st night when all monitors are running (nighttime), and
- During the pick-up (daytime).

A report, which summarizes the measurement program that will include figures depicting the wind turbine and measurement locations and tabular results, will be submitted as part of the application.

Results/Report

The LWECS document will be used as a guide for sound level data processing, result summaries, and the report structure. The focus of the data analysis will be at the location with the highest predicted sound level and at the offsite locations where wind turbine sound contribution will not be present. No extraneous noise events will be excluded from the data. Hourly periods of recorded precipitation will be removed from the datasets. The percentage of the excluded data will be presented. Sound levels will be presented in graphical format as they were measured in relation to wind speed over the measurement duration. The report will include various figures and tables to effectively summarize the results of the measurement program.

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Lake Benton II **Pipestone County, Minnesota**

Figure 1

Proposed Measurement Locations

Appendix B

NCEI Meteorological Data: NWS Station - Pipestone Municipal Airport, Pipestone, MN

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 1736 ft. Lat: 43.9831° N Lon: -96.3003° W

Station: **PIPESTONE MUNICIPAL AIRPORT, MN US 04965**

Local Climatological Data
Hourly Observations
December 2017

Generated on 02/07/2018

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Date	Time (LST)	Station Type	Sky Conditions	Visibility	Weather Type (see documentation)	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Altimeter Setting (inHg)
					AU | AW | MW	(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
12	0015	7	CLR:00	10.00		14	-10.0	13	-10.6	10	-12.0	85	8	360		28.45				FM-15		30.30
12	0035	7	CLR:00	10.00		14	-10.0	13	-10.6	10	-12.0	85	6	360		28.44				FM-15		30.29
12	0055	7	CLR:00	10.00		12	-11.0	11	-11.4	10	-12.0	92	6	340		28.44				FM-15		30.29
12	0115	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	6	330		28.44				FM-15		30.29
12	0135	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	6	300		28.44				FM-15		30.29
12	0155	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	7	330		28.43				FM-15		30.28
12	0215	7	CLR:00	10.00		12	-11.0	11	-11.4	10	-12.0	92	7	320		28.43				FM-15		30.28
12	0235	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	7	330		28.43				FM-15		30.28
12	0255	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	7	330		28.42				FM-15		30.27
12	0315	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	6	320		28.41				FM-15		30.26
12	0335	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	8	330		28.41				FM-15		30.26
12	0355	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	8	320		28.40				FM-15		30.25
12	0415	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	8	330		28.41				FM-15		30.26
12	0435	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	8	340		28.41				FM-15		30.26
12	0455	7	CLR:00	10.00		12	-11.0	11	-11.5	9	-13.0	85	6	330		28.40				FM-15		30.25
12	0515	7	CLR:00	10.00		10	-12.0	10	-12.4	9	-13.0	92	3	310		28.39				FM-15		30.24
12	0535	7	CLR:00	10.00		10	-12.0	10	-12.4	9	-13.0	92	5	320		28.39				FM-15		30.24
12	0555	7	CLR:00	10.00		10	-12.0	10	-12.4	9	-13.0	92	3	340		28.39				FM-15		30.24
12	0615	7	CLR:00	10.00		9	-13.0	9	-13.0	7	-14.0	92	0	000		28.38				FM-15		30.23
12	0635	7	SCT:04 21	10.00		9	-13.0	9	-13.0	7	-14.0	92	3	340		28.38				FM-15		30.22
12	0655	7	OVC:08 19	10.00		10	-12.0	10	-12.4	9	-13.0	92	0	000		28.36				FM-15		30.21
12	0715	7	OVC:08 19	10.00		12	-11.0	11	-11.4	10	-12.0	92	5	340		28.36				FM-15		30.21
12	0735	7	OVC:08 21	10.00		12	-11.0	11	-11.4	10	-12.0	92	0	000		28.35				FM-15		30.20
12	0755	7	OVC:08 21	10.00		12	-11.0	11	-11.4	10	-12.0	92	3	330		28.35				FM-15		30.19
12	0815	7	OVC:08 21	10.00		14	-10.0	13	-10.3	12	-11.0	92	6	320		28.35				FM-15		30.19
12	0835	7	OVC:08 21	10.00		16	-9.0	15	-9.5	12	-11.0	86	7	300		28.34				FM-15		30.18
12	0855	7	OVC:08 21	10.00		18	-8.0	17	-8.4	14	-10.0	86	8	250		28.32				FM-15		30.16
12	0915	7	OVC:08 21	10.00		18	-8.0	17	-8.1	16	-9.0	93	9	250		28.31				FM-15		30.15
12	0935	7	OVC:08 21	10.00		19	-7.0	18	-7.7	16	-9.0	86	8	250		28.31				FM-15		30.15
12	0955	7	OVC:08 21	10.00		21	-6.0	20	-6.6	18	-8.0	86	10	250		28.31				FM-15		30.15
12	1015	7	BKN:07 25	10.00		21	-6.0	20	-6.5	19	-7.0	93	9	270		28.31				FM-15		30.15
12	1035	7	SCT:04 25	10.00		23	-5.0	22	-5.7	19	-7.0	86	10	260		28.30				FM-15		30.14
12	1055	4		10.00		25	-4.0			21	-6.0	86	13	260						FM-15		30.12
12	1115	4		10.00		25	-4.0			21	-6.0	86	10	260						FM-15		30.12
12	1135	4		10.00		27	-3.0			21	-6.0	80	9	260						FM-15		30.10
12	1155	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	11	270		28.24				FM-15		30.08
12	1215	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	10	260		28.22				FM-15		30.06
12	1235	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	10	250		28.20				FM-15		30.04
12	1255	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	15	250		28.18				FM-15		30.02
12	1315	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	11	250	16	28.17				FM-15		30.01
12	1335	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	13	270	18	28.17				FM-15		30.00
12	1355	7	SCT:04 70	10.00		36	2.0	32	0.3	27	-3.0	70	15	250		28.15				FM-15		29.98
12	1415	7	BKN:07 70	10.00		36	2.0	32	0.3	27	-3.0	70	10	250		28.15				FM-15		29.98
12	1435	7	SCT:04 70	10.00		36	2.0	33	0.5	28	-2.0	75	11	250		28.13				FM-15		29.96
12	1455	7	SCT:04 70	10.00		37	3.0	33	0.8	28	-2.0	70	13	240		28.11				FM-15		29.94
12	1515	7	CLR:00	10.00		37	3.0	33	0.8	28	-2.0	70	16	250		28.08				FM-15		29.91
12	1535	7	CLR:00	10.00		37	3.0	33	0.8	28	-2.0	70	14	240		28.07				FM-15		29.90

12	1555	7	CLR:00	10.00		37	3.0	33	0.8	28	-2.0	70	11	250		28.06				FM-15		29.89
12	1615	7	CLR:00	10.00		36	2.0	33	0.5	28	-2.0	75	10	250		28.06				FM-15		29.89
12	1635	7	CLR:00	10.00		36	2.0	33	0.5	28	-2.0	75	11	240		28.05				FM-15		29.88
12	1655	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	11	240		28.03				FM-15		29.86
12	1715	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	11	240		28.02				FM-15		29.85
12	1735	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	10	240		28.01				FM-15		29.84
12	1755	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	10	230		28.00				FM-15		29.83
12	1815	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	10	230		27.99				FM-15		29.82
12	1835	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	9	240		27.99				FM-15		29.81
12	1855	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	13	240		27.96				FM-15		29.78
12	1915	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	10	230		27.95				FM-15		29.77
12	1935	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	9	230		27.93				FM-15		29.75
12	1955	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	9	220		27.92				FM-15		29.74
12	2015	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	7	230		27.91				FM-15		29.73
12	2035	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	240		27.90				FM-15		29.72
12	2055	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	9	230		27.89				FM-15		29.71
12	2115	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	240		27.87				FM-15		29.69
12	2135	7		10.00	* ||	28	-2.0	27	-2.8	25	-4.0	86	9	240		27.85				FM-15		29.67
12	2155	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	10	240		27.83				FM-15		29.65
12	2215	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	9	240		27.81				FM-15		29.63
12	2235	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	9	240		27.81				FM-15		29.62
12	2255	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	10	230		27.78				FM-15		29.60
12	2315	7	CLR:00	10.00		32	0.0	29	-1.5	25	-4.0	75	9	240		27.77				FM-15		29.58
12	2335	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	9	240		27.75				FM-15		29.56
12	2355	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	8	240		27.73				FM-15		29.54
13	0015	7	CLR:00	10.00		30	-1.0	27	-2.5	23	-5.0	75	9	240		27.72				FM-15		29.53
13	0035	7	CLR:00	10.00		30	-1.0	27	-2.5	23	-5.0	75	9	250		27.70				FM-15		29.51
13	0055	7	CLR:00	10.00		30	-1.0	27	-2.5	23	-5.0	75	8	260		27.69				FM-15		29.50
13	0115	7	CLR:00	10.00		32	0.0	29	-1.8	23	-5.0	69	11	270		27.67				FM-15		29.48
13	0135	7	CLR:00	10.00		32	0.0	29	-1.8	23	-5.0	69	11	280		27.65				FM-15		29.46
13	0155	7	CLR:00	10.00		36	2.0	31	-0.5	23	-5.0	60	13	290		27.65				FM-15		29.46
13	0215	7	CLR:00	10.00		36	2.0	31	-0.5	23	-5.0	60	11	290		27.66				FM-15		29.47
13	0235	7	CLR:00	10.00		37	3.0	32	-0.2	23	-5.0	56	14	300	20	27.65				FM-15		29.46
13	0255	7	CLR:00	10.00		39	4.0	33	0.8	25	-4.0	56	15	300	18	27.65				FM-15		29.46
13	0315	7	CLR:00	10.00		41	5.0	35	1.5	25	-4.0	53	18	300	24	27.65				FM-15		29.46
13	0335	7	CLR:00	10.00		43	6.0	36	2.1	25	-4.0	49	20	300	29	27.66				FM-15		29.47
13	0355	7	SCT:04 60 SCT:04 85	10.00		41	5.0	35	1.5	25	-4.0	53	18	300	28	27.66				FM-15		29.47
13	0415	7	SCT:04 70 SCT:04 85 SCT:04 110	10.00		43	6.0	37	2.6	28	-2.0	57	22	320	30	27.65				FM-15		29.46
13	0435	7	SCT:04 26 SCT:04 70 BKN:07 95	10.00		41	5.0	36	2.4	30	-1.0	66	22	330	41	27.67				FM-15		29.48
13	0455	7	BKN:07 19 OVC:08 24	10.00		39	4.0	36	2.2	32	0.0	75	26	320	34	27.68				FM-15		29.49
13	0515	7	OVC:08 17	10.00		39	4.0	37	2.7	34	1.0	81	25	330	37	27.68				FM-15		29.49
13	0535	7	OVC:08 15	10.00		39	4.0	37	2.7	34	1.0	81	30	330	41	27.69				FM-15		29.50
13	0555	7	OVC:08 15	10.00		37	3.0	35	1.6	32	0.0	81	31	340	38	27.71				FM-15		29.52
13	0615	7	OVC:08 15	10.00	DZ |DZ |	37	3.0	35	1.6	32	0.0	81	26	330	40	27.72				FM-15		29.53
13	0635	7	OVC:08 15	7.00	-RA |RA |	36	2.0	34	1.3	32	0.0	87	26	330	38	27.73				FM-15		29.54
13	0655	7	OVC:08 15	10.00		36	2.0	34	1.3	32	0.0	87	31	330	39	27.75				FM-15		29.56
13	0715	7	OVC:08 13	10.00		36	2.0	34	1.3	32	0.0	87	26	340	34	27.76				FM-15		29.57
13	0735	7	OVC:08 10	10.00		36	2.0	34	1.3	32	0.0	87	29	340	39	27.77				FM-15		29.58
13	0755	7	OVC:08 14	10.00		36	2.0	34	1.3	32	0.0	87	30	340	38	27.78				FM-15		29.59
13	0815	7	OVC:08 14	10.00		36	2.0	34	0.9	30	-1.0	81	26	340	44	27.79				FM-15		29.61
13	0835	7	BKN:07 16 OVC:08 22	10.00		36	2.0	34	0.9	30	-1.0	81	22	350	45	27.81				FM-15		29.62

13	0855	7	BKN:07 16 OVC:08 22	10.00		36	2.0	34	0.9	30	-1.0	81	24	360	36	27.82				FM-15		29.64
13	0915	7	OVC:08 14	10.00		36	2.0	34	0.9	30	-1.0	81	26	350	38	27.83				FM-15		29.65
13	0935	7	OVC:08 14	10.00		36	2.0	34	0.9	30	-1.0	81	20	350	37	27.84				FM-15		29.66
13	0955	7	OVC:08 12	10.00		36	2.0	34	0.9	30	-1.0	81	25	350	43	27.86				FM-15		29.68
13	1015	7	OVC:08 14	10.00		36	2.0	34	0.9	30	-1.0	81	22	350	31	27.86				FM-15		29.68
13	1035	7	OVC:08 14	10.00		36	2.0	34	0.9	30	-1.0	81	22	350	36	27.87				FM-15		29.69
13	1055	7	OVC:08 14	10.00		36	2.0	34	0.9	30	-1.0	81	26	340	37	27.88				FM-15		29.70
13	1115	7	OVC:08 12	10.00		34	1.0	32	0.2	30	-1.0	87	21	350	28	27.89				FM-15		29.71
13	1135	7	OVC:08 12	10.00		34	1.0	32	0.2	30	-1.0	87	18	360	30	27.90				FM-15		29.72
13	1155	7	OVC:08 12	10.00		34	1.0	32	-0.2	28	-2.0	81	16	360	32	27.91				FM-15		29.73
13	1215	7	OVC:08 10	10.00		32	0.0	30	-0.9	28	-2.0	87	20	360	25	27.92				FM-15		29.74
13	1235	7	OVC:08 10	10.00		32	0.0	30	-0.9	28	-2.0	87	16	360	26	27.92				FM-15		29.74
13	1255	7	BKN:07 12 OVC:08 19	10.00		34	1.0	32	-0.2	28	-2.0	81	20	350	30	27.92				FM-15		29.74
13	1315	7	SCT:04 17 OVC:08 23	10.00		34	1.0	31	-0.4	27	-3.0	75	21	350	34	27.92				FM-15		29.74
13	1335	7	BKN:07 22 OVC:08 29	10.00		34	1.0	31	-0.4	27	-3.0	75	23	350	33	27.92				FM-15		29.74
13	1355	7	BKN:07 20 OVC:08 30	10.00		34	1.0	32	-0.2	28	-2.0	81	20	350	33	27.92				FM-15		29.74
13	1415	7	BKN:07 18 OVC:08 32	10.00		34	1.0	32	-0.2	28	-2.0	81	18	340	30	27.93				FM-15		29.75
13	1435	7	SCT:04 18 OVC:08 35	10.00		34	1.0			27	-3.0	75	24	340	29					FM-15		
13	1455	7	BKN:07 20 OVC:08 37	10.00		34	1.0	31	-0.4	27	-3.0	75	18	350	28	27.94				FM-15		29.76
13	1515	7	OVC:08 18	10.00		34	1.0	31	-0.4	27	-3.0	75	22	350	33	27.96				FM-15		29.78
13	1535	7	BKN:07 18 BKN:07 24 OVC:08 29	10.00		32	0.0	30	-1.1	27	-3.0	80	15	350	26	27.96				FM-15		29.79
13	1555	7	BKN:07 20 BKN:07 26 OVC:08 31	10.00		32	0.0	30	-1.1	27	-3.0	80	11	360	17	27.98				FM-15		29.80
13	1615	7	OVC:08 20	10.00		30	-1.0	29	-1.7	27	-3.0	86	14	010	22	27.99				FM-15		29.81
13	1635	7	OVC:08 18	10.00		30	-1.0	29	-1.7	27	-3.0	86	14	360	21	28.00				FM-15		29.83
13	1655	7	BKN:07 18 OVC:08 26	10.00	UP ||	30	-1.0	29	-1.7	27	-3.0	86	14	360	23	28.01				FM-15		29.84
13	1715	7	SCT:04 18 BKN:07 26 OVC:08 41	10.00		30	-1.0	29	-1.7	27	-3.0	86	11	360	21	28.01				FM-15		29.84
13	1735	7	SCT:04 17 OVC:08 45	10.00		30	-1.0	29	-1.7	27	-3.0	86	11	340		28.02				FM-15		29.85
13	1755	7	OVC:08 45	10.00		30	-1.0	29	-1.7	27	-3.0	86	13	350	21	28.02				FM-15		29.85
13	1815	7	SCT:04 23 BKN:07 27 OVC:08 45	10.00		30	-1.0	29	-1.7	27	-3.0	86	13	350		28.03				FM-15		29.86
13	1835	7	SCT:04 23 SCT:04 27 OVC:08 45	10.00		30	-1.0	29	-1.7	27	-3.0	86	11	350	21	28.03				FM-15		29.86
13	1855	7	SCT:04 21 OVC:08 43	10.00		30	-1.0	28	-2.1	25	-4.0	80	15	350	22	28.04				FM-15		29.87
13	1915	7	SCT:04 23 OVC:08 45	10.00		30	-1.0	28	-2.1	25	-4.0	80	17	350	23	28.04				FM-15		29.87
13	1935	7	SCT:04 20 BKN:07 34 OVC:08 42	10.00	UP ||	30	-1.0	29	-1.7	27	-3.0	86	14	360	22	28.04				FM-15		29.87
13	1955	7	SCT:04 13 BKN:07 29 OVC:08 38	10.00		30	-1.0	28	-2.1	25	-4.0	80	16	030	24	28.06				FM-15		29.89
13	2015	7	BKN:07 10 OVC:08 16	10.00		27	-3.0	26	-3.2	25	-4.0	93	15	030	21	28.07				FM-15		29.90

13	2035	7	SCT:04 10 OVC:08 38	10.00		27	-3.0	26	-3.6	23	-5.0	86	11	020	18	28.08				FM-15		29.91
13	2055	7	SCT:04 10 OVC:08 40	10.00		27	-3.0	26	-3.6	23	-5.0	86	10	020	16	28.09				FM-15		29.92
13	2115	7	BKN:07 12 OVC:08 42	10.00		27	-3.0	26	-3.6	23	-5.0	86	11	020		28.10				FM-15		29.93
13	2135	7	BKN:07 14 OVC:08 42	10.00		27	-3.0	26	-3.6	23	-5.0	86	7	020		28.10				FM-15		29.93
13	2155	7	BKN:07 12 OVC:08 40	10.00		27	-3.0	26	-3.6	23	-5.0	86	9	020		28.11				FM-15		29.94
13	2215	7	OVC:08 12	10.00		27	-3.0	25	-3.9	21	-6.0	80	11	020		28.11				FM-15		29.94
13	2235	7	OVC:08 12	10.00		25	-4.0	24	-4.6	21	-6.0	86	10	360	16	28.11				FM-15		29.94
13	2255	7	OVC:08 16	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	010		28.12				FM-15		29.95
13	2315	7	BKN:07 8 OVC:08 18	10.00		25	-4.0	24	-4.6	21	-6.0	86	7	020		28.13				FM-15		29.96
13	2335	7	OVC:08 10	10.00		25	-4.0	24	-4.6	21	-6.0	86	7	020		28.13				FM-15		29.96
13	2355	7	OVC:08 10	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	020		28.13				FM-15		29.96
14	0015	7	OVC:08 10	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	020		28.14				FM-15		29.97
14	0035	7	OVC:08 10	10.00		25	-4.0	24	-4.6	21	-6.0	86	7	010		28.14				FM-15		29.97
14	0055	7	OVC:08 8	10.00		25	-4.0	24	-4.6	21	-6.0	86	6	040		28.13				FM-15		29.96
14	0115	7	OVC:08 8	10.00		23	-5.0	22	-5.4	21	-6.0	93	6	060		28.13				FM-15		29.96
14	0135	7	OVC:08 6	10.00		23	-5.0	22	-5.4	21	-6.0	93	6	050		28.13				FM-15		29.96
14	0155	7	OVC:08 6	10.00		23	-5.0	22	-5.4	21	-6.0	93	3	060		28.13				FM-15		29.96
14	0215	7	OVC:08 6	10.00		23	-5.0	22	-5.4	21	-6.0	93	0	000		28.14				FM-15		29.97
14	0235	7	OVC:08 6	10.00		23	-5.0	22	-5.4	21	-6.0	93	0	000		28.13				FM-15		29.96
14	0255	7	OVC:08 6	10.00		23	-5.0	22	-5.4	21	-6.0	93	0	000		28.13				FM-15		29.96
14	0315	7	OVC:08 6	10.00		23	-5.0	22	-5.4	21	-6.0	93	0	000		28.13				FM-15		29.96
14	0335	7	BKN:07 6 OVC:08 36	10.00		23	-5.0	22	-5.4	21	-6.0	93	0	000		28.13				FM-15		29.96
14	0355	7	SCT:04 6 OVC:08 36	10.00		23	-5.0	22	-5.4	21	-6.0	93	0	000		28.13				FM-15		29.96
14	0415	7	OVC:08 36	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.13				FM-15		29.96
14	0435	7	OVC:08 34	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.13				FM-15		29.96
14	0455	7	OVC:08 36	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.14				FM-15		29.97
14	0515	7	OVC:08 36	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.14				FM-15		29.97
14	0535	7	SCT:04 23 OVC:08 32	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.14				FM-15		29.97
14	0555	7	BKN:07 17 BKN:07 22 OVC:08 32	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.14				FM-15		29.97
14	0615	7	BKN:07 15 OVC:08 30	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.14				FM-15		29.97
14	0635	7	SCT:04 15 OVC:08 28	10.00		25	-4.0	24	-4.6	21	-6.0	86	0	000		28.14				FM-15		29.97
14	0655	7	OVC:08 28	10.00		25	-4.0	24	-4.3	23	-5.0	93	0	000		28.15				FM-15		29.98
14	0715	7	OVC:08 28	10.00		25	-4.0	24	-4.3	23	-5.0	93	0	000		28.15				FM-15		29.98
14	0735	7	SCT:04 4 OVC:08 28	10.00		25	-4.0	24	-4.3	23	-5.0	93	0	000		28.15				FM-15		29.98
14	0755	7	BKN:07 4 OVC:08 28	10.00		25	-4.0	24	-4.3	23	-5.0	93	3	280		28.16				FM-15		29.99
14	0815	7	OVC:08 4	7.00		25	-4.0	24	-4.3	23	-5.0	93	0	000		28.16				FM-15		29.99
14	0835	7	BKN:07 4 OVC:08 30	7.00		27	-3.0	26	-3.2	25	-4.0	93	0	000		28.16				FM-15		29.99
14	0855	7	SCT:04 4 OVC:08 30	10.00		27	-3.0	26	-3.2	25	-4.0	93	0	000		28.16				FM-15		29.99
14	0915	7	SCT:04 11 OVC:08 28	10.00		27	-3.0	26	-3.2	25	-4.0	93	0	000		28.17				FM-15		30.00
14	0935	7	SCT:04 6 SCT:04 10 OVC:08 28	10.00		27	-3.0	27	-2.8	27	-3.0	100	3	260		28.17				FM-15		30.01

14	0955	7	SCT:04 8 SCT:04 12 OVC:08 28	10.00		28	-2.0	28	-2.4	27	-3.0	93	5	270		28.17				FM-15		30.00
14	1015	7	SCT:04 8 OVC:08 30	10.00		28	-2.0	28	-2.4	27	-3.0	93	5	290		28.17				FM-15		30.01
14	1035	7	SCT:04 8 OVC:08 30	10.00		28	-2.0	28	-2.4	27	-3.0	93	6	260		28.17				FM-15		30.01
14	1055	7	SCT:04 10 OVC:08 32	10.00		28	-2.0	28	-2.4	27	-3.0	93	7	290		28.18				FM-15		30.02
14	1115	7	SCT:04 13 BKN:07 19 OVC:08 32	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	320		28.18				FM-15		30.02
14	1135	7	BKN:07 17 OVC:08 22	10.00		30	-1.0	28	-2.1	25	-4.0	80	10	320		28.17				FM-15		30.01
14	1155	7	BKN:07 17 OVC:08 22	10.00		30	-1.0	28	-2.1	25	-4.0	80	8	340		28.17				FM-15		30.01
14	1215	7	BKN:07 17 OVC:08 29	10.00		30	-1.0	28	-2.1	25	-4.0	80	9	340		28.17				FM-15		30.01
14	1235	7	SCT:04 19 OVC:08 29	7.00	-SN |SN |	30	-1.0	28	-2.1	25	-4.0	80	6	360		28.17				FM-15		30.01
14	1255	7	BKN:07 17 OVC:08 29	10.00		30	-1.0	28	-2.1	25	-4.0	80	6	360		28.17				FM-15		30.01
14	1315	7	OVC:08 17	10.00	-SN |SN |	30	-1.0	28	-2.1	25	-4.0	80	3	040		28.17				FM-15		30.01
14	1335	7	OVC:08 17	7.00	-SN |SN |	30	-1.0	28	-2.1	25	-4.0	80	5	350		28.17				FM-15		30.00
14	1355	7	OVC:08 17	10.00		30	-1.0	28	-2.1	25	-4.0	80	3	340		28.17				FM-15		30.00
14	1415	7	OVC:08 15	10.00		30	-1.0	28	-2.1	25	-4.0	80	3	350		28.17				FM-15		30.00
14	1435	7	OVC:08 15	10.00		30	-1.0	28	-2.1	25	-4.0	80	0	000		28.17				FM-15		30.00
14	1455	7	OVC:08 15	10.00		30	-1.0	28	-2.1	25	-4.0	80	0	000		28.17				FM-15		30.01
14	1515	7	OVC:08 13	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	310		28.17				FM-15		30.01
14	1535	7	OVC:08 13	10.00		30	-1.0	29	-1.7	27	-3.0	86	6	310		28.18				FM-15		30.02
14	1555	7	OVC:08 11	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	310		28.18				FM-15		30.02
14	1615	7	OVC:08 11	3.00	UP ||	28	-2.0	27	-2.8	25	-4.0	86	8	050		28.20				FM-15		30.03
14	1635	7	SCT:04 6 OVC:08 13	4.00	UP ||	27	-3.0	26	-3.2	25	-4.0	93	9	050		28.20				FM-15		30.04
14	1655	7	SCT:04 6 SCT:04 12 OVC:08 18	7.00	UP ||	27	-3.0	26	-3.2	25	-4.0	93	10	020		28.21				FM-15		30.05
14	1715	7	SCT:04 8 BKN:07 18 OVC:08 33	7.00	UP ||	27	-3.0	26	-3.2	25	-4.0	93	6	040		28.22				FM-15		30.06
14	1735	7	OVC:08 35	10.00		27	-3.0	26	-3.2	25	-4.0	93	6	040		28.21				FM-15		30.05
14	1755	7	OVC:08 37	10.00		27	-3.0	26	-3.2	25	-4.0	93	0	000		28.21				FM-15		30.05
14	1815	7	OVC:08 37	10.00		27	-3.0	26	-3.6	23	-5.0	86	5	360		28.22				FM-15		30.06
14	1835	7	BKN:07 37	10.00		25	-4.0	24	-4.3	23	-5.0	93	6	360		28.23				FM-15		30.07
14	1855	7	BKN:07 25 BKN:07 39	10.00		25	-4.0	24	-4.3	23	-5.0	93	8	340		28.23				FM-15		30.07
14	1915	7	BKN:07 19 OVC:08 26	10.00		27	-3.0	26	-3.6	23	-5.0	86	8	330		28.22				FM-15		30.06
14	1935	7	BKN:07 18 OVC:08 23	10.00		27	-3.0	26	-3.6	23	-5.0	86	8	340		28.23				FM-15		30.07
14	1955	7	SCT:04 12 SCT:04 22 BKN:07 27	10.00		27	-3.0	26	-3.6	23	-5.0	86	10	330	16	28.23				FM-15		30.07
14	2015	7	SCT:04 18 BKN:07 25 BKN:07 47	10.00		25	-4.0	24	-4.6	21	-6.0	86	11	330	18	28.23				FM-15		30.07
14	2035	7	OVC:08 45	10.00		25	-4.0	23	-5.0	19	-7.0	80	8	340		28.22				FM-15		30.06
14	2055	7	OVC:08 42	10.00		25	-4.0	23	-5.0	19	-7.0	80	6	300		28.21				FM-15		30.05
14	2115	7	OVC:08 40	10.00		25	-4.0	24	-4.6	21	-6.0	86	5	290		28.21				FM-15		30.05
14	2135	7	OVC:08 40	10.00		25	-4.0	24	-4.6	21	-6.0	86	7	290		28.21				FM-15		30.05
14	2155	7	OVC:08 40	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	290		28.21				FM-15		30.05
14	2215	7	OVC:08 40	10.00		25	-4.0	24	-4.6	21	-6.0	86	7	280		28.20				FM-15		30.04

14	2235	7	OVC:08 38	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	290		28.20				FM-15		30.04
14	2255	7	BKN:07 40 OVC:08 49	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	280		28.20				FM-15		30.04
14	2315	7	SCT:04 40 OVC:08 49	10.00		25	-4.0	24	-4.6	21	-6.0	86	8	270		28.20				FM-15		30.03
14	2335	7	OVC:08 49	10.00		25	-4.0	24	-4.6	21	-6.0	86	9	280		28.18				FM-15		30.02
14	2355	7	OVC:08 49	10.00		25	-4.0	24	-4.6	21	-6.0	86	9	280		28.18				FM-15		30.02
15	0015	7	OVC:08 48	10.00	-SN |SN |	27	-3.0	26	-3.6	23	-5.0	86	10	280		28.17				FM-15		30.00
15	0035	7	SCT:04 33 BKN:07 43 OVC:08 50	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	280		28.16				FM-15		29.99
15	0055	7	BKN:07 28 BKN:07 33 OVC:08 43	10.00		27	-3.0	26	-3.2	25	-4.0	93	9	280		28.15				FM-15		29.98
15	0115	7	BKN:07 28 OVC:08 45	10.00	UP ||	27	-3.0	26	-3.2	25	-4.0	93	8	270		28.14				FM-15		29.97
15	0135	7	SCT:04 28 OVC:08 47	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	260		28.13				FM-15		29.96
15	0155	7	SCT:04 28 OVC:08 49	10.00	-SN |SN |	27	-3.0	26	-3.2	25	-4.0	93	10	270		28.14				FM-15		29.97
15	0215	7	BKN:07 30 OVC:08 49	10.00		27	-3.0	26	-3.2	25	-4.0	93	9	270		28.13				FM-15		29.96
15	0235	7	SCT:04 30 OVC:08 47	10.00		27	-3.0	26	-3.2	25	-4.0	93	9	280		28.12				FM-15		29.95
15	0255	7	OVC:08 47	10.00		28	-2.0	27	-2.8	25	-4.0	86	9	280		28.11				FM-15		29.94
15	0315	7	OVC:08 45	10.00		28	-2.0	27	-2.8	25	-4.0	86	8	280		28.10				FM-15		29.93
15	0335	7	OVC:08 45	10.00		28	-2.0	27	-2.8	25	-4.0	86	8	270		28.10				FM-15		29.93
15	0355	7	OVC:08 45	10.00		28	-2.0	28	-2.4	27	-3.0	93	10	280		28.09				FM-15		29.92
15	0415	7	OVC:08 43	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	280		28.08				FM-15		29.91
15	0435	7	OVC:08 43	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	290		28.08				FM-15		29.91
15	0455	7	OVC:08 43	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	270		28.07				FM-15		29.90
15	0515	7	OVC:08 43	10.00		28	-2.0	28	-2.4	27	-3.0	93	10	270		28.06				FM-15		29.89
15	0535	7	OVC:08 45	10.00		28	-2.0	28	-2.4	27	-3.0	93	10	280		28.06				FM-15		29.89
15	0555	7	OVC:08 45	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	280		28.06				FM-15		29.89
15	0615	7	OVC:08 47	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	280		28.05				FM-15		29.88
15	0635	7	OVC:08 47	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	280		28.05				FM-15		29.88
15	0655	7	SCT:04 47 BKN:07 75	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	270		28.04				FM-15		29.87
15	0715	7	SCT:04 85	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	270		28.04				FM-15		29.87
15	0735	7	SCT:04 85	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	270		28.04				FM-15		29.87
15	0755	7	SCT:04 43 BKN:07 85	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	270		28.04				FM-15		29.87
15	0815	7	SCT:04 43 SCT:04 85	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	270		28.03				FM-15		29.86
15	0835	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	280		28.03				FM-15		29.86
15	0855	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	280		28.03				FM-15		29.86
15	0915	7	SCT:04 35	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	270		28.03				FM-15		29.86
15	0935	7	SCT:04 35 SCT:04 85	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	270		28.02				FM-15		29.85
15	0955	7	SCT:04 85 SCT:04 110	10.00		30	-1.0	29	-1.7	27	-3.0	86	13	270		28.01				FM-15		29.84
15	1015	7	SCT:04 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	10	260		28.01				FM-15		29.84
15	1035	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	9	270		28.01				FM-15		29.84
15	1055	7	SCT:04 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	9	280		28.01				FM-15	0.01	29.84
15	1115	7	SCT:04 90	10.00		32	0.0	30	-1.1	27	-3.0	80	10	280		28.01				FM-15		29.84
15	1135	7	SCT:04 80	10.00		34	1.0	32	-0.2	28	-2.0	81	8	270		27.99				FM-15		29.82
15	1155	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	8	270		27.98				FM-15		29.80
15	1215	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	8	240		27.96				FM-15		29.79
15	1235	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	10	250		27.96				FM-15		29.78
15	1255	7	SCT:04 80	10.00		36	2.0	32	0.3	27	-3.0	70	10	260		27.95				FM-15		29.77

15	1315	7	BKN:07 80	10.00		36	2.0	32	0.3	27	-3.0	70	10	250		27.93				FM-15		29.75
15	1335	7	OVC:08 80	10.00		36	2.0	32	0.3	27	-3.0	70	10	260		27.93				FM-15		29.75
15	1355	7	BKN:07 80	10.00		37	3.0	33	0.6	27	-3.0	65	10	250		27.92				FM-15		29.74
15	1415	7	SCT:04 80	10.00		37	3.0	33	0.6	27	-3.0	65	9	230		27.90				FM-15		29.72
15	1435	7	CLR:00	10.00		37	3.0	33	0.6	27	-3.0	65	9	250		27.89				FM-15		29.71
15	1455	7	SCT:04 100	10.00		37	3.0	33	0.6	27	-3.0	65	11	250		27.89				FM-15		29.71
15	1515	7	BKN:07 80	10.00		37	3.0	33	0.6	27	-3.0	65	13	240		27.89				FM-15		29.71
15	1535	7	BKN:07 80	10.00		37	3.0	33	0.6	27	-3.0	65	11	240		27.89				FM-15		29.71
15	1555	7	BKN:07 70 BKN:07 90	10.00		37	3.0	33	0.6	27	-3.0	65	9	230		27.89				FM-15		29.71
15	1615	7	OVC:08 70	10.00		37	3.0	33	0.6	27	-3.0	65	8	230		27.88				FM-15		29.70
15	1635	7	SCT:04 70 SCT:04 85	10.00		36	2.0	32	0.3	27	-3.0	70	8	220		27.87				FM-15		29.69
15	1655	7	BKN:07 85	10.00		36	2.0	32	-0.1	25	-4.0	65	7	220		27.86				FM-15		29.68
15	1715	7	BKN:07 85	10.00		34	1.0	31	-0.4	27	-3.0	75	7	210		27.86				FM-15		29.68
15	1735	7	BKN:07 85	10.00		34	1.0	31	-0.4	27	-3.0	75	8	210		27.86				FM-15		29.68
15	1755	7	SCT:04 85	10.00		34	1.0	31	-0.8	25	-4.0	70	10	210		27.85				FM-15		29.67
15	1815	7	CLR:00	10.00		34	1.0	31	-0.8	25	-4.0	70	10	210		27.83				FM-15		29.65
15	1835	7	SCT:04 85	10.00		34	1.0	31	-0.8	25	-4.0	70	10	220		27.83				FM-15		29.65
15	1855	7	BKN:07 75	10.00		34	1.0	31	-0.4	27	-3.0	75	11	210		27.82				FM-15		29.64
15	1915	7	SCT:04 75	10.00		34	1.0	31	-0.4	27	-3.0	75	13	210		27.81				FM-15		29.63
15	1935	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	13	220		27.81				FM-15		29.62
15	1955	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	13	230		27.81				FM-15		29.63
15	2015	7	CLR:00	10.00		34	1.0	31	-0.8	25	-4.0	70	9	230		27.81				FM-15		29.62
15	2035	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	10	240		27.79				FM-15		29.61
15	2055	7	SCT:04 120	10.00		36	2.0	32	-0.1	25	-4.0	65	10	240		27.79				FM-15		29.61
15	2115	7	SCT:04 120	10.00		36	2.0	32	0.3	27	-3.0	70	10	240		27.79				FM-15		29.61
15	2135	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	8	230		27.78				FM-15		29.60
15	2155	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	8	240		27.79				FM-15		29.61
15	2215	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	6	240		27.78				FM-15		29.60
15	2235	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	7	240		27.78				FM-15		29.60
15	2255	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	7	240		27.78				FM-15		29.60
15	2315	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	7	250		27.79				FM-15		29.61
15	2335	7	CLR:00	10.00		32	0.0	29	-1.5	25	-4.0	75	7	220		27.78				FM-15		29.60
15	2355	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	7	240		27.78				FM-15		29.60
16	0015	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	5	240		27.78				FM-15		29.60
16	0035	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	5	240		27.78				FM-15		29.60
16	0055	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	5	260		27.78				FM-15		29.60
16	0115	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	3	250		27.78				FM-15		29.60
16	0135	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	6	270		27.78				FM-15		29.60
16	0155	7	CLR:00	10.00		28	-2.0	26	-3.2	23	-5.0	80	5	240		27.78				FM-15		29.60
16	0215	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	3	270		27.79				FM-15		29.61
16	0235	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	0	000		27.81				FM-15		29.63
16	0255	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	0	000		27.81				FM-15		29.62
16	0315	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	5	340		27.81				FM-15		29.63
16	0335	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	310		27.81				FM-15		29.63
16	0355	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	8	320		27.81				FM-15		29.63
16	0415	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	5	300		27.83				FM-15		29.65
16	0435	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	3	240		27.84				FM-15		29.66
16	0455	7	CLR:00	10.00		25	-4.0	24	-4.6	21	-6.0	86	7	230		27.85				FM-15		29.67
16	0515	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	0	000		27.85				FM-15		29.67
16	0535	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	3	290		27.86				FM-15		29.68
16	0555	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	0	000		27.87				FM-15		29.69
16	0615	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	5	330		27.87				FM-15		29.69
16	0635	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	5	350		27.88				FM-15		29.70
16	0655	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	340		27.89				FM-15		29.71
16	0715	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	8	350		27.91				FM-15		29.73

16	0735	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	350		27.91				FM-15		29.73
16	0755	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	350		27.92				FM-15		29.74
16	0815	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	6	360		27.93				FM-15		29.75
16	0835	7	CLR:00	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	350		27.93				FM-15		29.75
16	0855	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	8	350		27.94				FM-15		29.76
16	0915	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	7	350		27.96				FM-15		29.78
16	0935	7	CLR:00	10.00		32	0.0	30	-1.1	27	-3.0	80	8	340		27.96				FM-15		29.79
16	0955	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	8	340		27.98				FM-15		29.80
16	1015	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	7	330		27.99				FM-15		29.82
16	1035	7	BKN:07 55	10.00		36	2.0	33	0.5	28	-2.0	75	6	340		27.99				FM-15		29.82
16	1055	7	OVC:08 50	10.00		36	2.0	33	0.5	28	-2.0	75	7	350		27.99				FM-15		29.82
16	1115	7	OVC:08 50	10.00		37	3.0	33	0.8	28	-2.0	70	10	350		28.00				FM-15		29.83
16	1135	7	BKN:07 50	10.00		37	3.0	33	0.8	28	-2.0	70	7	350		28.01				FM-15		29.84
16	1155	7	SCT:04 50	10.00		39	4.0	35	1.8	30	-1.0	70	11	340	21	28.01				FM-15		29.84
16	1215	7	CLR:00	10.00		39	4.0	35	1.8	30	-1.0	70	9	360		28.01				FM-15		29.84
16	1235	7	SCT:04 90	10.00		43	6.0	38	3.1	30	-1.0	61	10	010	17	28.01				FM-15		29.84
16	1255	7	CLR:00	10.00		43	6.0	38	3.1	30	-1.0	61	8	010		28.01				FM-15		29.84
16	1315	7	CLR:00	10.00		43	6.0	38	3.1	30	-1.0	61	9	010		28.03				FM-15		29.86
16	1335	7	CLR:00	10.00		41	5.0	36	2.5	30	-1.0	66	7	010		28.04				FM-15		29.87
16	1355	7	CLR:00	10.00		41	5.0	36	2.5	30	-1.0	66	8	020		28.05				FM-15		29.88
16	1415	7	CLR:00	10.00		41	5.0	36	2.5	30	-1.0	66	11	030	16	28.04				FM-15		29.87
16	1435	7	CLR:00	10.00		39	4.0	35	1.8	30	-1.0	70	11	030	17	28.04				FM-15		29.87
16	1455	7	CLR:00	10.00		39	4.0	35	1.8	30	-1.0	70	13	040	17	28.05				FM-15		29.88
16	1515	7	SCT:04 100	10.00		39	4.0	35	1.8	30	-1.0	70	11	030	16	28.07				FM-15		29.90
16	1535	7	CLR:00	10.00		39	4.0	35	1.8	30	-1.0	70	9	040		28.08				FM-15		29.91
16	1555	7	CLR:00	10.00		37	3.0	34	1.2	30	-1.0	75	7	050		28.09				FM-15		29.92
16	1615	7	CLR:00	10.00		37	3.0	33	0.8	28	-2.0	70	7	040		28.10				FM-15		29.93
16	1635	7	CLR:00	10.00		37	3.0	33	0.8	28	-2.0	70	9	030		28.10				FM-15		29.93
16	1655	7	CLR:00	10.00		36	2.0	33	0.5	28	-2.0	75	8	040		28.10				FM-15		29.93
16	1715	7	SCT:04 100	10.00		36	2.0	33	0.5	28	-2.0	75	9	040		28.11				FM-15		29.94
16	1735	7	SCT:04 90	10.00		34	1.0	32	-0.2	28	-2.0	81	6	040		28.13				FM-15		29.96
16	1755	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	0	000		28.13				FM-15		29.96
16	1815	7	SCT:04 110	10.00		32	0.0	30	-1.1	27	-3.0	80	0	000		28.14				FM-15		29.97
16	1835	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	040		28.15				FM-15		29.98
16	1855	7	SCT:04 12	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	030		28.16				FM-15		29.99
16	1915	7	BKN:07 12	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	050		28.17				FM-15		30.00
16	1935	7	SCT:04 12 SCT:04 110	10.00		30	-1.0	29	-1.7	27	-3.0	86	3	060		28.17				FM-15		30.01
16	1955	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	060		28.17				FM-15		30.01
16	2015	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	0	000		28.18				FM-15		30.02
16	2035	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	0	000		28.20				FM-15		30.04
16	2055	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	3	080		28.20				FM-15		30.04
16	2115	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	0	000		28.20				FM-15		30.04
16	2135	7	CLR:00	7.00		28	-2.0	27	-2.8	25	-4.0	86	3	070		28.20				FM-15		30.04
16	2155	7	CLR:00	7.00		28	-2.0	27	-2.8	25	-4.0	86	5	060		28.20				FM-15		30.04
16	2215	7	CLR:00	7.00		27	-3.0	26	-3.2	25	-4.0	93	5	050		28.20				FM-15		30.04
16	2235	7	CLR:00	7.00		27	-3.0	26	-3.2	25	-4.0	93	3	050		28.20				FM-15		30.04
16	2255	7	CLR:00	5.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	3	040		28.20				FM-15		30.04
16	2315	7	CLR:00	5.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	6	040		28.21				FM-15		30.05
16	2335	7	CLR:00	5.00	BR ||	25	-4.0	25	-3.9	25	-4.0	100	3	030		28.21				FM-15		30.05
16	2355	7	CLR:00	5.00	BR ||	27	-3.0	26	-3.2	25	-4.0	93	6	030		28.20				FM-15		30.04
17	0015	7	CLR:00	5.00	BR ||	27	-3.0	26	-3.2	25	-4.0	93	5	020		28.20				FM-15		30.04
17	0035	7	CLR:00	5.00	BR ||	27	-3.0	26	-3.2	25	-4.0	93	0	000		28.20				FM-15		30.04
17	0055	7	CLR:00	5.00	BR ||	25	-4.0	25	-3.9	25	-4.0	100	0	000		28.20				FM-15		30.04
17	0115	7	CLR:00	4.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	0	000		28.21				FM-15		30.05
17	0135	7	SCT:04 100	4.00	BR ||	25	-4.0	25	-3.9	25	-4.0	100	0	000		28.21				FM-15		30.05
17	0155	7	SCT:04 100	4.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	3	020		28.20				FM-15		30.04

17	0215	7	CLR:00	4.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	6	030		28.20				FM-15		30.03
17	0235	7	CLR:00	4.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	0	000		28.20				FM-15		30.04
17	0255	7	CLR:00	4.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	6	040		28.18				FM-15		30.02
17	0315	7	CLR:00	4.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	5	040		28.18				FM-15		30.02
17	0335	7	CLR:00	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	5	040		28.18				FM-15		30.02
17	0355	7	CLR:00	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	3	050		28.20				FM-15		30.03
17	0415	7	CLR:00	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	3	060		28.20				FM-15		30.03
17	0435	7	CLR:00	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	0	000		28.20				FM-15		30.03
17	0455	7	CLR:00	5.00	BR ||	21	-6.0	21	-6.1	21	-6.0	100	3	040		28.18				FM-15		30.02
17	0515	7	CLR:00	4.00	BR ||	21	-6.0	21	-6.1	21	-6.0	100	3	060		28.18				FM-15		30.02
17	0535	7	CLR:00	5.00	BR ||	21	-6.0	21	-6.1	21	-6.0	100	3	060		28.18				FM-15		30.02
17	0555	7	CLR:00	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	3	050		28.20				FM-15		30.03
17	0615	7	SCT:04 5	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	3	090		28.20				FM-15		30.03
17	0635	7	SCT:04 5	5.00	BR ||	23	-5.0	22	-5.4	21	-6.0	93	0	000		28.20				FM-15		30.04
17	0655	7	BKN:07 5	5.00	BR ||	25	-4.0	24	-4.6	21	-6.0	86	3	130		28.21				FM-15		30.05
17	0715	7	OVC:08 5	4.00	BR ||	25	-4.0	24	-4.3	23	-5.0	93	0	000		28.21				FM-15		30.05
17	0735	7	OVC:08 3	2.50	BR ||	25	-4.0	24	-4.3	23	-5.0	93	3	070		28.20				FM-15		30.04
17	0755	7	OVC:08 3	1.50	BR ||	25	-4.0	24	-4.3	23	-5.0	93	6	050		28.20				FM-15		30.03
17	0815	7	OVC:08 1	0.75	BR ||	25	-4.0	24	-4.3	23	-5.0	93	6	050		28.18				FM-15		30.02
17	0835	7	OVC:08 1	1.00	BR ||	25	-4.0	25	-3.9	25	-4.0	100	0	000		28.20				FM-15		30.03
17	0855	7	OVC:08 1	1.50	BR ||	25	-4.0	25	-3.9	25	-4.0	100	0	000		28.20				FM-15		30.03
17	0915	7	BKN:07 3	2.00	BR ||	25	-4.0	25	-3.9	25	-4.0	100	3	040		28.20				FM-15		30.03
17	0935	7	SCT:04 3 SCT:04 100	2.50	BR ||	27	-3.0	26	-3.2	25	-4.0	93	0	000		28.18				FM-15		30.02
17	0955	7	SCT:04 100	3.00	BR ||	27	-3.0	26	-3.2	25	-4.0	93	0	000		28.20				FM-15		30.03
17	1015	7		3.00	BR ||	27	-3.0	26	-3.2	25	-4.0	93	0	000		28.20				FM-15		30.03
17	1035	7	CLR:00	4.00	BR ||	27	-3.0	27	-2.8	27	-3.0	100	3	010		28.20				FM-15		30.03
17	1055	7	CLR:00	4.00	BR ||	27	-3.0	27	-2.8	27	-3.0	100	3	360		28.20				FM-15		30.04
17	1115	7	CLR:00	5.00	BR ||	28	-2.0	28	-2.4	27	-3.0	93	0	000		28.20				FM-15		30.03
17	1135	7	CLR:00	4.00	BR ||	28	-2.0	28	-2.4	27	-3.0	93	0	000		28.18				FM-15		30.02
17	1155	7	CLR:00	5.00	BR ||	28	-2.0	28	-2.4	27	-3.0	93	3	340		28.17				FM-15		30.01
17	1215	7	BKN:07 95	10.00		30	-1.0	29	-1.7	27	-3.0	86	0	000		28.17				FM-15		30.00
17	1235	7	BKN:07 95	5.00	BR ||	30	-1.0	29	-1.5	28	-2.0	93	3	360		28.16				FM-15		29.99
17	1255	7	SCT:04 95	10.00		32	0.0	30	-0.9	28	-2.0	87	0	000		28.15				FM-15		29.98
17	1315	7	SCT:04 95	10.00		34	1.0	32	-0.2	28	-2.0	81	0	000		28.14				FM-15		29.97
17	1335	7	SCT:04 75 SCT:04 95	10.00		34	1.0	32	-0.2	28	-2.0	81	0	000		28.13				FM-15		29.96
17	1355	7	OVC:08 75	10.00		34	1.0	32	-0.2	28	-2.0	81	0	000		28.11				FM-15		29.94
17	1415	7	SCT:04 75 BKN:07 100	10.00		36	2.0	33	0.5	28	-2.0	75	5	360		28.10				FM-15		29.93
17	1435	7	SCT:04 75 SCT:04 100	10.00		36	2.0	33	0.5	28	-2.0	75	3	020		28.10				FM-15		29.93
17	1455	7	BKN:07 100	10.00		37	3.0	33	0.8	28	-2.0	70	3	330		28.09				FM-15		29.92
17	1515	7	BKN:07 100	10.00		36	2.0	33	0.5	28	-2.0	75	3	320		28.09				FM-15		29.92
17	1535	7	BKN:07 100	10.00		36	2.0	33	0.5	28	-2.0	75	5	340		28.09				FM-15		29.92
17	1555	7	BKN:07 100	10.00		36	2.0	33	0.5	28	-2.0	75	3	320		28.09				FM-15		29.92
17	1615	7	OVC:08 100	10.00		36	2.0	33	0.5	28	-2.0	75	0	000		28.09				FM-15		29.92
17	1635	7	OVC:08 100	10.00		36	2.0	33	0.5	28	-2.0	75	5	330		28.09				FM-15		29.92
17	1655	7	OVC:08 100	10.00		36	2.0	33	0.5	28	-2.0	75	3	320		28.09				FM-15		29.92
17	1715	7	OVC:08 100	10.00		34	1.0	31	-0.4	27	-3.0	75	3	300		28.09				FM-15		29.92
17	1735	7	OVC:08 100	10.00		34	1.0	31	-0.4	27	-3.0	75	0	000		28.09				FM-15		29.92
17	1755	7	OVC:08 100	10.00		32	0.0	30	-1.1	27	-3.0	80	0	000		28.09				FM-15		29.92
17	1815	7	SCT:04 20 OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	0	000		28.09				FM-15		29.92
17	1835	7	SCT:04 20 OVC:08 100	10.00		32	0.0	30	-1.1	27	-3.0	80	0	000		28.10				FM-15		29.93
17	1855	7	SCT:04 20 OVC:08 100	10.00		32	0.0	30	-1.1	27	-3.0	80	0	000		28.09				FM-15		29.92

17	1916	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	3	220		28.09				FM-15		29.92
17	1935	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	0	000		28.10				FM-15		29.93
17	1955	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	230		28.10				FM-15		29.93
17	2016	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	5	220		28.10				FM-15		29.93
17	2035	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	6	220		28.09				FM-15		29.92
17	2055	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	6	230		28.09				FM-15		29.92
17	2116	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	220		28.08				FM-15		29.91
17	2135	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	220		28.08				FM-15		29.91
17	2155	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	220		28.07				FM-15		29.90
17	2215	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	220		28.06				FM-15		29.89
17	2235	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	7	240		28.06				FM-15		29.89
17	2255	7	OVC:08 100	10.00		30	-1.0	29	-1.7	27	-3.0	86	7	240		28.06				FM-15		29.89
17	2315	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	6	240		28.06				FM-15		29.89
17	2335	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	7	240		28.06				FM-15		29.89
17	2355	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	230		28.05				FM-15		29.88
18	0015	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	8	240		28.04				FM-15		29.87
18	0035	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	7	230		28.03				FM-15		29.86
18	0055	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	7	230		28.02				FM-15		29.85
18	0115	7	OVC:08 90	10.00		30	-1.0	29	-1.7	27	-3.0	86	6	210		28.01				FM-15		29.84
18	0135	7	SCT:04 90	10.00		28	-2.0	27	-2.8	25	-4.0	86	7	230		28.01				FM-15		29.84
18	0155	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	7	230		28.01				FM-15		29.84
18	0215	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	230		28.01				FM-15		29.84
18	0235	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	220		28.01				FM-15		29.84
18	0255	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	9	220		28.00				FM-15		29.83
18	0315	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	220		27.99				FM-15		29.82
18	0335	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	220		27.99				FM-15		29.81
18	0355	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	9	220		27.99				FM-15		29.81
18	0415	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	8	220		27.98				FM-15		29.80
18	0435	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	8	220		27.96				FM-15		29.79
18	0455	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	10	220		27.96				FM-15		29.78
18	0515	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	230		27.96				FM-15		29.78
18	0535	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	11	220		27.96				FM-15		29.78
18	0555	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	9	240		27.96				FM-15		29.78
18	0615	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	10	240		27.95				FM-15		29.77
18	0635	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	9	230		27.95				FM-15		29.77
18	0655	7	CLR:00	10.00		25	-4.0	24	-4.3	23	-5.0	93	7	230		27.95				FM-15		29.77
18	0715	7	CLR:00	10.00		25	-4.0	24	-4.3	23	-5.0	93	7	240		27.96				FM-15		29.78
18	0735	7	CLR:00	10.00		25	-4.0	24	-4.6	21	-6.0	86	6	240		27.96				FM-15		29.78
18	0755	7	CLR:00	10.00		25	-4.0	24	-4.6	21	-6.0	86	6	220		27.96				FM-15		29.78
18	0815	7	CLR:00	10.00		23	-5.0	22	-5.4	21	-6.0	93	5	230		27.96				FM-15		29.78
18	0835	7	CLR:00	10.00		25	-4.0	24	-4.6	21	-6.0	86	6	230		27.96				FM-15		29.78
18	0855	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	7	230		27.96				FM-15		29.78
18	0915	7	CLR:00	10.00	-SN |SN |	27	-3.0	26	-3.2	25	-4.0	93	6	230		27.96				FM-15		29.78
18	0935	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	7	230		27.94				FM-15		29.76
18	0955	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	240		27.94				FM-15		29.76
18	1015	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	10	240		27.94				FM-15		29.76
18	1035	7	CLR:00	10.00		32	0.0	30	-0.9	28	-2.0	87	10	260		27.94				FM-15		29.76
18	1055	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	11	250		27.93				FM-15		29.75
18	1115	7	CLR:00	10.00		36	2.0	33	0.5	28	-2.0	75	13	250		27.93				FM-15		29.75
18	1135	7	CLR:00	10.00		37	3.0	33	0.6	27	-3.0	65	16	250		27.92				FM-15		29.74
18	1155	7	CLR:00	10.00		39	4.0	34	1.2	27	-3.0	61	16	260		27.91				FM-15		29.73
18	1215	7	CLR:00	10.00		41	5.0	35	1.8	27	-3.0	57	13	260		27.91				FM-15		29.73
18	1235	7	CLR:00	10.00		43	6.0	36	2.5	27	-3.0	53	15	260		27.90				FM-15		29.72
18	1255	7	CLR:00	10.00		43	6.0	36	2.5	27	-3.0	53	15	260		27.89				FM-15		29.71
18	1315	7	CLR:00	10.00		45	7.0	38	3.1	27	-3.0	49	16	260	22	27.89				FM-15		29.71
18	1335	7	CLR:00	10.00		43	6.0	36	2.5	27	-3.0	53	14	240		27.89				FM-15		29.71
18	1355	7	CLR:00	10.00		43	6.0	36	2.5	27	-3.0	53	11	250		27.88				FM-15		29.70

18	1415	7	CLR:00	10.00		45	7.0	38	3.1	27	-3.0	49	15	240		27.85				FM-15		29.67
18	1435	7	CLR:00	10.00		45	7.0	38	3.1	27	-3.0	49	11	250	18	27.86				FM-15		29.68
18	1455	7	SCT:04 90	10.00		46	8.0	38	3.4	27	-3.0	46	13	250		27.86				FM-15		29.68
18	1515	7	SCT:04 90	10.00		46	8.0	38	3.4	27	-3.0	46	10	250		27.86				FM-15		29.68
18	1535	7	CLR:00	10.00		45	7.0	37	2.7	25	-4.0	46	10	250		27.86				FM-15		29.68
18	1555	7	CLR:00	10.00		43	6.0	36	2.1	25	-4.0	49	8	260		27.87				FM-15		29.69
18	1615	7	CLR:00	10.00		43	6.0	36	2.1	25	-4.0	49	9	250		27.87				FM-15		29.69
18	1635	7	CLR:00	10.00		41	5.0	35	1.5	25	-4.0	53	11	250		27.87				FM-15		29.69
18	1655	7	CLR:00	10.00		39	4.0	34	0.8	25	-4.0	56	9	250		27.88				FM-15		29.70
18	1715	7	CLR:00	10.00		37	3.0	32	0.2	25	-4.0	60	9	250		27.88				FM-15		29.70
18	1735	7	BKN:07 80	10.00		39	4.0	34	1.2	27	-3.0	61	10	250		27.89				FM-15		29.71
18	1755	7	BKN:07 80	10.00		37	3.0	32	0.2	25	-4.0	60	8	240		27.89				FM-15		29.71
18	1815	7	CLR:00	10.00		37	3.0	32	0.2	25	-4.0	60	8	240		27.89				FM-15		29.71
18	1835	7	CLR:00	10.00		37	3.0	32	0.2	25	-4.0	60	8	240		27.89				FM-15		29.71
18	1855	7	CLR:00	10.00		37	3.0	32	0.2	25	-4.0	60	8	240		27.89				FM-15		29.71
18	1915	7	CLR:00	10.00		37	3.0	33	0.6	27	-3.0	65	7	230		27.89				FM-15		29.71
18	1935	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	7	230		27.90				FM-15		29.72
18	1955	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	8	230		27.90				FM-15		29.72
18	2015	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	6	240		27.91				FM-15		29.73
18	2035	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	5	240		27.92				FM-15		29.74
18	2055	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	7	230		27.91				FM-15		29.73
18	2115	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	7	240		27.92				FM-15		29.74
18	2135	7	CLR:00	10.00		34	1.0	31	-0.8	25	-4.0	70	5	240		27.92				FM-15		29.74
18	2155	7	CLR:00	10.00		36	2.0	32	-0.1	25	-4.0	65	5	240		27.92				FM-15		29.74
18	2215	7	CLR:00	10.00		32	0.0	29	-1.5	25	-4.0	75	8	230		27.91				FM-15		29.73
18	2235	7	CLR:00	10.00		32	0.0	29	-1.5	25	-4.0	75	6	230		27.91				FM-15		29.73
18	2255	7	CLR:00	10.00		32	0.0	29	-1.5	25	-4.0	75	6	220		27.91				FM-15		29.73
18	2315	7	CLR:00	10.00		34	1.0	31	-0.8	25	-4.0	70	5	240		27.92				FM-15		29.74
18	2335	7	CLR:00	10.00		34	1.0	31	-0.8	25	-4.0	70	6	230		27.93				FM-15		29.75
18	2355	7	CLR:00	10.00		34	1.0	31	-0.8	25	-4.0	70	3	270		27.94				FM-15		29.76
19	0015	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	3	300		27.94				FM-15		29.76
19	0035	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	5	280		27.96				FM-15		29.78
19	0055	7	CLR:00	10.00		32	0.0	29	-1.5	25	-4.0	75	7	290		27.98				FM-15		29.80
19	0115	7	CLR:00	10.00		34	1.0	31	-0.4	27	-3.0	75	8	300		27.99				FM-15		29.82
19	0135	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	10	320		28.00				FM-15		29.83
19	0155	7	CLR:00	10.00		36	2.0	32	0.3	27	-3.0	70	8	300		28.01				FM-15		29.84
19	0215	7	BKN:07 80	10.00		36	2.0	32	0.3	27	-3.0	70	8	330		28.01				FM-15		29.84
19	0235	7	SCT:04 80	10.00		36	2.0	32	0.3	27	-3.0	70	8	330		28.01				FM-15		29.84
19	0255	7	CLR:00	10.00		36	2.0	33	0.5	28	-2.0	75	10	330		28.03				FM-15		29.86
19	0315	7	BKN:07 80	10.00		36	2.0	33	0.5	28	-2.0	75	10	330		28.05				FM-15		29.88
19	0335	7	BKN:07 80	10.00		36	2.0	33	0.5	28	-2.0	75	13	330	18	28.07				FM-15		29.90
19	0355	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	10	330		28.07				FM-15		29.90
19	0415	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	10	330		28.09				FM-15		29.92
19	0435	7	CLR:00	10.00		34	1.0	32	-0.2	28	-2.0	81	10	330		28.10				FM-15		29.93
19	0455	7	CLR:00	10.00		32	0.0	30	-0.9	28	-2.0	87	10	320		28.12				FM-15		29.95
19	0515	7	CLR:00	10.00		32	0.0	30	-0.9	28	-2.0	87	10	320		28.12				FM-15		29.95
19	0535	7	CLR:00	10.00		30	-1.0	29	-1.5	28	-2.0	93	8	310		28.14				FM-15		29.97
19	0555	7	CLR:00	10.00		30	-1.0	29	-1.7	27	-3.0	86	9	300		28.15				FM-15		29.98
19	0615	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	8	290		28.16				FM-15		29.99
19	0635	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	8	290		28.17				FM-15		30.01
19	0655	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	320		28.17				FM-15		30.01
19	0715	7	CLR:00	10.00		28	-2.0	28	-2.4	27	-3.0	93	9	300		28.18				FM-15		30.02
19	0735	7	CLR:00	10.00		27	-3.0	26	-3.6	23	-5.0	86	9	280		28.20				FM-15		30.04
19	0755	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	9	280		28.21				FM-15		30.05
19	0815	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	11	290		28.23				FM-15		30.07
19	0835	7	CLR:00	10.00		27	-3.0	26	-3.2	25	-4.0	93	13	300		28.23				FM-15		30.07
19	0855	7	SCT:04 100	10.00		28	-2.0	27	-2.8	25	-4.0	86	13	310		28.23				FM-15		30.07

19	0915	7	SCT:04 100	10.00		28	-2.0	27	-2.8	25	-4.0	86	13	310		28.23				FM-15		30.07
19	0935	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	13	310		28.24				FM-15		30.08
19	0955	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	13	310	18	28.24				FM-15		30.08
19	1015	7	CLR:00	10.00		30	-1.0	28	-2.1	25	-4.0	80	15	330		28.25				FM-15		30.09
19	1035	7	CLR:00	10.00		32	0.0	29	-1.8	23	-5.0	69	22	350	31	28.25				FM-15		30.09
19	1055	7	CLR:00	10.00		34	1.0	29	-1.5	21	-6.0	60	22	340	29	28.25				FM-15		30.09
19	1115	7	CLR:00	10.00		34	1.0	29	-1.8	19	-7.0	56	17	340	30	28.25				FM-15		30.09
19	1135	7	CLR:00	10.00		34	1.0	29	-1.8	19	-7.0	56	18	330	29	28.26				FM-15		30.10
19	1155	7	CLR:00	10.00		34	1.0	29	-1.8	19	-7.0	56	18	330	28	28.26				FM-15		30.10
19	1215	7	CLR:00	10.00		36	2.0	30	-1.1	19	-7.0	52	18	330	25	28.26				FM-15		30.10
19	1235	7	CLR:00	10.00		36	2.0	29	-1.6	16	-9.0	44	20	330	28	28.25				FM-15		30.09
19	1255	7	CLR:00	10.00		36	2.0	29	-1.9	14	-10.0	41	15	340	25	28.24				FM-15		30.08
19	1315	7	CLR:00	10.00		36	2.0	28	-2.2	12	-11.0	38	21	340	25	28.24				FM-15		30.08
19	1335	7	CLR:00	10.00		36	2.0	27	-2.5	9	-13.0	32	18	340	25	28.25				FM-15		30.09
19	1355	7	CLR:00	10.00		37	3.0	28	-2.2	9	-13.0	30	17	350	25	28.24				FM-15		30.08
19	1415	7	CLR:00	10.00		36	2.0	27	-2.7	7	-14.0	30	20	350	25	28.24				FM-15		30.08
19	1435	7	CLR:00	10.00		36	2.0	27	-2.7	7	-14.0	30	17	350	26	28.24				FM-15		30.08
19	1455	7	CLR:00	10.00		36	2.0	27	-2.5	9	-13.0	32	16	350	24	28.24				FM-15		30.08
19	1515	7	CLR:00	10.00		36	2.0	27	-2.5	9	-13.0	32	14	350	21	28.25				FM-15		30.09
19	1535	7	CLR:00	10.00		36	2.0	27	-2.7	7	-14.0	30	16	350	25	28.25				FM-15		30.09
19	1555	7	CLR:00	10.00		36	2.0	27	-2.5	9	-13.0	32	11	350	18	28.25				FM-15		30.09
19	1615	7	CLR:00	10.00		34	1.0	26	-3.2	9	-13.0	35	7	010		28.24				FM-15		30.08
19	1635	7	CLR:00	10.00		34	1.0	26	-3.1	10	-12.0	38	3	010		28.26				FM-15		30.10
19	1655	7	CLR:00	10.00		32	0.0	25	-3.9	9	-13.0	37	5	020		28.26				FM-15		30.10
19	1715	7	CLR:00	10.00		30	-1.0	24	-4.5	10	-12.0	43	5	350		28.26				FM-15		30.10
19	1735	7	CLR:00	10.00		28	-2.0	23	-5.2	10	-12.0	47	3	340		28.27				FM-15		30.11
19	1755	7	CLR:00	10.00		28	-2.0	23	-5.2	10	-12.0	47	3	300		28.27				FM-15		30.11
19	1815	7	CLR:00	10.00		28	-2.0	23	-5.2	10	-12.0	47	0	000		28.27				FM-15		30.11
19	1835	7	CLR:00	10.00		28	-2.0	23	-5.2	10	-12.0	47	5	340		28.28				FM-15		30.12
19	1855	7	CLR:00	10.00		27	-3.0	22	-5.6	10	-12.0	50	0	000		28.28				FM-15		30.12
19	1915	7	CLR:00	10.00		27	-3.0	22	-5.6	10	-12.0	50	0	000		28.29				FM-15		30.13
19	1935	7	CLR:00	10.00		28	-2.0	23	-5.0	12	-11.0	51	0	000		28.29				FM-15		30.13
19	1955	7	CLR:00	10.00		28	-2.0	23	-4.9	12	-11.0	51	3	340		28.30				FM-15		30.14
19	2015	7	SCT:04 110	10.00		21	-6.0	18	-7.8	10	-12.0	63	0	000		28.31				FM-15		30.15
19	2035	7	CLR:00	10.00		25	-4.0	21	-6.3	10	-12.0	54	0	000		28.30				FM-15		30.14
19	2055	7	CLR:00	10.00		23	-5.0	19	-7.1	10	-12.0	58	0	000		28.32				FM-15		30.16
19	2115	7	SCT:04 110	10.00		21	-6.0	18	-7.8	10	-12.0	63	0	000		28.32				FM-15		30.16
19	2136	7	OVC:08 110	10.00		23	-5.0	19	-7.1	10	-12.0	58	0	000		28.31				FM-15		30.15
19	2155	7	BKN:07 110	10.00		25	-4.0	21	-6.0	12	-11.0	59	0	000		28.30				FM-15		30.14
19	2215	7	OVC:08 110	10.00		21	-6.0	18	-7.5	12	-11.0	68	3	300		28.31				FM-15		30.15
19	2235	7	BKN:07 110	10.00		21	-6.0	18	-7.5	12	-11.0	68	0	000		28.31				FM-15		30.15
19	2255	7	SCT:04 110	10.00		23	-5.0	20	-6.8	12	-11.0	63	0	000		28.31				FM-15		30.15
19	2315	7	SCT:04 70	10.00		25	-4.0	21	-6.0	12	-11.0	59	0	000		28.30				FM-15		30.14
19	2335	7	SCT:04 70	10.00		27	-3.0	22	-5.3	12	-11.0	54	0	000		28.30				FM-15		30.14
19	2355	7	CLR:00	10.00		27	-3.0	22	-5.3	12	-11.0	54	0	000		28.30				FM-15		30.14
20	0015	7	CLR:00	10.00		25	-4.0	22	-5.8	14	-10.0	63	0	000		28.30				FM-15		30.14
20	0036	7	BKN:07 70	10.00		25	-4.0	22	-5.5	16	-9.0	69	0	000		28.30				FM-15		30.14
20	0055	7	OVC:08 70	10.00		25	-4.0	22	-5.5	16	-9.0	69	0	000		28.30				FM-15		30.14
20	0115	7	OVC:08 60	10.00		25	-4.0	22	-5.5	16	-9.0	69	0	000		28.29				FM-15		30.13
20	0136	7	OVC:08 60	10.00		27	-3.0	23	-4.7	16	-9.0	64	3	060		28.29				FM-15		30.13
20	0155	7	OVC:08 60	10.00		27	-3.0	23	-4.7	16	-9.0	64	0	000		28.29				FM-15		30.13
20	0215	7	OVC:08 60	10.00		27	-3.0	23	-4.7	16	-9.0	64	0	000		28.28				FM-15		30.12
20	0236	7	OVC:08 60	10.00		27	-3.0	23	-4.7	16	-9.0	64	0	000		28.27				FM-15		30.11
20	0255	7	OVC:08 60	10.00		27	-3.0	24	-4.4	18	-8.0	69	0	000		28.27				FM-15		30.11
20	0315	7	OVC:08 60	10.00		28	-2.0	25	-4.1	18	-8.0	64	0	000		28.26				FM-15		30.10
20	0335	7	OVC:08 60	10.00		28	-2.0	24	-4.4	16	-9.0	59	5	120		28.24				FM-15		30.08
20	0355	7	OVC:08 60	10.00		28	-2.0	25	-4.1	18	-8.0	64	5	110		28.24				FM-15		30.08

20	0415	7	SCT:04 60	10.00		27	-3.0	24	-4.4	18	-8.0	69	3	130		28.25				FM-15		30.09
20	0436	7	SCT:04 70	10.00		27	-3.0	24	-4.4	18	-8.0	69	3	090		28.25				FM-15		30.09
20	0455	7	BKN:07 70	10.00		28	-2.0	25	-4.1	18	-8.0	64	6	120		28.24				FM-15		30.08
20	0515	7	OVC:08 70	10.00		28	-2.0	25	-4.1	18	-8.0	64	6	120		28.23				FM-15		30.07
20	0535	7	OVC:08 70	10.00		28	-2.0	25	-4.1	18	-8.0	64	7	120		28.22				FM-15		30.06
20	0555	7	OVC:08 70	10.00		28	-2.0	25	-4.1	18	-8.0	64	5	120		28.23				FM-15		30.07
20	0615	7	OVC:08 70	10.00		27	-3.0	24	-4.4	18	-8.0	69	7	110		28.24				FM-15		30.08
20	0635	7	OVC:08 70	10.00		27	-3.0	24	-4.4	18	-8.0	69	9	110		28.24				FM-15		30.08
20	0655	7	OVC:08 70	10.00		27	-3.0	24	-4.4	18	-8.0	69	9	110		28.23				FM-15		30.07
20	0715	7	BKN:07 70 OVC:08 90	10.00		27	-3.0	24	-4.4	18	-8.0	69	11	120		28.22				FM-15		30.06
20	0735	7	SCT:04 70 OVC:08 90	10.00		27	-3.0	24	-4.4	18	-8.0	69	9	120		28.23				FM-15		30.07
20	0755	7	SCT:04 70 BKN:07 90	10.00		27	-3.0	24	-4.4	18	-8.0	69	10	120		28.22				FM-15		30.06
20	0815	7	SCT:04 70	10.00		27	-3.0	24	-4.4	18	-8.0	69	10	130		28.22				FM-15		30.06
20	0835	7	CLR:00	10.00		27	-3.0	23	-4.7	16	-9.0	64	10	130		28.21				FM-15		30.05
20	0855	7	CLR:00	10.00		27	-3.0	23	-4.7	16	-9.0	64	9	130		28.21				FM-15		30.05
20	0915	7	BKN:07 55	10.00		27	-3.0	23	-4.7	16	-9.0	64	13	120	18	28.20				FM-15		30.04
20	0935	7	OVC:08 55	10.00		27	-3.0	23	-4.7	16	-9.0	64	15	120	20	28.20				FM-15		30.03
20	0955	7	OVC:08 55	10.00		28	-2.0	24	-4.4	16	-9.0	59	14	130		28.18				FM-15		30.02
20	1015	7	BKN:07 55	10.00		28	-2.0	24	-4.4	16	-9.0	59	15	140	21	28.18				FM-15		30.02
20	1035	7	BKN:07 55	10.00		28	-2.0	24	-4.4	16	-9.0	59	13	140	18	28.18				FM-15		30.02
20	1055	7	OVC:08 55	10.00		30	-1.0	25	-3.7	16	-9.0	55	15	140	21	28.18				FM-15		30.02
20	1115	7	OVC:08 55	10.00		28	-2.0	24	-4.7	14	-10.0	55	15	140	20	28.18				FM-15		30.02
20	1135	7	OVC:08 55	10.00		30	-1.0	25	-3.7	16	-9.0	55	14	140	18	28.17				FM-15		30.01
20	1155	7	OVC:08 55	10.00		30	-1.0	25	-3.7	16	-9.0	55	11	130		28.17				FM-15		30.00
20	1215	7	OVC:08 55	10.00		30	-1.0	25	-3.7	16	-9.0	55	14	130	18	28.14				FM-15		29.97
20	1235	7	BKN:07 55	10.00		30	-1.0	25	-3.7	16	-9.0	55	15	140		28.11				FM-15		29.94
20	1255	7	CLR:00	10.00		30	-1.0	25	-3.7	16	-9.0	55	14	140	20	28.10				FM-15		29.93
20	1315	7	CLR:00	10.00		30	-1.0	25	-3.7	16	-9.0	55	15	140	22	28.09				FM-15		29.92
20	1335	7	CLR:00	10.00		30	-1.0	25	-3.7	16	-9.0	55	11	130		28.08				FM-15		29.91
20	1355	7	CLR:00	10.00		30	-1.0	25	-3.7	16	-9.0	55	16	140	23	28.06				FM-15		29.89
20	1415	7	CLR:00	10.00		30	-1.0	25	-3.7	16	-9.0	55	17	140	21	28.05				FM-15		29.88
20	1435	7	CLR:00	10.00		30	-1.0	25	-3.7	16	-9.0	55	18	140	23	28.04				FM-15		29.87
20	1455	7	CLR:00	10.00		30	-1.0	25	-4.0	14	-10.0	51	15	140		28.03				FM-15		29.86
20	1515	7	CLR:00	10.00		32	0.0	26	-3.3	14	-10.0	47	16	140	24	28.03				FM-15		29.86
20	1535	7	SCT:04 38	10.00		30	-1.0	25	-4.0	14	-10.0	51	16	140	21	28.03				FM-15		29.86
20	1555	7	OVC:08 38	10.00		30	-1.0	25	-4.0	14	-10.0	51	16	130		28.04				FM-15		29.87
20	1615	7	OVC:08 38	10.00		30	-1.0	25	-3.7	16	-9.0	55	13	130	20	28.02				FM-15		29.85
20	1635	7	OVC:08 36	10.00		30	-1.0	25	-3.7	16	-9.0	55	13	130		28.02				FM-15		29.85
20	1655	7	OVC:08 36	10.00		30	-1.0	25	-3.7	16	-9.0	55	13	130	16	28.00				FM-15		29.83
20	1715	7	OVC:08 36	10.00		30	-1.0	25	-3.7	16	-9.0	55	17	140	23	28.00				FM-15		29.83
20	1735	7	OVC:08 36	10.00		30	-1.0	25	-4.0	14	-10.0	51	10	130	21	28.01				FM-15		29.84
20	1755	7	OVC:08 34	10.00		30	-1.0	24	-4.3	12	-11.0	47	14	130	18	28.00				FM-15		29.83
20	1815	7	OVC:08 34	10.00		28	-2.0	24	-4.7	14	-10.0	55	16	120	20	28.01				FM-15		29.84
20	1835	7	OVC:08 34	10.00		28	-2.0	24	-4.7	14	-10.0	55	14	120	22	28.01				FM-15		29.84
20	1855	7	OVC:08 36	10.00		28	-2.0	24	-4.7	14	-10.0	55	15	120	21	28.01				FM-15		29.84
20	1915	7	OVC:08 36	10.00		27	-3.0	23	-5.0	14	-10.0	59	15	120		28.02				FM-15		29.85
20	1935	7	OVC:08 36	10.00		27	-3.0	23	-5.0	14	-10.0	59	17	110		28.02				FM-15		29.85
20	1955	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	15	110		28.02				FM-15		29.85
20	2015	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	17	120	24	28.02				FM-15		29.85
20	2035	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	16	120	24	28.03				FM-15		29.86
20	2055	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	16	110		28.03				FM-15		29.86
20	2115	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	16	110	20	28.04				FM-15		29.87
20	2135	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	15	110		28.04				FM-15		29.87
20	2155	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	14	110	18	28.03				FM-15		29.86

20	2215	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	11	110		28.06				FM-15		29.89
20	2235	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	15	110	18	28.06				FM-15		29.89
20	2255	7	OVC:08 34	10.00		25	-4.0	22	-5.8	14	-10.0	63	13	100		28.06				FM-15		29.89
20	2315	7	OVC:08 32	10.00		25	-4.0	22	-5.8	14	-10.0	63	11	110	20	28.06				FM-15		29.89
20	2335	7	OVC:08 32	10.00		25	-4.0	22	-5.8	14	-10.0	63	13	120	18	28.06				FM-15		29.89
20	2355	7	OVC:08 32	10.00		25	-4.0	22	-5.5	16	-9.0	69	13	110		28.06				FM-15		29.89

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Local Climatological Data
Hourly Precipitation
December 2017

Generated on 02/07/2018

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Current Location: Elev: 1736 ft. Lat: 43.9831° N Lon: -96.3003° W

Station: **PIPESTONE MUNICIPAL AIRPORT, MN US 04965**

Date	For Hour (LST) Ending at																						Date
	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	NOON	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	MID	
01																									01
02																									02
03																									03
04																									04
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28																									28
29																									29
30																									30
31																									31

Maximum Short Duration Precipitation

Time Period (Minutes)	5	10	15	20	30	45	60	80	100	120	150	180
Precipitation (inches)												
Ending Date Time (yyyy-mm-dd hh:mi)												

Hourly, daily, and monthly totals on the Daily Summary page and the Hourly Precipitation Table are shown as reported by the instrumentation at the site. However, NWS does not edit hourly values for its ASOS sites, but may edit the daily and monthly totals for selected sites which will be reflected on the Daily Summary page.

T = Trace
s = Suspect
* = Erroneous
blank = No precipitation observed
M = Missing

Appendix C
Short-term Sound Level Measurement Data

Table C-1: Short-term Sound Level Measurement Results

ST1	Sound Pressure Level							
	Leq	L10	L50	L90	Leq	L10	L50	L90
	dBA	dBA	dBA	dBA	dBC	dBC	dBC	dBC
Daytime	63	66	53	41	72	71	58	51
Nighttime	56	47	30	26	66	61	52	46
ST2	**Sound Pressure Level**							
	Leq	L10	L50	L90	Leq	L10	L50	L90
	dBA	dBA	dBA	dBA	dBC	dBC	dBC	dBC
Daytime	37	39	36	33	54	57	52	49
Nighttime	29	31	24	22	50	52	49	46
ST3	**Sound Pressure Level**							
	Leq	L10	L50	L90	Leq	L10	L50	L90
	dBA	dBA	dBA	dBA	dBC	dBC	dBC	dBC
Daytime	47	35	28	26	52	47	43	41
Nighttime	28	31	26	21	55	58	53	47
ST4	**Sound Pressure Level**							
	Leq	L10	L50	L90	Leq	L10	L50	L90
	dBA	dBA	dBA	dBA	dBC	dBC	dBC	dBC
Daytime	58	45	40	36	61	56	53	50
Nighttime	26	25	22	21	41	43	40	39

Notes:

1. Measured on December 14, 2017

2. Ground-level winds were 3 mph (1.3 m/s) due SW and hub-height winds were approximately 5.1 to 5.5 mph (2.3 to 2.5 m/s) during daytime measurements

3. Ground-level winds were 4 to 7 mph (1.8 to 3.1 m/s) due NNE and hub-height winds were approximately 6.0 to 13.4 mph (2.7 to 6.0 m/s) during nighttime measurements

Appendix D
LBWII Wind Turbine Coordinates

Table D-1: LBWII Wind Turbine Coordinates

Wind Turbine ID	Coordinates NAD83 UTM Zone 14N (meters)	
	X (Easting)	Y (Northing)
1	722492	4895751
2	722860	4895750
3	723247	4895742
4	723910	4895677
5	724370	4895699
6	724735	4895688
7	725354	4895011
8	725786	4894865
9	726149	4895406
10	727318	4896253
11	722491	4893658
12	723313	4893660
13	723874	4893662
14	724186	4894191
15	724488	4894695
16	724729	4893704
17	725481	4893479
18	726206	4893360
19	726552	4893449
20	727000	4893737
21	727373	4893761
22	727744	4893875
23	728130	4893842
24	725823	4892403
25	726982	4892207
26	727354	4892375
27	727763	4892471
28	726366	4890107
29	726461	4891021
30	724779	4892305
31	727444	4891400
32	727859	4891419
33	728546	4890809
34	728911	4890918
35	729449	4891510
36	729816	4891521
37	730568	4890005
38	730518	4888838
39	730865	4889052
40	731207	4888954
41	732117	4887288
42	732560	4885583
43	733019	4885981
44	733598	4886013
Alt1	722875	4893664
Alt2	726165	4892295
Alt3	726609	4891849
Alt4	726936	4895849

Appendix E
Sound Level Modeling Results - Tabular

Table E-1: Project + Existing Non-NEER Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
628	736638.46	4881827.70	Non-Participating	Class 1	27
629	736433.70	4881884.78	Non-Participating	Class 1	27
630	736596.26	4881828.63	Non-Participating	Class 1	27
631	733187.29	4880241.55	Non-Participating	Class 1	26
633	733624.45	4881075.48	Non-Participating	Class 1	27
634	733323.84	4881088.30	Non-Participating	Class 1	28
635	733270.97	4881967.88	Non-Participating	Class 1	29
637	736767.24	4883146.28	Non-Participating	Class 1	29
638	735557.73	4883556.86	Non-Participating	Class 1	33
641	734728.70	4883352.72	Non-Participating	Class 1	34
642	734499.54	4883423.35	Participating	Class 1	34
643	733479.64	4883417.53	Non-Participating	Class 1	36
644	732041.51	4881301.34	Non-Participating	Class 1	28
645	731919.09	4881473.27	Non-Participating	Class 1	27
646	731962.21	4883687.61	Non-Participating	Class 1	39
647	731788.80	4884080.32	Non-Participating	Class 1	42
648	731821.02	4884538.58	Non-Participating	Class 1	47
650	730296.88	4881626.46	Non-Participating	Class 1	27
651	730050.12	4880242.91	Non-Participating	Class 1	25
653	731517.34	4880133.32	Non-Participating	Class 1	26
654	728814.36	4880750.94	Non-Participating	Class 1	25
655	728671.93	4881399.84	Non-Participating	Class 1	26
656	728760.45	4881847.96	Non-Participating	Class 1	26
657	727355.77	4882323.98	Non-Participating	Class 1	26
659	728617.78	4883175.54	Non-Participating	Class 1	28
660	729189.09	4883054.84	Non-Participating	Class 1	28
661	730403.34	4882654.74	Non-Participating	Class 1	30
662	730266.57	4882804.25	Non-Participating	Class 1	30
665	730865.86	4883323.84	Non-Participating	Class 1	32
669	727326.75	4883951.03	Non-Participating	Class 1	28
671	728601.36	4884372.60	Non-Participating	Class 1	30
672	730187.97	4884033.26	Non-Participating	Class 1	32
673	730187.97	4884445.69	Non-Participating	Class 1	33
674	732314.49	4884885.77	Non-Participating	Class 1	47
675	731802.79	4885160.01	Non-Participating	Class 1	42
676	733393.32	4885425.05	Participating	Class 1	45
677	733468.29	4885531.75	Participation Pending	Class 1	46
678	733670.66	4885242.61	Non-Participating	Class 1	43
679	731910.23	4886609.40	Non-Participating	Class 1	42
680	735010.14	4885524.33	Non-Participating	Class 1	46
681	735961.60	4885097.78	Non-Participating	Class 1	36
682	736498.12	4884506.69	Non-Participating	Class 1	30
683	736780.59	4884121.39	Non-Participating	Class 1	30
685	736668.83	4885542.48	Non-Participating	Class 1	32
686	727053.96	4884800.97	Non-Participating	Class 1	29
687	728357.71	4885173.48	Non-Participating	Class 1	31
688	728694.92	4884999.83	Non-Participating	Class 1	31

Table E-1: Project + Existing Non-NEER Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
689	730371.92	4884938.93	Non-Participating	Class 1	34
692	730775.89	4884854.44	Non-Participating	Class 1	35
693	731700.75	4886401.74	Non-Participating	Class 1	41
694	730127.30	4886537.56	Non-Participating	Class 1	36
696	728938.32	4886501.92	Non-Participating	Class 1	34
697	728684.36	4886312.33	Non-Participating	Class 1	33
698	727887.73	4886361.41	Non-Participating	Class 1	32
699	727970.74	4886471.11	Non-Participating	Class 1	33
701	728473.93	4887419.20	Non-Participating	Class 1	36
702	731795.49	4887678.09	Participating	Class 1	45
704	734407.47	4888284.83	Non-Participating	Class 1	44
705	735769.99	4888210.16	Non-Participating	Class 1	35
706	733438.33	4888819.64	Non-Participating	Class 1	49
707	733263.09	4888589.76	Non-Participating	Class 1	49
708	734626.10	4889563.10	Non-Participating	Class 1	40
709	733230.18	4889340.38	Non-Participating	Class 1	43
711	733370.74	4890929.83	Non-Participating	Class 1	39
712	732646.32	4891326.17	Non-Participating	Class 1	46
713	729297.15	4887795.84	Non-Participating	Class 1	43
714	734492.64	4891386.58	Non-Participating	Class 1	35
715	733243.76	4892597.80	Non-Participating	Class 1	35
716	733109.39	4892398.67	Non-Participating	Class 1	36
717	731201.31	4891242.10	Non-Participating	Class 1	49
718	730749.54	4891299.90	Participating	Class 1	45
719	730751.43	4891412.92	Non-Participating	Class 1	44
724	729948.61	4889142.31	Non-Participating	Class 1	47
725	730464.35	4889505.78	Participation Pending	Class 1	48
727	730014.26	4890117.37	Non-Participating	Class 1	45
728	730040.78	4892226.62	Participation Pending	Class 1	43
729	729908.45	4892548.55	Non-Participating	Class 1	42
730	731654.41	4891914.55	Non-Participating	Class 1	42
731	731685.01	4892135.23	Non-Participating	Class 1	40
732	731470.35	4891866.41	Non-Participating	Class 1	42
733	731480.38	4891969.22	Non-Participating	Class 1	41
735	727081.69	4891135.05	Participating	Class 1	48
736	726743.00	4890587.95	Participation Pending	Class 1	46
737	728190.56	4891899.01	Participation Pending	Class 1	47
738	725835.57	4887861.84	Non-Participating	Class 1	33
739	725266.82	4888158.71	Non-Participating	Class 1	33
740	725278.78	4887707.37	Non-Participating	Class 1	32
741	723898.24	4887405.24	Non-Participating	Class 1	30
742	723511.96	4887931.38	Non-Participating	Class 1	31
743	722983.80	4887809.65	Non-Participating	Class 1	30
751	720815.07	4889613.59	Non-Participating	Class 1	30
752	721466.96	4889652.96	Non-Participating	Class 1	30
753	721981.26	4889138.31	Non-Participating	Class 1	30
754	722116.02	4888599.25	Non-Participating	Class 1	30

Table E-1: Project + Existing Non-NEER Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
755	723338.76	4889551.18	Non-Participating	Class 1	33
756	723743.31	4889680.88	Non-Participating	Class 1	34
757	723925.24	4889297.19	Non-Participating	Class 1	34
758	725383.24	4889715.19	Non-Participating	Class 1	39
759	723425.14	4891169.14	Non-Participating	Class 1	37
760	723562.07	4891024.38	Non-Participating	Class 1	37
761	723636.80	4890892.68	Non-Participating	Class 1	36
762	722028.37	4890492.16	Non-Participating	Class 1	33
763	721923.90	4891388.59	Non-Participating	Class 1	34
764	720716.93	4891096.77	Non-Participating	Class 1	31
765	720468.13	4892279.88	Non-Participating	Class 1	33
766	723630.99	4892268.00	Non-Participating	Class 1	41
767	724765.40	4891253.36	Participation Pending	Class 1	41
768	725750.62	4891088.34	Non-Participating	Class 1	44
769	725045.38	4892836.61	Participating	Class 1	46
770	725010.85	4892941.98	Participating	Class 1	46
771	725479.39	4892961.15	Participating	Class 1	47
772	723781.46	4892775.04	Non-Participating	Class 1	43
774	720439.90	4890371.37	Non-Participating	Class 1	30
775	728853.90	4892719.65	Non-Participating	Class 1	49
776	728801.94	4892921.48	Non-Participating	Class 1	45
777	729635.83	4893615.87	Non-Participating	Class 1	39
778	729999.74	4893607.42	Non-Participating	Class 1	38
779	728861.32	4894369.94	Participation Pending	Class 1	41
780	728556.68	4894573.27	Non-Participating	Class 1	42
781	728645.69	4896057.62	Non-Participating	Class 1	38
782	727977.67	4896142.98	Participation Pending	Class 1	42
784	728774.94	4896417.56	Non-Participating	Class 1	37
785	727978.15	4894306.55	Participating	Class 1	47
786	727907.63	4894565.86	Non-Participating	Class 1	44
787	727093.82	4894678.64	Non-Participating	Class 1	44
788	727104.75	4894362.78	Participation Pending	Class 1	46
789	725310.76	4894521.95	Participating	Class 1	47
790	725509.66	4894014.70	Participation Pending	Class 1	47
791	724967.32	4896341.13	Non-Participating	Class 1	44
792	726537.89	4896321.29	Non-Participating	Class 1	45
793	725625.32	4896059.58	Non-Participating	Class 1	44
794	727871.78	4895905.85	Non-Participating	Class 1	43
797	731519.45	4892696.60	Non-Participating	Class 1	38
798	731621.39	4893034.27	Non-Participating	Class 1	37
799	730265.43	4894441.93	Non-Participating	Class 1	36
802	720343.60	4892921.56	Non-Participating	Class 1	33
803	720221.40	4893006.28	Non-Participating	Class 1	33
804	720340.52	4892977.01	Non-Participating	Class 1	33
811	719410.70	4896051.41	Non-Participating	Class 1	31
822	721833.38	4893983.40	Non-Participating	Class 1	42
824	723617.02	4894105.53	Participation Pending	Class 1	47

Table E-1: Project + Existing Non-NEER Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
825	723318.79	4894198.02	Participation Pending	Class 1	46
826	723313.85	4894372.20	Non-Participating	Class 1	45
827	726284.30	4884664.15	Non-Participating	Class 1	28
828	726227.23	4884779.09	Non-Participating	Class 1	28
830	723456.49	4896774.78	Non-Participating	Class 1	42
832	737140.54	4887432.60	Non-Participating	Class 1	31
833	737433.18	4887469.45	Non-Participating	Class 1	30
834	725417.04	4885728.20	Non-Participating	Class 1	29
835	725421.79	4885694.95	Non-Participating	Class 1	29
836	725445.15	4885913.86	Non-Participating	Class 1	29
837	725103.37	4886342.53	Non-Participating	Class 1	30
839	725077.98	4886342.89	Non-Participating	Class 1	30
840	731572.34	4894632.10	Non-Participating	Class 1	33
842	731597.95	4894485.89	Non-Participating	Class 1	34
843	731473.93	4894440.61	Non-Participating	Class 1	33
844	731477.54	4894370.11	Non-Participating	Class 1	33
845	731452.84	4894245.07	Non-Participating	Class 1	34
847	726235.51	4894082.71	Participating	Class 1	47
848	732868.23	4884482.98	Non-Participating	Class 1	46
849	726865.68	4890093.88	Non-Participating	Class 1	45
850	731684.04	4886483.92	Non-Participating	Class 1	41
852	728972.39	4888154.05	Non-Participating	Class 1	43
864	719282.97	4897515.15	Non-Participating	Class 1	29
865	720904.17	4899187.90	Non-Participating	Class 1	29
866	722203.20	4898274.38	Non-Participating	Class 1	33
867	721690.13	4899054.22	Non-Participating	Class 1	30
868	723264.12	4899043.61	Non-Participating	Class 1	31
869	723148.39	4899253.41	Non-Participating	Class 1	29
870	725023.56	4897684.84	Non-Participating	Class 1	36
871	725540.63	4897544.85	Non-Participating	Class 1	37
872	724971.27	4897228.10	Non-Participating	Class 1	38
878	723990.20	4899418.91	Non-Participating	Class 1	31
879	725325.11	4899964.56	Non-Participating	Class 1	30
882	724716.86	4900688.30	Non-Participating	Class 1	29
883	725875.26	4900834.50	Non-Participating	Class 1	29
884	722427.30	4900617.84	Non-Participating	Class 1	28
885	721991.20	4899704.37	Non-Participating	Class 1	28
1068	727482.24	4897801.59	Non-Participating	Class 1	36
1069	728084.72	4897923.99	Non-Participating	Class 1	34
1070	730504.18	4896212.67	Non-Participating	Class 1	33
1072	729364.11	4894384.06	Non-Participating	Class 1	38
1074	720325.03	4892588.98	Non-Participating	Class 1	33
1077	734900.82	4891425.42	Non-Participating	Class 1	34
1078	736428.99	4889209.77	Non-Participating	Class 1	33
1079	734972.49	4888730.37	Non-Participating	Class 1	40
1081	726346.11	4887919.86	Non-Participating	Class 1	34
1083	725143.82	4886375.84	Non-Participating	Class 1	30

Table E-1: Project + Existing Non-NEER Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
1084	726577.73	4886299.32	Non-Participating	Class 1	29
1087	731621.64	4889439.12	Participating	Class 1	46
1088	731749.76	4889593.80	Non-Participating	Class 1	45
1090	731769.26	4890065.96	Non-Participating	Class 1	44
1093	723288.07	4889387.09	Non-Participating	Class 1	33
1095	725153.49	4889482.45	Non-Participating	Class 1	37
1098	726508.78	4897454.26	Non-Participating	Class 1	38
1099	727202.86	4899979.73	Non-Participating	Class 1	30
1100	726849.82	4900210.79	Non-Participating	Class 1	29
1108	725325.14	4892470.99	Participation Pending	Class 1	47
1113	731414.48	4896650.84	Non-Participating	Class 1	31
1114	731256.94	4897853.53	Non-Participating	Class 1	30
1115	730478.86	4897657.20	Non-Participating	Class 1	31
1116	728534.08	4898180.58	Non-Participating	Class 1	33
1128	729187.40	4900664.42	Non-Participating	Class 1	28
1129	729396.39	4900620.74	Non-Participating	Class 1	28
1130	728551.29	4900178.78	Non-Participating	Class 1	29
1131	728636.28	4899908.33	Non-Participating	Class 1	29
1159	723474.28	4886340.82	Non-Participating	Class 1	28
1162	722583.43	4886660.88	Non-Participating	Class 1	28
1164	730031.13	4892325.02	Participation Pending	Class 1	43
1165	723187.80	4897202.59	Non-Participating	Class 1	39
1166	731558.54	4889787.16	Participating	Class 1	44
1220	726862.73	4900154.76	Non-Participating	Class 1	29
1221	729627.32	4899791.10	Non-Participating	Class 1	29
1222	730232.94	4899163.96	Non-Participating	Class 1	29
1223	730006.51	4899244.00	Non-Participating	Class 1	29
1224	730463.57	4898318.26	Non-Participating	Class 1	30
1228	733013.45	4894302.57	Non-Participating	Class 1	32
1229	733098.15	4893740.29	Non-Participating	Class 1	33
1230	733858.46	4890521.03	Non-Participating	Class 1	37
1231	735473.83	4889953.67	Non-Participating	Class 1	34
1232	735685.71	4891453.72	Non-Participating	Class 1	32
1237	725438.81	4885334.67	Non-Participating	Class 1	26
1238	725428.82	4885373.50	Non-Participating	Class 1	26
1239	725418.27	4885437.82	Non-Participating	Class 1	26
1240	725445.66	4885483.24	Non-Participating	Class 1	27
1241	725416.53	4885531.51	Non-Participating	Class 1	29
1244	727344.46	4883105.16	Non-Participating	Class 1	27
1252	731233.76	4895703.87	Non-Participating	Class 1	32
1253	731421.66	4895952.93	Non-Participating	Class 1	32
1254	731504.38	4895953.21	Non-Participating	Class 1	32
1255	732316.50	4896167.19	Non-Participating	Class 1	30
1256	732352.81	4896137.06	Non-Participating	Class 1	30
1257	732542.24	4895379.65	Non-Participating	Class 1	31
1258	732564.87	4895321.64	Non-Participating	Class 1	31

Table E-2: Project Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
628	736638.46	4881827.70	Non-Participating	Class 1	23
629	736433.70	4881884.78	Non-Participating	Class 1	23
630	736596.26	4881828.63	Non-Participating	Class 1	23
631	733187.29	4880241.55	Non-Participating	Class 1	23
633	733624.45	4881075.48	Non-Participating	Class 1	25
634	733323.84	4881088.30	Non-Participating	Class 1	25
635	733270.97	4881967.88	Non-Participating	Class 1	27
637	736767.24	4883146.28	Non-Participating	Class 1	25
638	735557.73	4883556.86	Non-Participating	Class 1	28
641	734728.70	4883352.72	Non-Participating	Class 1	29
642	734499.54	4883423.35	Participating	Class 1	29
643	733479.64	4883417.53	Non-Participating	Class 1	31
644	732041.51	4881301.34	Non-Participating	Class 1	25
645	731919.09	4881473.27	Non-Participating	Class 1	25
646	731962.21	4883687.61	Non-Participating	Class 1	32
647	731788.80	4884080.32	Non-Participating	Class 1	33
648	731821.02	4884538.58	Non-Participating	Class 1	36
650	730296.88	4881626.46	Non-Participating	Class 1	25
651	730050.12	4880242.91	Non-Participating	Class 1	23
653	731517.34	4880133.32	Non-Participating	Class 1	23
654	728814.36	4880750.94	Non-Participating	Class 1	23
655	728671.93	4881399.84	Non-Participating	Class 1	24
656	728760.45	4881847.96	Non-Participating	Class 1	25
657	727355.77	4882323.98	Non-Participating	Class 1	25
659	728617.78	4883175.54	Non-Participating	Class 1	27
660	729189.09	4883054.84	Non-Participating	Class 1	27
661	730403.34	4882654.74	Non-Participating	Class 1	27
662	730266.57	4882804.25	Non-Participating	Class 1	27
665	730865.86	4883323.84	Non-Participating	Class 1	29
669	727326.75	4883951.03	Non-Participating	Class 1	27
671	728601.36	4884372.60	Non-Participating	Class 1	28
672	730187.97	4884033.26	Non-Participating	Class 1	30
673	730187.97	4884445.69	Non-Participating	Class 1	30
674	732314.49	4884885.77	Non-Participating	Class 1	41
675	731802.79	4885160.01	Non-Participating	Class 1	39
676	733393.32	4885425.05	Participating	Class 1	45
677	733468.29	4885531.75	Participation Pending	Class 1	46
678	733670.66	4885242.61	Non-Participating	Class 1	41
679	731910.23	4886609.40	Non-Participating	Class 1	42
680	735010.14	4885524.33	Non-Participating	Class 1	34
681	735961.60	4885097.78	Non-Participating	Class 1	29
682	736498.12	4884506.69	Non-Participating	Class 1	23
683	736780.59	4884121.39	Non-Participating	Class 1	25
685	736668.83	4885542.48	Non-Participating	Class 1	27
686	727053.96	4884800.97	Non-Participating	Class 1	28
687	728357.71	4885173.48	Non-Participating	Class 1	29
688	728694.92	4884999.83	Non-Participating	Class 1	29

Table E-2: Project Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
689	730371.92	4884938.93	Non-Participating	Class 1	32
692	730775.89	4884854.44	Non-Participating	Class 1	32
693	731700.75	4886401.74	Non-Participating	Class 1	40
694	730127.30	4886537.56	Non-Participating	Class 1	34
696	728938.32	4886501.92	Non-Participating	Class 1	32
697	728684.36	4886312.33	Non-Participating	Class 1	32
698	727887.73	4886361.41	Non-Participating	Class 1	31
699	727970.74	4886471.11	Non-Participating	Class 1	31
701	728473.93	4887419.20	Non-Participating	Class 1	34
702	731795.49	4887678.09	Participating	Class 1	44
704	734407.47	4888284.83	Non-Participating	Class 1	32
705	735769.99	4888210.16	Non-Participating	Class 1	29
706	733438.33	4888819.64	Non-Participating	Class 1	34
707	733263.09	4888589.76	Non-Participating	Class 1	35
708	734626.10	4889563.10	Non-Participating	Class 1	30
709	733230.18	4889340.38	Non-Participating	Class 1	34
711	733370.74	4890929.83	Non-Participating	Class 1	32
712	732646.32	4891326.17	Non-Participating	Class 1	33
713	729297.15	4887795.84	Non-Participating	Class 1	36
714	734492.64	4891386.58	Non-Participating	Class 1	29
715	733243.76	4892597.80	Non-Participating	Class 1	31
716	733109.39	4892398.67	Non-Participating	Class 1	31
717	731201.31	4891242.10	Non-Participating	Class 1	38
718	730749.54	4891299.90	Participating	Class 1	40
719	730751.43	4891412.92	Non-Participating	Class 1	40
724	729948.61	4889142.31	Non-Participating	Class 1	44
725	730464.35	4889505.78	Participation Pending	Class 1	47
727	730014.26	4890117.37	Non-Participating	Class 1	44
728	730040.78	4892226.62	Participation Pending	Class 1	42
729	729908.45	4892548.55	Non-Participating	Class 1	40
730	731654.41	4891914.55	Non-Participating	Class 1	35
731	731685.01	4892135.23	Non-Participating	Class 1	35
732	731470.35	4891866.41	Non-Participating	Class 1	36
733	731480.38	4891969.22	Non-Participating	Class 1	36
735	727081.69	4891135.05	Participating	Class 1	47
736	726743.00	4890587.95	Participation Pending	Class 1	46
737	728190.56	4891899.01	Participation Pending	Class 1	47
738	725835.57	4887861.84	Non-Participating	Class 1	33
739	725266.82	4888158.71	Non-Participating	Class 1	33
740	725278.78	4887707.37	Non-Participating	Class 1	32
741	723898.24	4887405.24	Non-Participating	Class 1	30
742	723511.96	4887931.38	Non-Participating	Class 1	30
743	722983.80	4887809.65	Non-Participating	Class 1	30
751	720815.07	4889613.59	Non-Participating	Class 1	29
752	721466.96	4889652.96	Non-Participating	Class 1	30
753	721981.26	4889138.31	Non-Participating	Class 1	30
754	722116.02	4888599.25	Non-Participating	Class 1	30

Table E-2: Project Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
755	723338.76	4889551.18	Non-Participating	Class 1	33
756	723743.31	4889680.88	Non-Participating	Class 1	34
757	723925.24	4889297.19	Non-Participating	Class 1	33
758	725383.24	4889715.19	Non-Participating	Class 1	39
759	723425.14	4891169.14	Non-Participating	Class 1	37
760	723562.07	4891024.38	Non-Participating	Class 1	37
761	723636.80	4890892.68	Non-Participating	Class 1	36
762	722028.37	4890492.16	Non-Participating	Class 1	33
763	721923.90	4891388.59	Non-Participating	Class 1	34
764	720716.93	4891096.77	Non-Participating	Class 1	31
765	720468.13	4892279.88	Non-Participating	Class 1	33
766	723630.99	4892268.00	Non-Participating	Class 1	41
767	724765.40	4891253.36	Participation Pending	Class 1	41
768	725750.62	4891088.34	Non-Participating	Class 1	44
769	725045.38	4892836.61	Participating	Class 1	46
770	725010.85	4892941.98	Participating	Class 1	46
771	725479.39	4892961.15	Participating	Class 1	47
772	723781.46	4892775.04	Non-Participating	Class 1	43
774	720439.90	4890371.37	Non-Participating	Class 1	30
775	728853.90	4892719.65	Non-Participating	Class 1	42
776	728801.94	4892921.48	Non-Participating	Class 1	42
777	729635.83	4893615.87	Non-Participating	Class 1	38
778	729999.74	4893607.42	Non-Participating	Class 1	37
779	728861.32	4894369.94	Participation Pending	Class 1	41
780	728556.68	4894573.27	Non-Participating	Class 1	42
781	728645.69	4896057.62	Non-Participating	Class 1	38
782	727977.67	4896142.98	Participation Pending	Class 1	42
784	728774.94	4896417.56	Non-Participating	Class 1	37
785	727978.15	4894306.55	Participating	Class 1	47
786	727907.63	4894565.86	Non-Participating	Class 1	44
787	727093.82	4894678.64	Non-Participating	Class 1	44
788	727104.75	4894362.78	Participation Pending	Class 1	46
789	725310.76	4894521.95	Participating	Class 1	47
790	725509.66	4894014.70	Participation Pending	Class 1	46
791	724967.32	4896341.13	Non-Participating	Class 1	44
792	726537.89	4896321.29	Non-Participating	Class 1	44
793	725625.32	4896059.58	Non-Participating	Class 1	44
794	727871.78	4895905.85	Non-Participating	Class 1	43
797	731519.45	4892696.60	Non-Participating	Class 1	35
798	731621.39	4893034.27	Non-Participating	Class 1	34
799	730265.43	4894441.93	Non-Participating	Class 1	35
802	720343.60	4892921.56	Non-Participating	Class 1	33
803	720221.40	4893006.28	Non-Participating	Class 1	33
804	720340.52	4892977.01	Non-Participating	Class 1	33
811	719410.70	4896051.41	Non-Participating	Class 1	31
822	721833.38	4893983.40	Non-Participating	Class 1	42
824	723617.02	4894105.53	Participation Pending	Class 1	47

Table E-2: Project Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
825	723318.79	4894198.02	Participation Pending	Class 1	46
826	723313.85	4894372.20	Non-Participating	Class 1	45
827	726284.30	4884664.15	Non-Participating	Class 1	27
828	726227.23	4884779.09	Non-Participating	Class 1	27
830	723456.49	4896774.78	Non-Participating	Class 1	42
832	737140.54	4887432.60	Non-Participating	Class 1	26
833	737433.18	4887469.45	Non-Participating	Class 1	25
834	725417.04	4885728.20	Non-Participating	Class 1	28
835	725421.79	4885694.95	Non-Participating	Class 1	28
836	725445.15	4885913.86	Non-Participating	Class 1	29
837	725103.37	4886342.53	Non-Participating	Class 1	29
839	725077.98	4886342.89	Non-Participating	Class 1	29
840	731572.34	4894632.10	Non-Participating	Class 1	32
842	731597.95	4894485.89	Non-Participating	Class 1	32
843	731473.93	4894440.61	Non-Participating	Class 1	32
844	731477.54	4894370.11	Non-Participating	Class 1	32
845	731452.84	4894245.07	Non-Participating	Class 1	33
847	726235.51	4894082.71	Participating	Class 1	47
848	732868.23	4884482.98	Non-Participating	Class 1	37
849	726865.68	4890093.88	Non-Participating	Class 1	45
850	731684.04	4886483.92	Non-Participating	Class 1	40
852	728972.39	4888154.05	Non-Participating	Class 1	36
864	719282.97	4897515.15	Non-Participating	Class 1	29
865	720904.17	4899187.90	Non-Participating	Class 1	29
866	722203.20	4898274.38	Non-Participating	Class 1	33
867	721690.13	4899054.22	Non-Participating	Class 1	30
868	723264.12	4899043.61	Non-Participating	Class 1	31
869	723148.39	4899253.41	Non-Participating	Class 1	29
870	725023.56	4897684.84	Non-Participating	Class 1	36
871	725540.63	4897544.85	Non-Participating	Class 1	37
872	724971.27	4897228.10	Non-Participating	Class 1	38
878	723990.20	4899418.91	Non-Participating	Class 1	31
879	725325.11	4899964.56	Non-Participating	Class 1	30
882	724716.86	4900688.30	Non-Participating	Class 1	28
883	725875.26	4900834.50	Non-Participating	Class 1	28
884	722427.30	4900617.84	Non-Participating	Class 1	27
885	721991.20	4899704.37	Non-Participating	Class 1	28
1068	727482.24	4897801.59	Non-Participating	Class 1	36
1069	728084.72	4897923.99	Non-Participating	Class 1	34
1070	730504.18	4896212.67	Non-Participating	Class 1	32
1072	729364.11	4894384.06	Non-Participating	Class 1	38
1074	720325.03	4892588.98	Non-Participating	Class 1	33
1077	734900.82	4891425.42	Non-Participating	Class 1	29
1078	736428.99	4889209.77	Non-Participating	Class 1	27
1079	734972.49	4888730.37	Non-Participating	Class 1	30
1081	726346.11	4887919.86	Non-Participating	Class 1	33
1083	725143.82	4886375.84	Non-Participating	Class 1	29

Table E-2: Project Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
1084	726577.73	4886299.32	Non-Participating	Class 1	29
1087	731621.64	4889439.12	Participating	Class 1	44
1088	731749.76	4889593.80	Non-Participating	Class 1	42
1090	731769.26	4890065.96	Non-Participating	Class 1	39
1093	723288.07	4889387.09	Non-Participating	Class 1	33
1095	725153.49	4889482.45	Non-Participating	Class 1	37
1098	726508.78	4897454.26	Non-Participating	Class 1	37
1099	727202.86	4899979.73	Non-Participating	Class 1	30
1100	726849.82	4900210.79	Non-Participating	Class 1	29
1108	725325.14	4892470.99	Participation Pending	Class 1	47
1113	731414.48	4896650.84	Non-Participating	Class 1	30
1114	731256.94	4897853.53	Non-Participating	Class 1	29
1115	730478.86	4897657.20	Non-Participating	Class 1	30
1116	728534.08	4898180.58	Non-Participating	Class 1	32
1128	729187.40	4900664.42	Non-Participating	Class 1	27
1129	729396.39	4900620.74	Non-Participating	Class 1	27
1130	728551.29	4900178.78	Non-Participating	Class 1	28
1131	728636.28	4899908.33	Non-Participating	Class 1	29
1159	723474.28	4886340.82	Non-Participating	Class 1	28
1162	722583.43	4886660.88	Non-Participating	Class 1	27
1164	730031.13	4892325.02	Participation Pending	Class 1	42
1165	723187.80	4897202.59	Non-Participating	Class 1	39
1166	731558.54	4889787.16	Participating	Class 1	42
1220	726862.73	4900154.76	Non-Participating	Class 1	29
1221	729627.32	4899791.10	Non-Participating	Class 1	28
1222	730232.94	4899163.96	Non-Participating	Class 1	28
1223	730006.51	4899244.00	Non-Participating	Class 1	28
1224	730463.57	4898318.26	Non-Participating	Class 1	29
1228	733013.45	4894302.57	Non-Participating	Class 1	30
1229	733098.15	4893740.29	Non-Participating	Class 1	30
1230	733858.46	4890521.03	Non-Participating	Class 1	31
1231	735473.83	4889953.67	Non-Participating	Class 1	27
1232	735685.71	4891453.72	Non-Participating	Class 1	27
1237	725438.81	4885334.67	Non-Participating	Class 1	25
1238	725428.82	4885373.50	Non-Participating	Class 1	26
1239	725418.27	4885437.82	Non-Participating	Class 1	25
1240	725445.66	4885483.24	Non-Participating	Class 1	27
1241	725416.53	4885531.51	Non-Participating	Class 1	28
1244	727344.46	4883105.16	Non-Participating	Class 1	26
1252	731233.76	4895703.87	Non-Participating	Class 1	31
1253	731421.66	4895952.93	Non-Participating	Class 1	31
1254	731504.38	4895953.21	Non-Participating	Class 1	31
1255	732316.50	4896167.19	Non-Participating	Class 1	29
1256	732352.81	4896137.06	Non-Participating	Class 1	29
1257	732542.24	4895379.65	Non-Participating	Class 1	29
1258	732564.87	4895321.64	Non-Participating	Class 1	29

Table E-3: Existing Non-NEER Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Existing Non-NEER WTs Only Sound Level (dBA)
	X (m)	Y (m)			
628	736638.46	4881827.70	Non-Participating	Class 1	25
629	736433.70	4881884.78	Non-Participating	Class 1	25
630	736596.26	4881828.63	Non-Participating	Class 1	25
631	733187.29	4880241.55	Non-Participating	Class 1	23
633	733624.45	4881075.48	Non-Participating	Class 1	24
634	733323.84	4881088.30	Non-Participating	Class 1	24
635	733270.97	4881967.88	Non-Participating	Class 1	25
637	736767.24	4883146.28	Non-Participating	Class 1	27
638	735557.73	4883556.86	Non-Participating	Class 1	32
641	734728.70	4883352.72	Non-Participating	Class 1	32
642	734499.54	4883423.35	Participating	Class 1	33
643	733479.64	4883417.53	Non-Participating	Class 1	34
644	732041.51	4881301.34	Non-Participating	Class 1	24
645	731919.09	4881473.27	Non-Participating	Class 1	23
646	731962.21	4883687.61	Non-Participating	Class 1	39
647	731788.80	4884080.32	Non-Participating	Class 1	42
648	731821.02	4884538.58	Non-Participating	Class 1	46
650	730296.88	4881626.46	Non-Participating	Class 1	23
651	730050.12	4880242.91	Non-Participating	Class 1	21
653	731517.34	4880133.32	Non-Participating	Class 1	22
654	728814.36	4880750.94	Non-Participating	Class 1	21
655	728671.93	4881399.84	Non-Participating	Class 1	22
656	728760.45	4881847.96	Non-Participating	Class 1	20
657	727355.77	4882323.98	Non-Participating	Class 1	18
659	728617.78	4883175.54	Non-Participating	Class 1	22
660	729189.09	4883054.84	Non-Participating	Class 1	23
661	730403.34	4882654.74	Non-Participating	Class 1	26
662	730266.57	4882804.25	Non-Participating	Class 1	27
665	730865.86	4883323.84	Non-Participating	Class 1	30
669	727326.75	4883951.03	Non-Participating	Class 1	22
671	728601.36	4884372.60	Non-Participating	Class 1	24
672	730187.97	4884033.26	Non-Participating	Class 1	28
673	730187.97	4884445.69	Non-Participating	Class 1	29
674	732314.49	4884885.77	Non-Participating	Class 1	46
675	731802.79	4885160.01	Non-Participating	Class 1	39
676	733393.32	4885425.05	Participating	Class 1	37
677	733468.29	4885531.75	Participation Pending	Class 1	37
678	733670.66	4885242.61	Non-Participating	Class 1	38
679	731910.23	4886609.40	Non-Participating	Class 1	32
680	735010.14	4885524.33	Non-Participating	Class 1	46
681	735961.60	4885097.78	Non-Participating	Class 1	35
682	736498.12	4884506.69	Non-Participating	Class 1	29
683	736780.59	4884121.39	Non-Participating	Class 1	29
685	736668.83	4885542.48	Non-Participating	Class 1	30
686	727053.96	4884800.97	Non-Participating	Class 1	23
687	728357.71	4885173.48	Non-Participating	Class 1	25
688	728694.92	4884999.83	Non-Participating	Class 1	25
689	730371.92	4884938.93	Non-Participating	Class 1	30

Table E-3: Existing Non-NEER Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Existing Non-NEER WTs Only Sound Level (dBA)
	X (m)	Y (m)			
692	730775.89	4884854.44	Non-Participating	Class 1	32
693	731700.75	4886401.74	Non-Participating	Class 1	33
694	730127.30	4886537.56	Non-Participating	Class 1	33
696	728938.32	4886501.92	Non-Participating	Class 1	30
697	728684.36	4886312.33	Non-Participating	Class 1	28
698	727887.73	4886361.41	Non-Participating	Class 1	26
699	727970.74	4886471.11	Non-Participating	Class 1	27
701	728473.93	4887419.20	Non-Participating	Class 1	33
702	731795.49	4887678.09	Participating	Class 1	37
704	734407.47	4888284.83	Non-Participating	Class 1	44
705	735769.99	4888210.16	Non-Participating	Class 1	34
706	733438.33	4888819.64	Non-Participating	Class 1	48
707	733263.09	4888589.76	Non-Participating	Class 1	48
708	734626.10	4889563.10	Non-Participating	Class 1	39
709	733230.18	4889340.38	Non-Participating	Class 1	42
711	733370.74	4890929.83	Non-Participating	Class 1	38
712	732646.32	4891326.17	Non-Participating	Class 1	45
713	729297.15	4887795.84	Non-Participating	Class 1	42
714	734492.64	4891386.58	Non-Participating	Class 1	33
715	733243.76	4892597.80	Non-Participating	Class 1	33
716	733109.39	4892398.67	Non-Participating	Class 1	35
717	731201.31	4891242.10	Non-Participating	Class 1	48
718	730749.54	4891299.90	Participating	Class 1	43
719	730751.43	4891412.92	Non-Participating	Class 1	42
724	729948.61	4889142.31	Non-Participating	Class 1	45
725	730464.35	4889505.78	Participation Pending	Class 1	39
727	730014.26	4890117.37	Non-Participating	Class 1	37
728	730040.78	4892226.62	Participation Pending	Class 1	35
729	729908.45	4892548.55	Non-Participating	Class 1	36
730	731654.41	4891914.55	Non-Participating	Class 1	41
731	731685.01	4892135.23	Non-Participating	Class 1	39
732	731470.35	4891866.41	Non-Participating	Class 1	41
733	731480.38	4891969.22	Non-Participating	Class 1	40
735	727081.69	4891135.05	Participating	Class 1	24
736	726743.00	4890587.95	Participation Pending	Class 1	24
737	728190.56	4891899.01	Participation Pending	Class 1	33
738	725835.57	4887861.84	Non-Participating	Class 1	23
739	725266.82	4888158.71	Non-Participating	Class 1	18
740	725278.78	4887707.37	Non-Participating	Class 1	19
741	723898.24	4887405.24	Non-Participating	Class 1	20
742	723511.96	4887931.38	Non-Participating	Class 1	19
743	722983.80	4887809.65	Non-Participating	Class 1	19
751	720815.07	4889613.59	Non-Participating	Class 1	15
752	721466.96	4889652.96	Non-Participating	Class 1	15
753	721981.26	4889138.31	Non-Participating	Class 1	16
754	722116.02	4888599.25	Non-Participating	Class 1	13
755	723338.76	4889551.18	Non-Participating	Class 1	14
756	723743.31	4889680.88	Non-Participating	Class 1	15

Table E-3: Existing Non-NEER Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Existing Non-NEER WTs Only Sound Level (dBA)
	X (m)	Y (m)			
757	723925.24	4889297.19	Non-Participating	Class 1	15
758	725383.24	4889715.19	Non-Participating	Class 1	23
759	723425.14	4891169.14	Non-Participating	Class 1	19
760	723562.07	4891024.38	Non-Participating	Class 1	19
761	723636.80	4890892.68	Non-Participating	Class 1	17
762	722028.37	4890492.16	Non-Participating	Class 1	17
763	721923.90	4891388.59	Non-Participating	Class 1	11
764	720716.93	4891096.77	Non-Participating	Class 1	13
765	720468.13	4892279.88	Non-Participating	Class 1	14
766	723630.99	4892268.00	Non-Participating	Class 1	14
767	724765.40	4891253.36	Participation Pending	Class 1	17
768	725750.62	4891088.34	Non-Participating	Class 1	23
769	725045.38	4892836.61	Participating	Class 1	15
770	725010.85	4892941.98	Participating	Class 1	16
771	725479.39	4892961.15	Participating	Class 1	17
772	723781.46	4892775.04	Non-Participating	Class 1	14
774	720439.90	4890371.37	Non-Participating	Class 1	14
775	728853.90	4892719.65	Non-Participating	Class 1	48
776	728801.94	4892921.48	Non-Participating	Class 1	43
777	729635.83	4893615.87	Non-Participating	Class 1	32
778	729999.74	4893607.42	Non-Participating	Class 1	32
779	728861.32	4894369.94	Participation Pending	Class 1	28
780	728556.68	4894573.27	Non-Participating	Class 1	27
781	728645.69	4896057.62	Non-Participating	Class 1	24
782	727977.67	4896142.98	Participation Pending	Class 1	23
784	728774.94	4896417.56	Non-Participating	Class 1	23
785	727978.15	4894306.55	Participating	Class 1	27
786	727907.63	4894565.86	Non-Participating	Class 1	26
787	727093.82	4894678.64	Non-Participating	Class 1	20
788	727104.75	4894362.78	Participation Pending	Class 1	21
789	725310.76	4894521.95	Participating	Class 1	22
790	725509.66	4894014.70	Participation Pending	Class 1	22
791	724967.32	4896341.13	Non-Participating	Class 1	19
792	726537.89	4896321.29	Non-Participating	Class 1	20
793	725625.32	4896059.58	Non-Participating	Class 1	18
794	727871.78	4895905.85	Non-Participating	Class 1	23
797	731519.45	4892696.60	Non-Participating	Class 1	35
798	731621.39	4893034.27	Non-Participating	Class 1	33
799	730265.43	4894441.93	Non-Participating	Class 1	28
802	720343.60	4892921.56	Non-Participating	Class 1	15
803	720221.40	4893006.28	Non-Participating	Class 1	15
804	720340.52	4892977.01	Non-Participating	Class 1	15
811	719410.70	4896051.41	Non-Participating	Class 1	11
822	721833.38	4893983.40	Non-Participating	Class 1	10
824	723617.02	4894105.53	Participation Pending	Class 1	17
825	723318.79	4894198.02	Participation Pending	Class 1	12
826	723313.85	4894372.20	Non-Participating	Class 1	12
827	726284.30	4884664.15	Non-Participating	Class 1	21

Table E-3: Existing Non-NEER Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Existing Non-NEER WTs Only Sound Level (dBA)
	X (m)	Y (m)			
828	726227.23	4884779.09	Non-Participating	Class 1	22
830	723456.49	4896774.78	Non-Participating	Class 1	10
832	737140.54	4887432.60	Non-Participating	Class 1	29
833	737433.18	4887469.45	Non-Participating	Class 1	28
834	725417.04	4885728.20	Non-Participating	Class 1	21
835	725421.79	4885694.95	Non-Participating	Class 1	21
836	725445.15	4885913.86	Non-Participating	Class 1	20
837	725103.37	4886342.53	Non-Participating	Class 1	20
839	725077.98	4886342.89	Non-Participating	Class 1	20
840	731572.34	4894632.10	Non-Participating	Class 1	28
842	731597.95	4894485.89	Non-Participating	Class 1	28
843	731473.93	4894440.61	Non-Participating	Class 1	24
844	731477.54	4894370.11	Non-Participating	Class 1	24
845	731452.84	4894245.07	Non-Participating	Class 1	29
847	726235.51	4894082.71	Participating	Class 1	19
848	732868.23	4884482.98	Non-Participating	Class 1	45
849	726865.68	4890093.88	Non-Participating	Class 1	25
850	731684.04	4886483.92	Non-Participating	Class 1	33
852	728972.39	4888154.05	Non-Participating	Class 1	41
864	719282.97	4897515.15	Non-Participating	Class 1	11
865	720904.17	4899187.90	Non-Participating	Class 1	7
866	722203.20	4898274.38	Non-Participating	Class 1	8
867	721690.13	4899054.22	Non-Participating	Class 1	7
868	723264.12	4899043.61	Non-Participating	Class 1	17
869	723148.39	4899253.41	Non-Participating	Class 1	8
870	725023.56	4897684.84	Non-Participating	Class 1	19
871	725540.63	4897544.85	Non-Participating	Class 1	19
872	724971.27	4897228.10	Non-Participating	Class 1	19
878	723990.20	4899418.91	Non-Participating	Class 1	17
879	725325.11	4899964.56	Non-Participating	Class 1	17
882	724716.86	4900688.30	Non-Participating	Class 1	17
883	725875.26	4900834.50	Non-Participating	Class 1	17
884	722427.30	4900617.84	Non-Participating	Class 1	15
885	721991.20	4899704.37	Non-Participating	Class 1	7
1068	727482.24	4897801.59	Non-Participating	Class 1	19
1069	728084.72	4897923.99	Non-Participating	Class 1	21
1070	730504.18	4896212.67	Non-Participating	Class 1	24
1072	729364.11	4894384.06	Non-Participating	Class 1	29
1074	720325.03	4892588.98	Non-Participating	Class 1	14
1077	734900.82	4891425.42	Non-Participating	Class 1	32
1078	736428.99	4889209.77	Non-Participating	Class 1	31
1079	734972.49	4888730.37	Non-Participating	Class 1	40
1081	726346.11	4887919.86	Non-Participating	Class 1	24
1083	725143.82	4886375.84	Non-Participating	Class 1	20
1084	726577.73	4886299.32	Non-Participating	Class 1	18
1087	731621.64	4889439.12	Participating	Class 1	42
1088	731749.76	4889593.80	Non-Participating	Class 1	42
1090	731769.26	4890065.96	Non-Participating	Class 1	42

Table E-3: Existing Non-NEER Only Results

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Existing Non-NEER WTs Only Sound Level (dBA)
	X (m)	Y (m)			
1093	723288.07	4889387.09	Non-Participating	Class 1	15
1095	725153.49	4889482.45	Non-Participating	Class 1	20
1098	726508.78	4897454.26	Non-Participating	Class 1	20
1099	727202.86	4899979.73	Non-Participating	Class 1	15
1100	726849.82	4900210.79	Non-Participating	Class 1	14
1108	725325.14	4892470.99	Participation Pending	Class 1	19
1113	731414.48	4896650.84	Non-Participating	Class 1	24
1114	731256.94	4897853.53	Non-Participating	Class 1	22
1115	730478.86	4897657.20	Non-Participating	Class 1	22
1116	728534.08	4898180.58	Non-Participating	Class 1	21
1128	729187.40	4900664.42	Non-Participating	Class 1	18
1129	729396.39	4900620.74	Non-Participating	Class 1	18
1130	728551.29	4900178.78	Non-Participating	Class 1	19
1131	728636.28	4899908.33	Non-Participating	Class 1	19
1159	723474.28	4886340.82	Non-Participating	Class 1	19
1162	722583.43	4886660.88	Non-Participating	Class 1	19
1164	730031.13	4892325.02	Participation Pending	Class 1	35
1165	723187.80	4897202.59	Non-Participating	Class 1	18
1166	731558.54	4889787.16	Participating	Class 1	41
1220	726862.73	4900154.76	Non-Participating	Class 1	15
1221	729627.32	4899791.10	Non-Participating	Class 1	19
1222	730232.94	4899163.96	Non-Participating	Class 1	20
1223	730006.51	4899244.00	Non-Participating	Class 1	20
1224	730463.57	4898318.26	Non-Participating	Class 1	21
1228	733013.45	4894302.57	Non-Participating	Class 1	29
1229	733098.15	4893740.29	Non-Participating	Class 1	30
1230	733858.46	4890521.03	Non-Participating	Class 1	36
1231	735473.83	4889953.67	Non-Participating	Class 1	33
1232	735685.71	4891453.72	Non-Participating	Class 1	30
1237	725438.81	4885334.67	Non-Participating	Class 1	18
1238	725428.82	4885373.50	Non-Participating	Class 1	18
1239	725418.27	4885437.82	Non-Participating	Class 1	19
1240	725445.66	4885483.24	Non-Participating	Class 1	19
1241	725416.53	4885531.51	Non-Participating	Class 1	20
1244	727344.46	4883105.16	Non-Participating	Class 1	22
1252	731233.76	4895703.87	Non-Participating	Class 1	26
1253	731421.66	4895952.93	Non-Participating	Class 1	25
1254	731504.38	4895953.21	Non-Participating	Class 1	25
1255	732316.50	4896167.19	Non-Participating	Class 1	25
1256	732352.81	4896137.06	Non-Participating	Class 1	25
1257	732542.24	4895379.65	Non-Participating	Class 1	26
1258	732564.87	4895321.64	Non-Participating	Class 1	26

Appendix F

Sound Level Modeling Results – Tabular Sorted by Sound Level

Table F-1: Project + Existing Non-NEER Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
775	728853.90	4892719.65	Non-Participating	Class 1	49
717	731201.31	4891242.10	Non-Participating	Class 1	49
706	733438.33	4888819.64	Non-Participating	Class 1	49
707	733263.09	4888589.76	Non-Participating	Class 1	49
725	730464.35	4889505.78	Participation Pending	Class 1	48
735	727081.69	4891135.05	Participating	Class 1	48
824	723617.02	4894105.53	Participation Pending	Class 1	47
674	732314.49	4884885.77	Non-Participating	Class 1	47
724	729948.61	4889142.31	Non-Participating	Class 1	47
789	725310.76	4894521.95	Participating	Class 1	47
785	727978.15	4894306.55	Participating	Class 1	47
1108	725325.14	4892470.99	Participation Pending	Class 1	47
771	725479.39	4892961.15	Participating	Class 1	47
737	728190.56	4891899.01	Participation Pending	Class 1	47
648	731821.02	4884538.58	Non-Participating	Class 1	47
790	725509.66	4894014.70	Participation Pending	Class 1	47
847	726235.51	4894082.71	Participating	Class 1	47
680	735010.14	4885524.33	Non-Participating	Class 1	46
736	726743.00	4890587.95	Participation Pending	Class 1	46
788	727104.75	4894362.78	Participation Pending	Class 1	46
825	723318.79	4894198.02	Participation Pending	Class 1	46
677	733468.29	4885531.75	Participation Pending	Class 1	46
769	725045.38	4892836.61	Participating	Class 1	46
848	732868.23	4884482.98	Non-Participating	Class 1	46
1087	731621.64	4889439.12	Participating	Class 1	46
770	725010.85	4892941.98	Participating	Class 1	46
712	732646.32	4891326.17	Non-Participating	Class 1	46
776	728801.94	4892921.48	Non-Participating	Class 1	45
826	723313.85	4894372.20	Non-Participating	Class 1	45
676	733393.32	4885425.05	Participating	Class 1	45
718	730749.54	4891299.90	Participating	Class 1	45
727	730014.26	4890117.37	Non-Participating	Class 1	45
849	726865.68	4890093.88	Non-Participating	Class 1	45
1088	731749.76	4889593.80	Non-Participating	Class 1	45
702	731795.49	4887678.09	Participating	Class 1	45
792	726537.89	4896321.29	Non-Participating	Class 1	45
786	727907.63	4894565.86	Non-Participating	Class 1	44
787	727093.82	4894678.64	Non-Participating	Class 1	44
1166	731558.54	4889787.16	Participating	Class 1	44
719	730751.43	4891412.92	Non-Participating	Class 1	44
1090	731769.26	4890065.96	Non-Participating	Class 1	44
704	734407.47	4888284.83	Non-Participating	Class 1	44
768	725750.62	4891088.34	Non-Participating	Class 1	44
791	724967.32	4896341.13	Non-Participating	Class 1	44
793	725625.32	4896059.58	Non-Participating	Class 1	44
678	733670.66	4885242.61	Non-Participating	Class 1	43
728	730040.78	4892226.62	Participation Pending	Class 1	43

Table F-1: Project + Existing Non-NEER Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
713	729297.15	4887795.84	Non-Participating	Class 1	43
794	727871.78	4895905.85	Non-Participating	Class 1	43
709	733230.18	4889340.38	Non-Participating	Class 1	43
772	723781.46	4892775.04	Non-Participating	Class 1	43
852	728972.39	4888154.05	Non-Participating	Class 1	43
1164	730031.13	4892325.02	Participation Pending	Class 1	43
647	731788.80	4884080.32	Non-Participating	Class 1	42
782	727977.67	4896142.98	Participation Pending	Class 1	42
679	731910.23	4886609.40	Non-Participating	Class 1	42
732	731470.35	4891866.41	Non-Participating	Class 1	42
675	731802.79	4885160.01	Non-Participating	Class 1	42
822	721833.38	4893983.40	Non-Participating	Class 1	42
730	731654.41	4891914.55	Non-Participating	Class 1	42
729	729908.45	4892548.55	Non-Participating	Class 1	42
780	728556.68	4894573.27	Non-Participating	Class 1	42
830	723456.49	4896774.78	Non-Participating	Class 1	42
733	731480.38	4891969.22	Non-Participating	Class 1	41
779	728861.32	4894369.94	Participation Pending	Class 1	41
850	731684.04	4886483.92	Non-Participating	Class 1	41
693	731700.75	4886401.74	Non-Participating	Class 1	41
766	723630.99	4892268.00	Non-Participating	Class 1	41
767	724765.40	4891253.36	Participation Pending	Class 1	41
731	731685.01	4892135.23	Non-Participating	Class 1	40
1079	734972.49	4888730.37	Non-Participating	Class 1	40
708	734626.10	4889563.10	Non-Participating	Class 1	40
646	731962.21	4883687.61	Non-Participating	Class 1	39
711	733370.74	4890929.83	Non-Participating	Class 1	39
777	729635.83	4893615.87	Non-Participating	Class 1	39
758	725383.24	4889715.19	Non-Participating	Class 1	39
1165	723187.80	4897202.59	Non-Participating	Class 1	39
872	724971.27	4897228.10	Non-Participating	Class 1	38
1072	729364.11	4894384.06	Non-Participating	Class 1	38
778	729999.74	4893607.42	Non-Participating	Class 1	38
781	728645.69	4896057.62	Non-Participating	Class 1	38
797	731519.45	4892696.60	Non-Participating	Class 1	38
1098	726508.78	4897454.26	Non-Participating	Class 1	38
1230	733858.46	4890521.03	Non-Participating	Class 1	37
1095	725153.49	4889482.45	Non-Participating	Class 1	37
871	725540.63	4897544.85	Non-Participating	Class 1	37
759	723425.14	4891169.14	Non-Participating	Class 1	37
784	728774.94	4896417.56	Non-Participating	Class 1	37
760	723562.07	4891024.38	Non-Participating	Class 1	37
798	731621.39	4893034.27	Non-Participating	Class 1	37
694	730127.30	4886537.56	Non-Participating	Class 1	36
761	723636.80	4890892.68	Non-Participating	Class 1	36
681	735961.60	4885097.78	Non-Participating	Class 1	36
716	733109.39	4892398.67	Non-Participating	Class 1	36

Table F-1: Project + Existing Non-NEER Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
701	728473.93	4887419.20	Non-Participating	Class 1	36
870	725023.56	4897684.84	Non-Participating	Class 1	36
799	730265.43	4894441.93	Non-Participating	Class 1	36
1068	727482.24	4897801.59	Non-Participating	Class 1	36
643	733479.64	4883417.53	Non-Participating	Class 1	36
715	733243.76	4892597.80	Non-Participating	Class 1	35
692	730775.89	4884854.44	Non-Participating	Class 1	35
705	735769.99	4888210.16	Non-Participating	Class 1	35
714	734492.64	4891386.58	Non-Participating	Class 1	35
696	728938.32	4886501.92	Non-Participating	Class 1	34
1069	728084.72	4897923.99	Non-Participating	Class 1	34
642	734499.54	4883423.35	Participating	Class 1	34
689	730371.92	4884938.93	Non-Participating	Class 1	34
763	721923.90	4891388.59	Non-Participating	Class 1	34
845	731452.84	4894245.07	Non-Participating	Class 1	34
756	723743.31	4889680.88	Non-Participating	Class 1	34
1081	726346.11	4887919.86	Non-Participating	Class 1	34
1231	735473.83	4889953.67	Non-Participating	Class 1	34
641	734728.70	4883352.72	Non-Participating	Class 1	34
842	731597.95	4894485.89	Non-Participating	Class 1	34
1077	734900.82	4891425.42	Non-Participating	Class 1	34
757	723925.24	4889297.19	Non-Participating	Class 1	34
840	731572.34	4894632.10	Non-Participating	Class 1	33
738	725835.57	4887861.84	Non-Participating	Class 1	33
638	735557.73	4883556.86	Non-Participating	Class 1	33
802	720343.60	4892921.56	Non-Participating	Class 1	33
804	720340.52	4892977.01	Non-Participating	Class 1	33
697	728684.36	4886312.33	Non-Participating	Class 1	33
739	725266.82	4888158.71	Non-Participating	Class 1	33
1229	733098.15	4893740.29	Non-Participating	Class 1	33
673	730187.97	4884445.69	Non-Participating	Class 1	33
755	723338.76	4889551.18	Non-Participating	Class 1	33
866	722203.20	4898274.38	Non-Participating	Class 1	33
803	720221.40	4893006.28	Non-Participating	Class 1	33
1070	730504.18	4896212.67	Non-Participating	Class 1	33
762	722028.37	4890492.16	Non-Participating	Class 1	33
1116	728534.08	4898180.58	Non-Participating	Class 1	33
765	720468.13	4892279.88	Non-Participating	Class 1	33
844	731477.54	4894370.11	Non-Participating	Class 1	33
1074	720325.03	4892588.98	Non-Participating	Class 1	33
1093	723288.07	4889387.09	Non-Participating	Class 1	33
699	727970.74	4886471.11	Non-Participating	Class 1	33
843	731473.93	4894440.61	Non-Participating	Class 1	33
1078	736428.99	4889209.77	Non-Participating	Class 1	33
665	730865.86	4883323.84	Non-Participating	Class 1	32
1252	731233.76	4895703.87	Non-Participating	Class 1	32
698	727887.73	4886361.41	Non-Participating	Class 1	32

Table F-1: Project + Existing Non-NEER Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
740	725278.78	4887707.37	Non-Participating	Class 1	32
1228	733013.45	4894302.57	Non-Participating	Class 1	32
1232	735685.71	4891453.72	Non-Participating	Class 1	32
1253	731421.66	4895952.93	Non-Participating	Class 1	32
672	730187.97	4884033.26	Non-Participating	Class 1	32
685	736668.83	4885542.48	Non-Participating	Class 1	32
1254	731504.38	4895953.21	Non-Participating	Class 1	32
868	723264.12	4899043.61	Non-Participating	Class 1	31
764	720716.93	4891096.77	Non-Participating	Class 1	31
1258	732564.87	4895321.64	Non-Participating	Class 1	31
878	723990.20	4899418.91	Non-Participating	Class 1	31
1257	732542.24	4895379.65	Non-Participating	Class 1	31
832	737140.54	4887432.60	Non-Participating	Class 1	31
1113	731414.48	4896650.84	Non-Participating	Class 1	31
1115	730478.86	4897657.20	Non-Participating	Class 1	31
687	728357.71	4885173.48	Non-Participating	Class 1	31
688	728694.92	4884999.83	Non-Participating	Class 1	31
742	723511.96	4887931.38	Non-Participating	Class 1	31
811	719410.70	4896051.41	Non-Participating	Class 1	31
752	721466.96	4889652.96	Non-Participating	Class 1	30
753	721981.26	4889138.31	Non-Participating	Class 1	30
867	721690.13	4899054.22	Non-Participating	Class 1	30
1255	732316.50	4896167.19	Non-Participating	Class 1	30
1256	732352.81	4896137.06	Non-Participating	Class 1	30
682	736498.12	4884506.69	Non-Participating	Class 1	30
741	723898.24	4887405.24	Non-Participating	Class 1	30
879	725325.11	4899964.56	Non-Participating	Class 1	30
683	736780.59	4884121.39	Non-Participating	Class 1	30
662	730266.57	4882804.25	Non-Participating	Class 1	30
743	722983.80	4887809.65	Non-Participating	Class 1	30
774	720439.90	4890371.37	Non-Participating	Class 1	30
833	737433.18	4887469.45	Non-Participating	Class 1	30
1224	730463.57	4898318.26	Non-Participating	Class 1	30
661	730403.34	4882654.74	Non-Participating	Class 1	30
671	728601.36	4884372.60	Non-Participating	Class 1	30
754	722116.02	4888599.25	Non-Participating	Class 1	30
1083	725143.82	4886375.84	Non-Participating	Class 1	30
1099	727202.86	4899979.73	Non-Participating	Class 1	30
1114	731256.94	4897853.53	Non-Participating	Class 1	30
751	720815.07	4889613.59	Non-Participating	Class 1	30
837	725103.37	4886342.53	Non-Participating	Class 1	30
839	725077.98	4886342.89	Non-Participating	Class 1	30
1220	726862.73	4900154.76	Non-Participating	Class 1	29
637	736767.24	4883146.28	Non-Participating	Class 1	29
1100	726849.82	4900210.79	Non-Participating	Class 1	29
836	725445.15	4885913.86	Non-Participating	Class 1	29
865	720904.17	4899187.90	Non-Participating	Class 1	29

Table F-1: Project + Existing Non-NEER Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project + Existing Non-NEER WTs Sound Level (dBA)
	X (m)	Y (m)			
1131	728636.28	4899908.33	Non-Participating	Class 1	29
686	727053.96	4884800.97	Non-Participating	Class 1	29
834	725417.04	4885728.20	Non-Participating	Class 1	29
864	719282.97	4897515.15	Non-Participating	Class 1	29
869	723148.39	4899253.41	Non-Participating	Class 1	29
1084	726577.73	4886299.32	Non-Participating	Class 1	29
1223	730006.51	4899244.00	Non-Participating	Class 1	29
635	733270.97	4881967.88	Non-Participating	Class 1	29
835	725421.79	4885694.95	Non-Participating	Class 1	29
1222	730232.94	4899163.96	Non-Participating	Class 1	29
882	724716.86	4900688.30	Non-Participating	Class 1	29
1130	728551.29	4900178.78	Non-Participating	Class 1	29
1241	725416.53	4885531.51	Non-Participating	Class 1	29
883	725875.26	4900834.50	Non-Participating	Class 1	29
1221	729627.32	4899791.10	Non-Participating	Class 1	29
828	726227.23	4884779.09	Non-Participating	Class 1	28
1159	723474.28	4886340.82	Non-Participating	Class 1	28
660	729189.09	4883054.84	Non-Participating	Class 1	28
827	726284.30	4884664.15	Non-Participating	Class 1	28
885	721991.20	4899704.37	Non-Participating	Class 1	28
669	727326.75	4883951.03	Non-Participating	Class 1	28
1162	722583.43	4886660.88	Non-Participating	Class 1	28
659	728617.78	4883175.54	Non-Participating	Class 1	28
644	732041.51	4881301.34	Non-Participating	Class 1	28
884	722427.30	4900617.84	Non-Participating	Class 1	28
634	733323.84	4881088.30	Non-Participating	Class 1	28
1128	729187.40	4900664.42	Non-Participating	Class 1	28
1129	729396.39	4900620.74	Non-Participating	Class 1	28
629	736433.70	4881884.78	Non-Participating	Class 1	27
1240	725445.66	4885483.24	Non-Participating	Class 1	27
633	733624.45	4881075.48	Non-Participating	Class 1	27
645	731919.09	4881473.27	Non-Participating	Class 1	27
650	730296.88	4881626.46	Non-Participating	Class 1	27
1244	727344.46	4883105.16	Non-Participating	Class 1	27
630	736596.26	4881828.63	Non-Participating	Class 1	27
628	736638.46	4881827.70	Non-Participating	Class 1	27
1238	725428.82	4885373.50	Non-Participating	Class 1	26
656	728760.45	4881847.96	Non-Participating	Class 1	26
655	728671.93	4881399.84	Non-Participating	Class 1	26
631	733187.29	4880241.55	Non-Participating	Class 1	26
1237	725438.81	4885334.67	Non-Participating	Class 1	26
1239	725418.27	4885437.82	Non-Participating	Class 1	26
653	731517.34	4880133.32	Non-Participating	Class 1	26
657	727355.77	4882323.98	Non-Participating	Class 1	26
651	730050.12	4880242.91	Non-Participating	Class 1	25
654	728814.36	4880750.94	Non-Participating	Class 1	25

Table F-2: Project Only Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
735	727081.69	4891135.05	Participating	Class 1	47
824	723617.02	4894105.53	Participation Pending	Class 1	47
789	725310.76	4894521.95	Participating	Class 1	47
771	725479.39	4892961.15	Participating	Class 1	47
785	727978.15	4894306.55	Participating	Class 1	47
725	730464.35	4889505.78	Participation Pending	Class 1	47
1108	725325.14	4892470.99	Participation Pending	Class 1	47
737	728190.56	4891899.01	Participation Pending	Class 1	47
847	726235.51	4894082.71	Participating	Class 1	47
788	727104.75	4894362.78	Participation Pending	Class 1	46
790	725509.66	4894014.70	Participation Pending	Class 1	46
825	723318.79	4894198.02	Participation Pending	Class 1	46
736	726743.00	4890587.95	Participation Pending	Class 1	46
769	725045.38	4892836.61	Participating	Class 1	46
770	725010.85	4892941.98	Participating	Class 1	46
677	733468.29	4885531.75	Participation Pending	Class 1	46
826	723313.85	4894372.20	Non-Participating	Class 1	45
849	726865.68	4890093.88	Non-Participating	Class 1	45
676	733393.32	4885425.05	Participating	Class 1	45
787	727093.82	4894678.64	Non-Participating	Class 1	44
792	726537.89	4896321.29	Non-Participating	Class 1	44
786	727907.63	4894565.86	Non-Participating	Class 1	44
727	730014.26	4890117.37	Non-Participating	Class 1	44
702	731795.49	4887678.09	Participating	Class 1	44
791	724967.32	4896341.13	Non-Participating	Class 1	44
768	725750.62	4891088.34	Non-Participating	Class 1	44
724	729948.61	4889142.31	Non-Participating	Class 1	44
793	725625.32	4896059.58	Non-Participating	Class 1	44
1087	731621.64	4889439.12	Participating	Class 1	44
794	727871.78	4895905.85	Non-Participating	Class 1	43
772	723781.46	4892775.04	Non-Participating	Class 1	43
728	730040.78	4892226.62	Participation Pending	Class 1	42
782	727977.67	4896142.98	Participation Pending	Class 1	42
775	728853.90	4892719.65	Non-Participating	Class 1	42
776	728801.94	4892921.48	Non-Participating	Class 1	42
822	721833.38	4893983.40	Non-Participating	Class 1	42
1166	731558.54	4889787.16	Participating	Class 1	42
679	731910.23	4886609.40	Non-Participating	Class 1	42
830	723456.49	4896774.78	Non-Participating	Class 1	42
780	728556.68	4894573.27	Non-Participating	Class 1	42
1088	731749.76	4889593.80	Non-Participating	Class 1	42
1164	730031.13	4892325.02	Participation Pending	Class 1	42
678	733670.66	4885242.61	Non-Participating	Class 1	41
766	723630.99	4892268.00	Non-Participating	Class 1	41
779	728861.32	4894369.94	Participation Pending	Class 1	41
674	732314.49	4884885.77	Non-Participating	Class 1	41
718	730749.54	4891299.90	Participating	Class 1	40

Table F-2: Project Only Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
767	724765.40	4891253.36	Participation Pending	Class 1	40
719	730751.43	4891412.92	Non-Participating	Class 1	40
729	729908.45	4892548.55	Non-Participating	Class 1	40
850	731684.04	4886483.92	Non-Participating	Class 1	40
693	731700.75	4886401.74	Non-Participating	Class 1	40
1090	731769.26	4890065.96	Non-Participating	Class 1	39
675	731802.79	4885160.01	Non-Participating	Class 1	39
758	725383.24	4889715.19	Non-Participating	Class 1	39
1165	723187.80	4897202.59	Non-Participating	Class 1	39
717	731201.31	4891242.10	Non-Participating	Class 1	38
872	724971.27	4897228.10	Non-Participating	Class 1	38
777	729635.83	4893615.87	Non-Participating	Class 1	38
1072	729364.11	4894384.06	Non-Participating	Class 1	38
781	728645.69	4896057.62	Non-Participating	Class 1	38
1098	726508.78	4897454.26	Non-Participating	Class 1	37
848	732868.23	4884482.98	Non-Participating	Class 1	37
778	729999.74	4893607.42	Non-Participating	Class 1	37
1095	725153.49	4889482.45	Non-Participating	Class 1	37
871	725540.63	4897544.85	Non-Participating	Class 1	37
759	723425.14	4891169.14	Non-Participating	Class 1	37
760	723562.07	4891024.38	Non-Participating	Class 1	37
784	728774.94	4896417.56	Non-Participating	Class 1	37
761	723636.80	4890892.68	Non-Participating	Class 1	36
852	728972.39	4888154.05	Non-Participating	Class 1	36
713	729297.15	4887795.84	Non-Participating	Class 1	36
732	731470.35	4891866.41	Non-Participating	Class 1	36
733	731480.38	4891969.22	Non-Participating	Class 1	36
870	725023.56	4897684.84	Non-Participating	Class 1	36
648	731821.02	4884538.58	Non-Participating	Class 1	36
1068	727482.24	4897801.59	Non-Participating	Class 1	36
730	731654.41	4891914.55	Non-Participating	Class 1	35
731	731685.01	4892135.23	Non-Participating	Class 1	35
799	730265.43	4894441.93	Non-Participating	Class 1	35
707	733263.09	4888589.76	Non-Participating	Class 1	35
797	731519.45	4892696.60	Non-Participating	Class 1	35
694	730127.30	4886537.56	Non-Participating	Class 1	34
706	733438.33	4888819.64	Non-Participating	Class 1	34
763	721923.90	4891388.59	Non-Participating	Class 1	34
709	733230.18	4889340.38	Non-Participating	Class 1	34
1069	728084.72	4897923.99	Non-Participating	Class 1	34
680	735010.14	4885524.33	Non-Participating	Class 1	34
756	723743.31	4889680.88	Non-Participating	Class 1	34
798	731621.39	4893034.27	Non-Participating	Class 1	34
701	728473.93	4887419.20	Non-Participating	Class 1	34
757	723925.24	4889297.19	Non-Participating	Class 1	33
712	732646.32	4891326.17	Non-Participating	Class 1	33
1081	726346.11	4887919.86	Non-Participating	Class 1	33

Table F-2: Project Only Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
804	720340.52	4892977.01	Non-Participating	Class 1	33
802	720343.60	4892921.56	Non-Participating	Class 1	33
739	725266.82	4888158.71	Non-Participating	Class 1	33
866	722203.20	4898274.38	Non-Participating	Class 1	33
738	725835.57	4887861.84	Non-Participating	Class 1	33
755	723338.76	4889551.18	Non-Participating	Class 1	33
647	731788.80	4884080.32	Non-Participating	Class 1	33
803	720221.40	4893006.28	Non-Participating	Class 1	33
1074	720325.03	4892588.98	Non-Participating	Class 1	33
762	722028.37	4890492.16	Non-Participating	Class 1	33
765	720468.13	4892279.88	Non-Participating	Class 1	33
845	731452.84	4894245.07	Non-Participating	Class 1	33
1093	723288.07	4889387.09	Non-Participating	Class 1	33
1116	728534.08	4898180.58	Non-Participating	Class 1	32
704	734407.47	4888284.83	Non-Participating	Class 1	32
692	730775.89	4884854.44	Non-Participating	Class 1	32
696	728938.32	4886501.92	Non-Participating	Class 1	32
1070	730504.18	4896212.67	Non-Participating	Class 1	32
711	733370.74	4890929.83	Non-Participating	Class 1	32
842	731597.95	4894485.89	Non-Participating	Class 1	32
844	731477.54	4894370.11	Non-Participating	Class 1	32
840	731572.34	4894632.10	Non-Participating	Class 1	32
843	731473.93	4894440.61	Non-Participating	Class 1	32
689	730371.92	4884938.93	Non-Participating	Class 1	32
740	725278.78	4887707.37	Non-Participating	Class 1	32
646	731962.21	4883687.61	Non-Participating	Class 1	32
697	728684.36	4886312.33	Non-Participating	Class 1	32
764	720716.93	4891096.77	Non-Participating	Class 1	31
1252	731233.76	4895703.87	Non-Participating	Class 1	31
699	727970.74	4886471.11	Non-Participating	Class 1	31
868	723264.12	4899043.61	Non-Participating	Class 1	31
716	733109.39	4892398.67	Non-Participating	Class 1	31
698	727887.73	4886361.41	Non-Participating	Class 1	31
878	723990.20	4899418.91	Non-Participating	Class 1	31
643	733479.64	4883417.53	Non-Participating	Class 1	31
715	733243.76	4892597.80	Non-Participating	Class 1	31
1253	731421.66	4895952.93	Non-Participating	Class 1	31
811	719410.70	4896051.41	Non-Participating	Class 1	31
1230	733858.46	4890521.03	Non-Participating	Class 1	31
1254	731504.38	4895953.21	Non-Participating	Class 1	31
673	730187.97	4884445.69	Non-Participating	Class 1	30
867	721690.13	4899054.22	Non-Participating	Class 1	30
1079	734972.49	4888730.37	Non-Participating	Class 1	30
742	723511.96	4887931.38	Non-Participating	Class 1	30
752	721466.96	4889652.96	Non-Participating	Class 1	30
753	721981.26	4889138.31	Non-Participating	Class 1	30
1115	730478.86	4897657.20	Non-Participating	Class 1	30

Table F-2: Project Only Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
879	725325.11	4899964.56	Non-Participating	Class 1	30
708	734626.10	4889563.10	Non-Participating	Class 1	30
1113	731414.48	4896650.84	Non-Participating	Class 1	30
1229	733098.15	4893740.29	Non-Participating	Class 1	30
741	723898.24	4887405.24	Non-Participating	Class 1	30
774	720439.90	4890371.37	Non-Participating	Class 1	30
754	722116.02	4888599.25	Non-Participating	Class 1	30
1228	733013.45	4894302.57	Non-Participating	Class 1	30
672	730187.97	4884033.26	Non-Participating	Class 1	30
743	722983.80	4887809.65	Non-Participating	Class 1	30
1099	727202.86	4899979.73	Non-Participating	Class 1	30
1257	732542.24	4895379.65	Non-Participating	Class 1	29
1258	732564.87	4895321.64	Non-Participating	Class 1	29
642	734499.54	4883423.35	Participating	Class 1	29
687	728357.71	4885173.48	Non-Participating	Class 1	29
688	728694.92	4884999.83	Non-Participating	Class 1	29
751	720815.07	4889613.59	Non-Participating	Class 1	29
1220	726862.73	4900154.76	Non-Participating	Class 1	29
681	735961.60	4885097.78	Non-Participating	Class 1	29
714	734492.64	4891386.58	Non-Participating	Class 1	29
1100	726849.82	4900210.79	Non-Participating	Class 1	29
1224	730463.57	4898318.26	Non-Participating	Class 1	29
865	720904.17	4899187.90	Non-Participating	Class 1	29
1083	725143.82	4886375.84	Non-Participating	Class 1	29
837	725103.37	4886342.53	Non-Participating	Class 1	29
839	725077.98	4886342.89	Non-Participating	Class 1	29
869	723148.39	4899253.41	Non-Participating	Class 1	29
1255	732316.50	4896167.19	Non-Participating	Class 1	29
1256	732352.81	4896137.06	Non-Participating	Class 1	29
705	735769.99	4888210.16	Non-Participating	Class 1	29
864	719282.97	4897515.15	Non-Participating	Class 1	29
641	734728.70	4883352.72	Non-Participating	Class 1	29
665	730865.86	4883323.84	Non-Participating	Class 1	29
1114	731256.94	4897853.53	Non-Participating	Class 1	29
1131	728636.28	4899908.33	Non-Participating	Class 1	29
1084	726577.73	4886299.32	Non-Participating	Class 1	29
836	725445.15	4885913.86	Non-Participating	Class 1	29
1077	734900.82	4891425.42	Non-Participating	Class 1	29
882	724716.86	4900688.30	Non-Participating	Class 1	28
1223	730006.51	4899244.00	Non-Participating	Class 1	28
671	728601.36	4884372.60	Non-Participating	Class 1	28
1222	730232.94	4899163.96	Non-Participating	Class 1	28
834	725417.04	4885728.20	Non-Participating	Class 1	28
835	725421.79	4885694.95	Non-Participating	Class 1	28
883	725875.26	4900834.50	Non-Participating	Class 1	28
1130	728551.29	4900178.78	Non-Participating	Class 1	28
885	721991.20	4899704.37	Non-Participating	Class 1	28

Table F-2: Project Only Results by Sound Level

Receptor ID	Coordinates UTM NAD83 Zone 14N		Participation Status	Noise Area Class.	Project Only Sound Level (dBA)
	X (m)	Y (m)			
1221	729627.32	4899791.10	Non-Participating	Class 1	28
1241	725416.53	4885531.51	Non-Participating	Class 1	28
686	727053.96	4884800.97	Non-Participating	Class 1	28
1159	723474.28	4886340.82	Non-Participating	Class 1	28
638	735557.73	4883556.86	Non-Participating	Class 1	28
884	722427.30	4900617.84	Non-Participating	Class 1	27
1162	722583.43	4886660.88	Non-Participating	Class 1	27
662	730266.57	4882804.25	Non-Participating	Class 1	27
828	726227.23	4884779.09	Non-Participating	Class 1	27
827	726284.30	4884664.15	Non-Participating	Class 1	27
1232	735685.71	4891453.72	Non-Participating	Class 1	27
661	730403.34	4882654.74	Non-Participating	Class 1	27
1078	736428.99	4889209.77	Non-Participating	Class 1	27
1128	729187.40	4900664.42	Non-Participating	Class 1	27
1129	729396.39	4900620.74	Non-Participating	Class 1	27
660	729189.09	4883054.84	Non-Participating	Class 1	27
669	727326.75	4883951.03	Non-Participating	Class 1	27
1231	735473.83	4889953.67	Non-Participating	Class 1	27
1240	725445.66	4885483.24	Non-Participating	Class 1	27
685	736668.83	4885542.48	Non-Participating	Class 1	27
635	733270.97	4881967.88	Non-Participating	Class 1	27
659	728617.78	4883175.54	Non-Participating	Class 1	27
832	737140.54	4887432.60	Non-Participating	Class 1	26
1244	727344.46	4883105.16	Non-Participating	Class 1	26
1238	725428.82	4885373.50	Non-Participating	Class 1	26
645	731919.09	4881473.27	Non-Participating	Class 1	25
650	730296.88	4881626.46	Non-Participating	Class 1	25
644	732041.51	4881301.34	Non-Participating	Class 1	25
1237	725438.81	4885334.67	Non-Participating	Class 1	25
833	737433.18	4887469.45	Non-Participating	Class 1	25
637	736767.24	4883146.28	Non-Participating	Class 1	25
656	728760.45	4881847.96	Non-Participating	Class 1	25
1239	725418.27	4885437.82	Non-Participating	Class 1	25
657	727355.77	4882323.98	Non-Participating	Class 1	25
683	736780.59	4884121.39	Non-Participating	Class 1	25
634	733323.84	4881088.30	Non-Participating	Class 1	25
633	733624.45	4881075.48	Non-Participating	Class 1	25
655	728671.93	4881399.84	Non-Participating	Class 1	24
629	736433.70	4881884.78	Non-Participating	Class 1	23
654	728814.36	4880750.94	Non-Participating	Class 1	23
631	733187.29	4880241.55	Non-Participating	Class 1	23
653	731517.34	4880133.32	Non-Participating	Class 1	23
630	736596.26	4881828.63	Non-Participating	Class 1	23
651	730050.12	4880242.91	Non-Participating	Class 1	23
682	736498.12	4884506.69	Non-Participating	Class 1	23
628	736638.46	4881827.70	Non-Participating	Class 1	23

APPENDIX D – Shadow Flicker Analysis

SHADOW FLICKER MODELING REPORT

Lake Benton Wind II Project
Pipestone County, Minnesota

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1.0 EXECUTIVE SUMMARY

The Lake Benton Wind II Project (the Project or LBWII) is a proposed wind power generation facility proposed to consist of 44 wind turbines in Pipestone County, Minnesota. The Project is being developed by Lake Benton Power Partners II, LLC, an indirect, wholly-owned subsidiary of NextEra Energy Resources, LLC (NEER). Atwell, LLC (Atwell) retained to assist in the permitting of the Project has retained Epsilon Associates, Inc. (Epsilon) to conduct a shadow flicker assessment for the proposed wind turbines for this Project. This report presents results of the study.

Shadow flicker modeling was conservatively conducted for 48 GE wind turbines, which includes 4 alternate wind turbine locations. The purpose of this analysis is to predict the expected annual durations of wind turbine shadow flicker at nearby residences.

The maximum expected annual duration of shadow flicker at a modeling receptor resulting from the operation of the 44 proposed and 4 alternate wind turbines is 30 hours, 25 minutes which is in the process of being a participant in the Project. The maximum expected annual duration of flicker at a non-participating receptor is 19 hours, 4 minutes. The modeling results are conservative in that modeling receptors were treated as "greenhouses" and the surrounding area was assumed to be without vegetation or structures ("bare earth").

2.0 INTRODUCTION

The proposed Project to be located in Pipestone County, Minnesota is proposed to consist of 44 wind turbines. The proposed wind turbines are a combination of GE 2.1 megawatt (MW) and GE 2.3 MW units with rotor diameters of 116 meters and hub heights of 80 and 90 meters, respectively. Three GE 2.1-116 units will be LNTE models and six GE 2.3-116 units will be Low Noise Trailing Edge (LNTE) models. Figure 2-1 shows the locations of the 44 proposed and 4 alternate wind turbines over aerial imagery in Pipestone County.

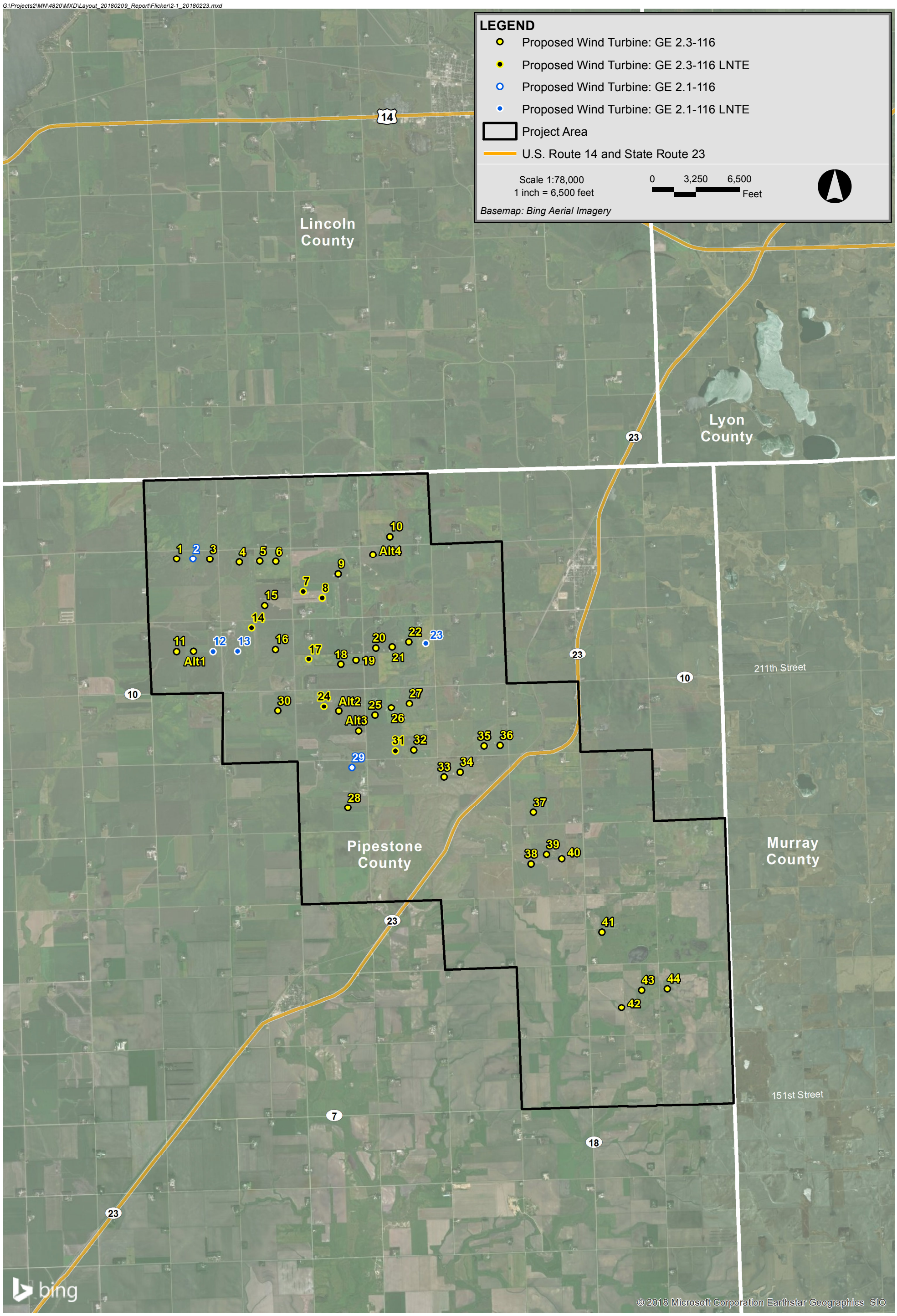
With respect to wind turbines, shadow flicker can be defined as an intermittent change in the intensity of light in a given area resulting from the operation of a wind turbine due to its interaction with the sun. While indoors, an observer experiences repeated changes in the brightness of the room as shadows cast from the wind turbine blades briefly pass by windows as the blades rotate. In order for this to occur, the wind turbine must be operating, the sun must be shining, and the window must be within the shadow region of the wind turbine, otherwise there is no shadow flicker. A stationary wind turbine only generates a stationary shadow similar to any other structure.

Based on the current design and operation of typical modern wind turbines, shadow flicker is not a cause of epileptic seizures. According to the Epilepsy Foundation, "Generally, flashing lights most likely to trigger seizures are between the frequency of 5 to 30 flashes per second (Hertz)."[1] The wind turbines for this Project have a maximum rotational speed of 15.7 rpm which corresponds to a shadow flicker frequency of 0.8 Hz. This frequency is well below the frequency identified by the Epilepsy Foundation; therefore, the triggering of epileptic seizures is not a concern with this Project.

This report presents the findings of a shadow flicker modeling study for the Project. The wind turbines were modeled with the WindPRO software package using information provided by Atwell. The expected annual duration of shadow flicker was calculated at modeling receptors and shadow flicker isolines for the area surrounding the Project were generated. The results of the modeling are found within this report.

[1] Epilepsy Foundation, http://www.epilepsy.com/learn/triggers-seizures/photosensitivity-and-seizures. Accessed in December 2017.

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Lake Benton Wind II Project **Pipestone County, Minnesota**

Epsilon Associates Inc.

Figure 2-1
Aerial Locus

3.0 SHADOW FLICKER MODELING

3.1 Modeling Methodology

Shadow flicker was modeled using a software package, WindPRO version 3.1.633. WindPRO is a software suite developed by EMD International A/S and is used for assessing potential environmental impacts from wind turbines. Using the Shadow module within WindPRO, worst-case shadow flicker in the area surrounding the wind turbines was calculated based on data inputs including: location of the wind turbines, location of discrete receptor points, wind turbine dimensions, flicker calculation limits, and terrain data. Based on these data, the model was able to incorporate the appropriate sun angle and maximum daily sunlight for this latitude into the calculations. The resulting worst-case calculations assume that the sun is always shining during daylight hours and that the wind turbine is always operating. The WindPRO Shadow module can be further refined by incorporating sunshine probabilities and wind turbine operational estimates by wind direction over the course of a year. The values produced by this further refinement are known as the "expected" shadow flicker. Both worst-case and expected annual shadow flicker durations are presented in this section.

The proposed wind turbine layout for the Project dated February 9, 2018 was provided by Atwell. Of the 48 conservatively modeled wind turbines, 4 are alternative wind turbine locations. Locations of the turbines are shown in Figure 3-1 and the coordinates are provided in Appendix A. Five (5) wind turbines are proposed to be GE 2.1-116 wind turbines and 43 are proposed to be GE 2.3-116 wind turbines with a 116 meter rotor diameter and hub heights of 80 meters and 90 meters, respectively. A subset of the GE 2.3 wind turbines and GE 2.1 wind turbines will have the optional LNTE blades. This option does not impact the shadow flicker calculations. Each wind turbine has the following characteristics based on the technical data provided by Atwell and/or NEER:

		GE 2.1-116	GE 2.3-116
♦ Rated Power	=	2,100 kW	2,300 kW
♦ Hub Height	=	90 meters	90 meters
♦ Rotor Diameter	=	116 meters	116 meters
♦ Cut-in Wind Speed	=	3 m/s	3 m/s
♦ Cut-out Wind Speed	=	31 m/s	32 m/s
♦ Maximum RPM	=	15.7 rpm	15.7 rpm

This modeling analysis was conducted only for the 48 wind turbines associated with this Project.

To-date, there are no federal, state, or local regulations regarding the maximum radial distance from a wind turbine to which shadow flicker should be analyzed applicable to this Project. In the United States, shadow flicker is commonly evaluated out to a distance of ten times the rotor diameter. According to the Massachusetts Model Bylaw for wind energy

facilities, shadow flicker impacts are minimal at and beyond a distance of ten rotor diameters.[2] Defining the shadow flicker calculation area has also been addressed in Europe where the ten times rotor diameter approach has been accepted in multiple European countries.[3] Some jurisdictions conservatively require a larger calculation area. The New Hampshire Site Evaluation Committee through rulemaking docket 2014-04 adopted rules on December 15, 2015 outlining application requirements and criteria for energy facilities, including wind energy facilities. As part of these revised regulations, Site 301.08(a)(2) requires an evaluation distance of at least 1 mile from a wind turbine.[4] Section 16-50j-94, part (g), of the Regulations of Connecticut State Agencies identifies the components required in a shadow flicker evaluation report which includes the calculation of shadow flicker from each proposed wind turbine to any off-site occupied structure within a 1.25 mile radius.[5] For this Project, ten times the rotor diameter of the proposed wind turbine corresponds to a distance of 0.72 miles (1,160 m). Conservatively, this analysis includes shadow flicker calculations out to 1.25 miles (2,012 m) from each wind turbine in the model for the proposed layout.

A dataset containing participation status information for property parcels in the proximity of the Project was provided by Atwell on January 16, 2018. Parcels identified as "LSE" within the dataset are participating and are indicated as such on Figure 3-1. Parcels not identified as "LSE" but contain proposed wind turbines have been assigned a "participation pending" status. Additionally, any parcel within or partially within 5 rotor diameters in the prevailing wind direction(s) and 3 rotor diameters in non-prevailing wind directions (5 by 3 setback) must be a participating parcel for the Project. This 5 by 3 setback data layer was provided by Atwell and is shown on Figure 3-1. Any non-"LSE" parcel that was within or partially within the 5 by 3 setback has been assigned a "participation pending" status. Participation status used throughout this analysis is shown in Figure 3-1.

A modeling receptor dataset dated November 21, 2017 was provided by Atwell. Receptors within 2 miles of the Project Area (234) were input into the WindPRO mode. Each modeling point was assumed to have a window facing all directions ("greenhouse" mode) which yields conservative results. Participation status for each modeling receptor was assigned based on the data presented in Figure 3-1. All modeling receptors are identified in

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[2] Massachusetts Department of Energy Resources, "Model As-of-Right Zoning Ordinance or Bylaw: Allowing Use of Wind Energy Facilities" 2009.

[3] Parsons Brinckerhoff, "Update of UK Shadow Flicker Evidence Base" Prepared for Department of Energy and Climate Change, 2011.

[4] State of New Hampshire Site Evaluation Committee Site 300 Rules (2015), available at http://www.gencourt.state.nh.us/rules/state_agencies/site100-300.html Accessed in January 2018.

[5] State of Connecticut CSC Wind Regulations (2014), available at https://www.cga.ct.gov/aspx/CGARegulations/CGARegulations.aspx?Yr=2014&Reg=2012-054&Amd=E Accessed in January 2018.

Figure 3-2 and are distinguished as either participating, participation pending, or non-participating. The model was set to limit calculations to 2,012 meters from a wind turbine, the equivalent of 1.25 miles. Consequently, shadow flicker at any of the 234 modeling receptors greater than the corresponding limitation distance from a wind turbine was zero. In addition to modeling discrete points, shadow flicker was calculated at grid points in the area surrounding the modeled wind turbines to generate flicker isolines. A 20-meter spacing was used for this grid.

The terrain height contour elevations for the modeling domain were generated from elevation information derived from the National Elevation Dataset (NED) developed by the U.S. Geological Survey. Conservatively, obstacles, i.e. buildings and vegetation, were excluded from the analysis. This is effectively a "bare earth" scenario which is conservative. When accounted for in the shadow flicker calculations, such obstacles may significantly mitigate or eliminate the flicker effect depending on their size, type, and location. In addition, shadow flicker durations were calculated only when the angle of the sun was at least 3° above the horizon.

Monthly sunshine probability values were input for each month from January to December. These numbers were obtained from a publicly available historical dataset for Sioux City, Iowa from the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI).[6] Table 3-1 shows the percentage of sunshine hours by month used in the shadow flicker modeling. These values are the percentages that the sun is expected to be shining during daylight hours.

The number of hours the wind turbines are expected to operate for the 16 cardinal wind directions was input into the model. A 31-year hourly time series for wind speed and wind direction at 90 meters above ground level was provided by NEER. Epsilon used these data to calculate the typical annual number of operational hours per wind direction sector. These hours per wind direction sector are used by WindPRO to estimate the "wind direction" and "operation time" reduction factors. Based on this dataset, the wind turbines would operate 98% of the year. Table 3-2 shows the distribution of operational hours for the 16 wind directions.

[6] NCEI (formerly NCDC), http://www1.ncdc.noaa.gov/pub/data/ccd-data/pctpos15.txt. Accessed in November 2017.

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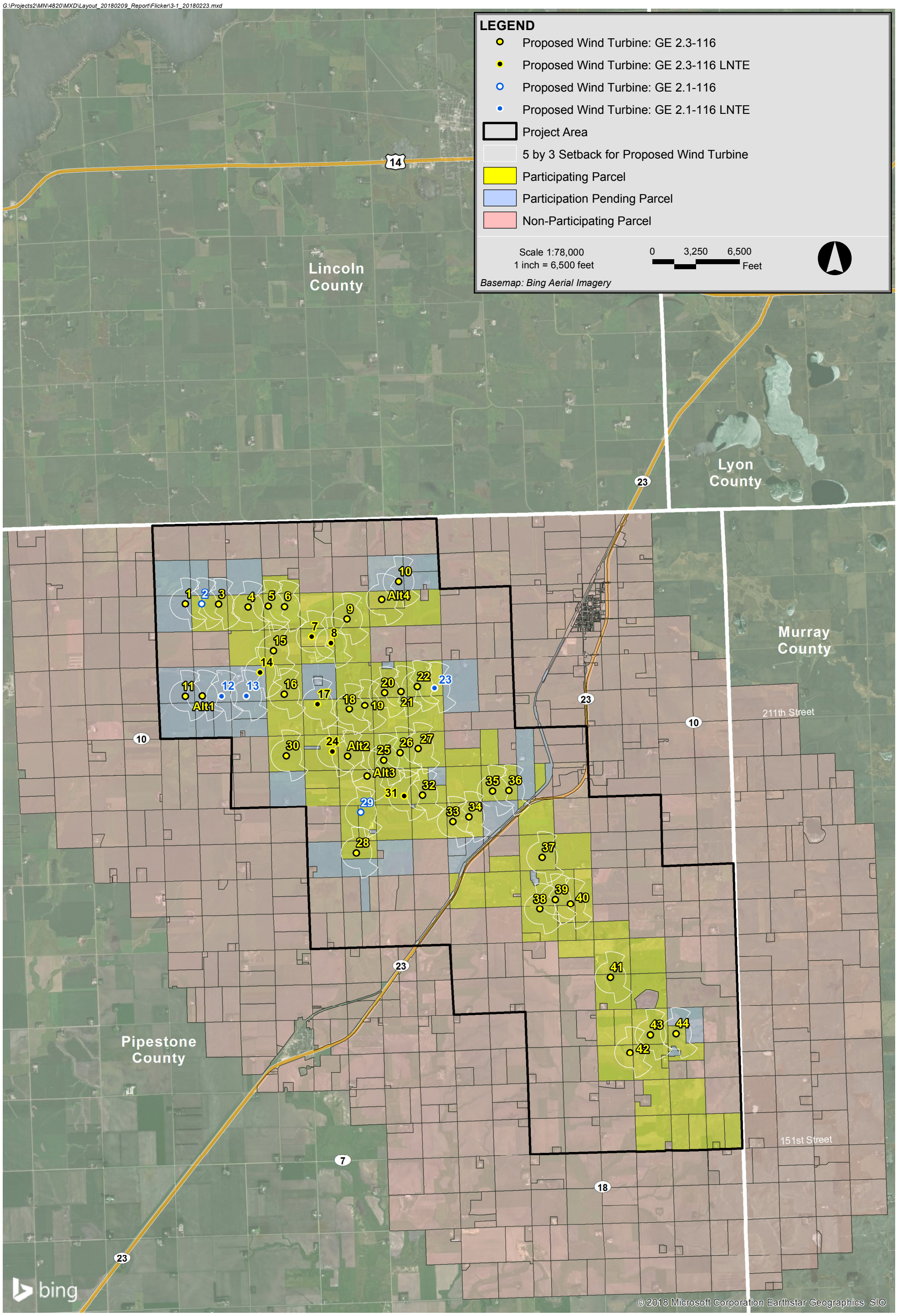
LEGEND

- Proposed Wind Turbine: GE 2.3-116
- Proposed Wind Turbine: GE 2.3-116 LNTE
- Proposed Wind Turbine: GE 2.1-116
- Proposed Wind Turbine: GE 2.1-116 LNTE
- Project Area
- 5 by 3 Setback for Proposed Wind Turbine
- Participating Parcel
- Participation Pending Parcel
- Non-Participating Parcel

Scale 1:78,000
1 inch = 6,500 feet

0 3,250 6,500 Feet

Basemap: Bing Aerial Imagery



Lake Benton Wind II Project Pipestone County, Minnesota

Epsilon ASSOCIATES INC.

Figure 3-1
Participation Status

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LEGEND

- Proposed Wind Turbine: GE 2.3-116
- Proposed Wind Turbine: GE 2.3-116 LNTE
- Proposed Wind Turbine: GE 2.1-116
- Proposed Wind Turbine: GE 2.1-116 LNTE
- Project Area
- Participating Receptor
- Participation Pending Receptor
- Non-Participating Receptor
- Participating Parcel
- Participation Pending Parcel
- Non-Participating Parcel

Scale 1:78,000
1 inch = 6,500 feet

0 3,250 6,500 Feet

Basemap: Bing Aerial Imagery

Lincoln County

Lyon County

Murray County

Pipestone County

211th Street

151st Street

bing
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Lake Benton Wind II Project Pipestone County, Minnesota

Epsilon ASSOCIATES INC.

Figure 3-2
Shadow Flicker Modeling Locations

Table 3-1 Monthly Percent of Possible Sunshine

Month	Possible Sunshine
January	57%
February	57%
March	59%
April	59%
May	62%
June	70%
July	73%
August	70%
September	65%
October	60%
November	48%
December	48%

Table 3-2 Operational Hours per Wind Direction Sector

Wind Sector	Operational Hours
N	668
NNE	495
NE	401
ENE	328
E	295
ESE	263
SE	318
SSE	507
S	1,122
SSW	895
SW	495
WSW	362
W	431
WNW	587
NW	708
NNW	710
Annual	8,585

3.2 Results

Following the modeling methodology outlined in Section 3.1, WindPRO was used to calculate shadow flicker at the 234 discrete modeling points in Pipestone County and generate shadow flicker isolines based on the grid calculations. Table B-1 in Appendix B presents the modeling results for the 234 modeling receptor locations. Both worst-case and expected values are presented.

The modeled worst-case annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 90 hours, 55 minutes per year. The maximum flicker was at a receptor with pending participation (#1108). The maximum predicted annual flicker at a non-participating receptor (#849) is 54 hours, 49 minutes.

The predicted expected annual shadow flicker duration ranged from 0 hours, 0 minutes per year to 30 hours, 25 minutes per year. The maximum expected flicker was at a receptor with pending participation (#1108). The maximum modeled expected annual flicker at a non-participating receptor (#849) is 19 hours, 4 minutes. The majority of the receptors (170) were predicted to experience no annual shadow flicker. 34 locations were predicted to experience some shadow flicker but less than 10 hours per year. The modeling results showed that 29 locations would be expected to have 10 to 30 hours of shadow flicker per year. One receptor is expected to have over 30 hours of flicker per year. Figure 3-3 displays the modeled flicker isolines (expected hrs/yr) over aerial imagery in relation to modeled wind turbines and modeling receptors.

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LEGEND

- Proposed Wind Turbine: GE 2.3-116
- Proposed Wind Turbine: GE 2.3-116 LNTE
- Proposed Wind Turbine: GE 2.1-116
- Proposed Wind Turbine: GE 2.1-116 LNTE
- Project Area
- Participating Receptor
- Participation Pending Receptor
- Non-Participating Receptor
- Participating Parcel
- Participation Pending Parcel
- Non-Participating Parcel

Modeled Shadow Flicker: Expected Values (Hours per Year)

0 30 100
10 50 150

Scale 1:66,000
1 inch = 5,500 feet

0 2,750 5,500 Feet

Basemap: Bing Aerial Imagery

Lincoln County
Lyon County
Murray County
Pipestone County
211th Street
151st Street

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Lake Benton Wind II Project Pipestone County, Minnesota

Epsilon ASSOCIATES INC.

Figure 3-3
Shadow Flicker Modeling Results

Appendix A
Wind Turbine Coordinates

Table A-1: LBWII Wind Turbine Coordinates

Wind Turbine ID	Coordinates NAD83 UTM Zone 14N (meters)	
	X (Easting)	Y (Northing)
1	722492	4895751
2	722860	4895750
3	723247	4895742
4	723910	4895677
5	724370	4895699
6	724735	4895688
7	725354	4895011
8	725786	4894865
9	726149	4895406
10	727318	4896253
11	722491	4893658
12	723313	4893660
13	723874	4893662
14	724186	4894191
15	724488	4894695
16	724729	4893704
17	725481	4893479
18	726206	4893360
19	726552	4893449
20	727000	4893737
21	727373	4893761
22	727744	4893875
23	728130	4893842
24	725823	4892403
25	726982	4892207
26	727354	4892375
27	727763	4892471
28	726366	4890107
29	726461	4891021
30	724779	4892305
31	727444	4891400
32	727859	4891419
33	728546	4890809
34	728911	4890918
35	729449	4891510
36	729816	4891521
37	730568	4890005
38	730518	4888838
39	730865	4889052
40	731207	4888954
41	732117	4887288
42	732560	4885583
43	733019	4885981
44	733598	4886013
Alt1	722875	4893664
Alt2	726165	4892295
Alt3	726609	4891849
Alt4	726936	4895849

Appendix B
Shadow Flicker Modeling Results: Modeling Receptors

Table B-1: Shadow Flicker Modeling Results

Modeling ID	Participation Status	Coordinates NAD83 UTM Zone 14N (meters)		Worst-Case Shadow Flicker - Annual	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker - Daily	Expected Shadow Flicker - Annual
		X (Easting)	Y (Northing)	(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
628	Non-Participating	736638.46	4881827.70	0:00	0	0:00	0:00
629	Non-Participating	736433.70	4881884.78	0:00	0	0:00	0:00
630	Non-Participating	736596.26	4881828.63	0:00	0	0:00	0:00
631	Non-Participating	733187.29	4880241.55	0:00	0	0:00	0:00
633	Non-Participating	733624.45	4881075.48	0:00	0	0:00	0:00
634	Non-Participating	733323.84	4881088.30	0:00	0	0:00	0:00
635	Non-Participating	733270.97	4881967.88	0:00	0	0:00	0:00
637	Non-Participating	736767.24	4883146.28	0:00	0	0:00	0:00
638	Non-Participating	735557.73	4883556.86	0:00	0	0:00	0:00
641	Non-Participating	734728.70	4883352.72	0:00	0	0:00	0:00
642	Participating	734499.54	4883423.35	0:00	0	0:00	0:00
643	Non-Participating	733479.64	4883417.53	0:00	0	0:00	0:00
644	Non-Participating	732041.51	4881301.34	0:00	0	0:00	0:00
645	Non-Participating	731919.09	4881473.27	0:00	0	0:00	0:00
646	Non-Participating	731962.21	4883687.61	0:00	0	0:00	0:00
647	Non-Participating	731788.80	4884080.32	0:00	0	0:00	0:00
648	Non-Participating	731821.02	4884538.58	0:00	0	0:00	0:00
650	Non-Participating	730296.88	4881626.46	0:00	0	0:00	0:00
651	Non-Participating	730050.12	4880242.91	0:00	0	0:00	0:00
653	Non-Participating	731517.34	4880133.32	0:00	0	0:00	0:00
654	Non-Participating	728814.36	4880750.94	0:00	0	0:00	0:00
655	Non-Participating	728671.93	4881399.84	0:00	0	0:00	0:00
656	Non-Participating	728760.45	4881847.96	0:00	0	0:00	0:00
657	Non-Participating	727355.77	4882323.98	0:00	0	0:00	0:00
659	Non-Participating	728617.78	4883175.54	0:00	0	0:00	0:00
660	Non-Participating	729189.09	4883054.84	0:00	0	0:00	0:00
661	Non-Participating	730403.34	4882654.74	0:00	0	0:00	0:00
662	Non-Participating	730266.57	4882804.25	0:00	0	0:00	0:00
665	Non-Participating	730865.86	4883323.84	0:00	0	0:00	0:00
669	Non-Participating	727326.75	4883951.03	0:00	0	0:00	0:00
671	Non-Participating	728601.36	4884372.60	0:00	0	0:00	0:00
672	Non-Participating	730187.97	4884033.26	0:00	0	0:00	0:00
673	Non-Participating	730187.97	4884445.69	0:00	0	0:00	0:00
674	Non-Participating	732314.49	4884885.77	0:00	0	0:00	0:00
675	Non-Participating	731802.79	4885160.01	31:57	84	0:37	12:20
676	Participating	733393.32	4885425.05	19:49	50	0:33	7:07
677	Participation Pending	733468.29	4885531.75	14:38	40	0:30	5:03
678	Non-Participating	733670.66	4885242.61	11:50	43	0:24	4:34
679	Non-Participating	731910.23	4886609.40	11:10	60	0:21	3:40
680	Non-Participating	735010.14	4885524.33	5:25	31	0:15	2:08
681	Non-Participating	735961.60	4885097.78	0:00	0	0:00	0:00
682	Non-Participating	736498.12	4884506.69	0:00	0	0:00	0:00
683	Non-Participating	736780.59	4884121.39	0:00	0	0:00	0:00
685	Non-Participating	736668.83	4885542.48	0:00	0	0:00	0:00
686	Non-Participating	727053.96	4884800.97	0:00	0	0:00	0:00
687	Non-Participating	728357.71	4885173.48	0:00	0	0:00	0:00
688	Non-Participating	728694.92	4884999.83	0:00	0	0:00	0:00
689	Non-Participating	730371.92	4884938.93	0:00	0	0:00	0:00
692	Non-Participating	730775.89	4884854.44	2:56	23	0:12	1:03
693	Non-Participating	731700.75	4886401.74	6:22	40	0:18	2:09
694	Non-Participating	730127.30	4886537.56	0:00	0	0:00	0:00
696	Non-Participating	728938.32	4886501.92	0:00	0	0:00	0:00
697	Non-Participating	728684.36	4886312.33	0:00	0	0:00	0:00
698	Non-Participating	727887.73	4886361.41	0:00	0	0:00	0:00
699	Non-Participating	727970.74	4886471.11	0:00	0	0:00	0:00
701	Non-Participating	728473.93	4887419.20	0:00	0	0:00	0:00
702	Participating	731795.49	4887678.09	33:29	53	0:47	11:32
704	Non-Participating	734407.47	4888284.83	0:00	0	0:00	0:00
705	Non-Participating	735769.99	4888210.16	0:00	0	0:00	0:00
706	Non-Participating	733438.33	4888819.64	0:00	0	0:00	0:00
707	Non-Participating	733263.09	4888589.76	0:00	0	0:00	0:00
708	Non-Participating	734626.10	4889563.10	0:00	0	0:00	0:00
709	Non-Participating	733230.18	4889340.38	0:00	0	0:00	0:00
711	Non-Participating	733370.74	4890929.83	0:00	0	0:00	0:00

Table B-1: Shadow Flicker Modeling Results

Modeling ID	Participation Status	Coordinates NAD83 UTM Zone 14N (meters)		Worst-Case Shadow Flicker - Annual	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker - Daily	Expected Shadow Flicker - Annual
		X (Easting)	Y (Northing)	(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
712	Non-Participating	732646.32	4891326.17	0:00	0	0:00	0:00
713	Non-Participating	729297.15	4887795.84	0:00	0	0:00	0:00
714	Non-Participating	734492.64	4891386.58	0:00	0	0:00	0:00
715	Non-Participating	733243.76	4892597.80	0:00	0	0:00	0:00
716	Non-Participating	733109.39	4892398.67	0:00	0	0:00	0:00
717	Non-Participating	731201.31	4891242.10	7:28	38	0:19	2:40
718	Participating	730749.54	4891299.90	26:37	87	0:29	9:36
719	Non-Participating	730751.43	4891412.92	20:41	70	0:29	7:11
724	Non-Participating	729948.61	4889142.31	52:22	116	0:43	17:39
725	Participation Pending	730464.35	4889505.78	49:15	69	1:01	16:25
727	Non-Participating	730014.26	4890117.37	48:48	123	0:47	17:30
728	Participation Pending	730040.78	4892226.62	0:00	0	0:00	0:00
729	Non-Participating	729908.45	4892548.55	0:00	0	0:00	0:00
730	Non-Participating	731654.41	4891914.55	2:29	17	0:13	0:45
731	Non-Participating	731685.01	4892135.23	2:11	17	0:12	0:41
732	Non-Participating	731470.35	4891866.41	3:24	20	0:15	1:03
733	Non-Participating	731480.38	4891969.22	3:16	20	0:15	1:01
735	Participating	727081.69	4891135.05	60:29	137	0:44	20:28
736	Participation Pending	726743.00	4890587.95	24:50	63	0:37	7:40
737	Participation Pending	728190.56	4891899.01	51:45	211	0:31	16:48
738	Non-Participating	725835.57	4887861.84	0:00	0	0:00	0:00
739	Non-Participating	725266.82	4888158.71	0:00	0	0:00	0:00
740	Non-Participating	725278.78	4887707.37	0:00	0	0:00	0:00
741	Non-Participating	723898.24	4887405.24	0:00	0	0:00	0:00
742	Non-Participating	723511.96	4887931.38	0:00	0	0:00	0:00
743	Non-Participating	722983.80	4887809.65	0:00	0	0:00	0:00
751	Non-Participating	720815.07	4889613.59	0:00	0	0:00	0:00
752	Non-Participating	721466.96	4889652.96	0:00	0	0:00	0:00
753	Non-Participating	721981.26	4889138.31	0:00	0	0:00	0:00
754	Non-Participating	722116.02	4888599.25	0:00	0	0:00	0:00
755	Non-Participating	723338.76	4889551.18	0:00	0	0:00	0:00
756	Non-Participating	723743.31	4889680.88	0:00	0	0:00	0:00
757	Non-Participating	723925.24	4889297.19	0:00	0	0:00	0:00
758	Non-Participating	725383.24	4889715.19	15:15	50	0:27	5:31
759	Non-Participating	723425.14	4891169.14	0:00	0	0:00	0:00
760	Non-Participating	723562.07	4891024.38	0:00	0	0:00	0:00
761	Non-Participating	723636.80	4890892.68	0:00	0	0:00	0:00
762	Non-Participating	722028.37	4890492.16	0:00	0	0:00	0:00
763	Non-Participating	721923.90	4891388.59	0:00	0	0:00	0:00
764	Non-Participating	720716.93	4891096.77	0:00	0	0:00	0:00
765	Non-Participating	720468.13	4892279.88	0:00	0	0:00	0:00
766	Non-Participating	723630.99	4892268.00	8:00	30	0:23	2:40
767	Participation Pending	724765.40	4891253.36	9:25	72	0:11	3:07
768	Non-Participating	725750.62	4891088.34	23:14	68	0:37	7:51
769	Participating	725045.38	4892836.61	46:21	153	0:42	16:05
770	Participating	725010.85	4892941.98	46:41	157	0:41	15:50
771	Participating	725479.39	4892961.15	73:33	182	0:43	26:07
772	Non-Participating	723781.46	4892775.04	14:49	64	0:26	5:00
774	Non-Participating	720439.90	4890371.37	0:00	0	0:00	0:00
775	Non-Participating	728853.90	4892719.65	9:02	37	0:24	2:49
776	Non-Participating	728801.94	4892921.48	15:10	67	0:29	5:11
777	Non-Participating	729635.83	4893615.87	3:55	24	0:15	1:23
778	Non-Participating	729999.74	4893607.42	1:50	16	0:10	0:38
779	Participation Pending	728861.32	4894369.94	36:57	107	0:32	11:12
780	Non-Participating	728556.68	4894573.27	41:39	107	0:36	12:21
781	Non-Participating	728645.69	4896057.62	8:16	47	0:18	2:52
782	Participation Pending	727977.67	4896142.98	44:08	113	0:41	15:20
784	Non-Participating	728774.94	4896417.56	5:51	39	0:16	1:53
785	Participating	727978.15	4894306.55	77:50	113	1:09	23:48
786	Non-Participating	727907.63	4894565.86	33:09	106	0:34	10:41
787	Non-Participating	727093.82	4894678.64	18:53	90	0:27	6:22
788	Participation Pending	727104.75	4894362.78	64:04	149	0:36	21:54
789	Participating	725310.76	4894521.95	28:47	106	0:33	10:00
790	Participation Pending	725509.66	4894014.70	43:36	152	0:32	14:18

Table B-1: Shadow Flicker Modeling Results

Modeling ID	Participation Status	Coordinates NAD83 UTM Zone 14N (meters)		Worst-Case Shadow Flicker - Annual	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker - Daily	Expected Shadow Flicker - Annual
		X (Easting)	Y (Northing)	(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
791	Non-Participating	724967.32	4896341.13	39:31	108	0:46	12:00
792	Non-Participating	726537.89	4896321.29	38:16	103	0:34	13:05
793	Non-Participating	725625.32	4896059.58	27:45	72	0:41	8:51
794	Non-Participating	727871.78	4895905.85	15:31	55	0:29	5:06
797	Non-Participating	731519.45	4892696.60	0:00	0	0:00	0:00
798	Non-Participating	731621.39	4893034.27	0:00	0	0:00	0:00
799	Non-Participating	730265.43	4894441.93	0:00	0	0:00	0:00
802	Non-Participating	720343.60	4892921.56	0:00	0	0:00	0:00
803	Non-Participating	720221.40	4893006.28	0:00	0	0:00	0:00
804	Non-Participating	720340.52	4892977.01	0:00	0	0:00	0:00
811	Non-Participating	719410.70	4896051.41	0:00	0	0:00	0:00
822	Non-Participating	721833.38	4893983.40	40:56	79	0:45	13:52
824	Participation Pending	723617.02	4894105.53	87:34	199	0:47	28:33
825	Participation Pending	723318.79	4894198.02	73:45	198	0:56	24:05
826	Non-Participating	723313.85	4894372.20	49:52	156	0:30	15:55
827	Non-Participating	726284.30	4884664.15	0:00	0	0:00	0:00
828	Non-Participating	726227.23	4884779.09	0:00	0	0:00	0:00
830	Non-Participating	723456.49	4896774.78	0:00	0	0:00	0:00
832	Non-Participating	737140.54	4887432.60	0:00	0	0:00	0:00
833	Non-Participating	737433.18	4887469.45	0:00	0	0:00	0:00
834	Non-Participating	725417.04	4885728.20	0:00	0	0:00	0:00
835	Non-Participating	725421.79	4885694.95	0:00	0	0:00	0:00
836	Non-Participating	725445.15	4885913.86	0:00	0	0:00	0:00
837	Non-Participating	725103.37	4886342.53	0:00	0	0:00	0:00
839	Non-Participating	725077.98	4886342.89	0:00	0	0:00	0:00
840	Non-Participating	731572.34	4894632.10	0:00	0	0:00	0:00
842	Non-Participating	731597.95	4894485.89	0:00	0	0:00	0:00
843	Non-Participating	731473.93	4894440.61	0:00	0	0:00	0:00
844	Non-Participating	731477.54	4894370.11	0:00	0	0:00	0:00
845	Non-Participating	731452.84	4894245.07	0:00	0	0:00	0:00
847	Participating	726235.51	4894082.71	63:01	185	0:36	20:16
848	Non-Participating	732868.23	4884482.98	0:00	0	0:00	0:00
849	Non-Participating	726865.68	4890093.88	54:49	99	0:54	19:04
850	Non-Participating	731684.04	4886483.92	6:00	40	0:17	2:02
852	Non-Participating	728972.39	4888154.05	4:49	29	0:15	1:45
864	Non-Participating	719282.97	4897515.15	0:00	0	0:00	0:00
865	Non-Participating	720904.17	4899187.90	0:00	0	0:00	0:00
866	Non-Participating	722203.20	4898274.38	0:00	0	0:00	0:00
867	Non-Participating	721690.13	4899054.22	0:00	0	0:00	0:00
868	Non-Participating	723264.12	4899043.61	0:00	0	0:00	0:00
869	Non-Participating	723148.39	4899253.41	0:00	0	0:00	0:00
870	Non-Participating	725023.56	4897684.84	0:00	0	0:00	0:00
871	Non-Participating	725540.63	4897544.85	0:00	0	0:00	0:00
872	Non-Participating	724971.27	4897228.10	0:00	0	0:00	0:00
878	Non-Participating	723990.20	4899418.91	0:00	0	0:00	0:00
879	Non-Participating	725325.11	4899964.56	0:00	0	0:00	0:00
882	Non-Participating	724716.86	4900688.30	0:00	0	0:00	0:00
883	Non-Participating	725875.26	4900834.50	0:00	0	0:00	0:00
884	Non-Participating	722427.30	4900617.84	0:00	0	0:00	0:00
885	Non-Participating	721991.20	4899704.37	0:00	0	0:00	0:00
1068	Non-Participating	727482.24	4897801.59	0:00	0	0:00	0:00
1069	Non-Participating	728084.72	4897923.99	0:00	0	0:00	0:00
1070	Non-Participating	730504.18	4896212.67	0:00	0	0:00	0:00
1072	Non-Participating	729364.11	4894384.06	9:40	47	0:20	3:04
1074	Non-Participating	720325.03	4892588.98	0:00	0	0:00	0:00
1077	Non-Participating	734900.82	4891425.42	0:00	0	0:00	0:00
1078	Non-Participating	736428.99	4889209.77	0:00	0	0:00	0:00
1079	Non-Participating	734972.49	4888730.37	0:00	0	0:00	0:00
1081	Non-Participating	726346.11	4887919.86	0:00	0	0:00	0:00
1083	Non-Participating	725143.82	4886375.84	0:00	0	0:00	0:00
1084	Non-Participating	726577.73	4886299.32	0:00	0	0:00	0:00
1087	Participating	731621.64	4889439.12	78:17	171	0:45	25:20
1088	Non-Participating	731749.76	4889593.80	45:10	136	0:30	14:41
1090	Non-Participating	731769.26	4890065.96	7:42	29	0:23	2:34

Table B-1: Shadow Flicker Modeling Results

Modeling ID	Participation Status	Coordinates NAD83 UTM Zone 14N (meters)		Worst-Case Shadow Flicker - Annual	Worst-Case Shadow Flicker Days per Year	Worst-Case Shadow Flicker - Daily	Expected Shadow Flicker - Annual
		X (Easting)	Y (Northing)	(HH:MM/year)	(Days/year)	(HH:MM/day)	(HH:MM/year)
1093	Non-Participating	723288.07	4889387.09	0:00	0	0:00	0:00
1095	Non-Participating	725153.49	4889482.45	13:58	64	0:20	5:19
1098	Non-Participating	726508.78	4897454.26	0:00	0	0:00	0:00
1099	Non-Participating	727202.86	4899979.73	0:00	0	0:00	0:00
1100	Non-Participating	726849.82	4900210.79	0:00	0	0:00	0:00
1108	Participation Pending	725325.14	4892470.99	91:55	126	1:27	30:25
1113	Non-Participating	731414.48	4896650.84	0:00	0	0:00	0:00
1114	Non-Participating	731256.94	4897853.53	0:00	0	0:00	0:00
1115	Non-Participating	730478.86	4897657.20	0:00	0	0:00	0:00
1116	Non-Participating	728534.08	4898180.58	0:00	0	0:00	0:00
1128	Non-Participating	729187.40	4900664.42	0:00	0	0:00	0:00
1129	Non-Participating	729396.39	4900620.74	0:00	0	0:00	0:00
1130	Non-Participating	728551.29	4900178.78	0:00	0	0:00	0:00
1131	Non-Participating	728636.28	4899908.33	0:00	0	0:00	0:00
1159	Non-Participating	723474.28	4886340.82	0:00	0	0:00	0:00
1162	Non-Participating	722583.43	4886660.88	0:00	0	0:00	0:00
1164	Participation Pending	730031.13	4892325.02	0:00	0	0:00	0:00
1165	Non-Participating	723187.80	4897202.59	0:00	0	0:00	0:00
1166	Participating	731558.54	4889787.16	40:20	86	0:43	13:03
1220	Non-Participating	726862.73	4900154.76	0:00	0	0:00	0:00
1221	Non-Participating	729627.32	4899791.10	0:00	0	0:00	0:00
1222	Non-Participating	730232.94	4899163.96	0:00	0	0:00	0:00
1223	Non-Participating	730006.51	4899244.00	0:00	0	0:00	0:00
1224	Non-Participating	730463.57	4898318.26	0:00	0	0:00	0:00
1228	Non-Participating	733013.45	4894302.57	0:00	0	0:00	0:00
1229	Non-Participating	733098.15	4893740.29	0:00	0	0:00	0:00
1230	Non-Participating	733858.46	4890521.03	0:00	0	0:00	0:00
1231	Non-Participating	735473.83	4889953.67	0:00	0	0:00	0:00
1232	Non-Participating	735685.71	4891453.72	0:00	0	0:00	0:00
1237	Non-Participating	725438.81	4885334.67	0:00	0	0:00	0:00
1238	Non-Participating	725428.82	4885373.50	0:00	0	0:00	0:00
1239	Non-Participating	725418.27	4885437.82	0:00	0	0:00	0:00
1240	Non-Participating	725445.66	4885483.24	0:00	0	0:00	0:00
1241	Non-Participating	725416.53	4885531.51	0:00	0	0:00	0:00
1244	Non-Participating	727344.46	4883105.16	0:00	0	0:00	0:00
1252	Non-Participating	731233.76	4895703.87	0:00	0	0:00	0:00
1253	Non-Participating	731421.66	4895952.93	0:00	0	0:00	0:00
1254	Non-Participating	731504.38	4895953.21	0:00	0	0:00	0:00
1255	Non-Participating	732316.50	4896167.19	0:00	0	0:00	0:00
1256	Non-Participating	732352.81	4896137.06	0:00	0	0:00	0:00
1257	Non-Participating	732542.24	4895379.65	0:00	0	0:00	0:00
1258	Non-Participating	732564.87	4895321.64	0:00	0	0:00	0:00

APPENDIX E – Electromagnetic Interference Analysis

Lake Benton II, MN
Electromagnetic Interference Analysis

The following document was prepared by WindLogics Inc. for the use of NextEra Energy Resources, Juno Beach, Florida, its successors and/or assigns. WindLogics Inc. has prepared this report based on available government information by the Federal Communications Commission (FCC) and internal analysis methods. We cannot guarantee the accuracy of the data collected by the FCC. Microwave tower and link information may be inaccurate or incomplete due to FCC applicant error.

Executive Summary

A review of the Federal Communications Commission (FCC) national database and the Universal Licensing System (ULS) was conducted to identify microwave links, microwave towers, local cellular towers, media towers, television, and aviation towers. Wind turbine offset distances were taken in consideration for the design of the wind turbine array.

Electromagnetic analysis results show that interference is not expected to impact nearby microwave, AM, cellular, TV, and aviation towers based on the array design.

The analysis is current as of April 26, 2018. WindLogics recommends a refresh of this analysis if the proposed wind energy generation project has not been constructed after two years.

This report only provides analysis for licensed radio towers and links found within the FCC database. Many local municipalities (police, fire, etc.) do not license microwave links, WindLogics recommends that NextEra Energy Resources coordinate with the appropriate local municipality officials. Also not included within the database are microwave towers and links utilized by the Federal government (Dept. of Defense, Dept. of Commerce, etc.), again for public safety concerns. A Federal communications study by the National Telecommunications and Information Agency (NTIA) was filed to identify potential interference caused to Federal microwave communication and a response was received November 20, 2017 stating “No Harmful Interference Anticipated” (NHIA).

Lake Benton II, MN – Electromagnetic Interference

WindLogics, an affiliate of NextEra Energy Resources assessed the potential for interference of licensed communication links in close proximity the proposed Lake Benton II Project area for the purposes of determining exclusion zones to aid the design of a proposed wind energy generation project. This report summarizes the microwave links and towers along with local cellular towers, media towers (AM and FM), television, and aviation towers, identified within and near the assessment area.

The site is located in Pipestone County, Minnesota, roughly 76 kilometers northeast of the city of Sioux Falls, South Dakota. Figure 1 below, depicts the project location of Lake Benton II.

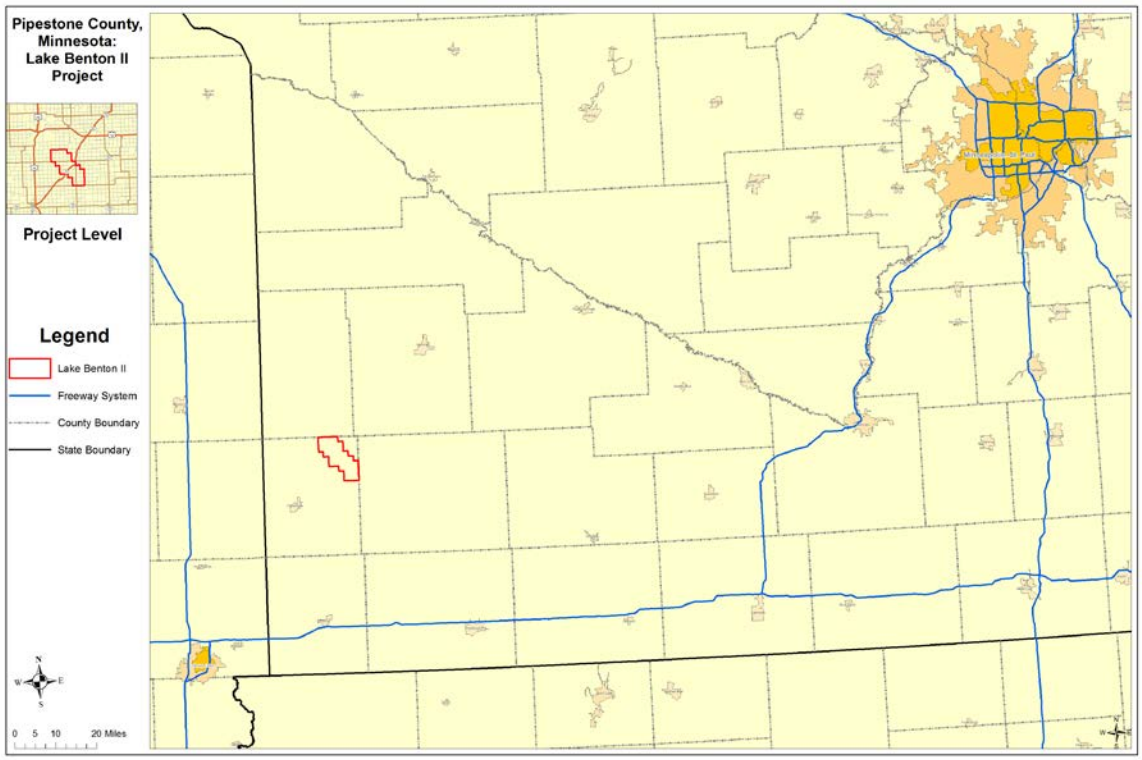


Figure 1: Lake Benton II Project Location

Turbine Technology

Lake Benton II is a proposed hybrid wind energy generation site that consists of 44 turbine locations. The layout is composed of 39 GE2.3-116 turbines (2.3MW rated capacity, 116m rotor diameter, 90m hub height) and 5 GE2.1-116 (2.1MW rated capacity, 116m rotor diameter, 80m hub height) for a total capacity of 100.2 MW. Turbine layout details are included in Table 1 and Figure 2.

Turbine Technology	GE2.3-116 / GE2.1-116
Turbine Count	39 / 5
Hub Height (m)	90 / 80
Rotor Diameter (m)	116 / 116
Turbine Rated Power (MW)	2.3 / 2.1
Total Capacity (MW)	100.2

Table 1: Lake Benton II Layout Summary

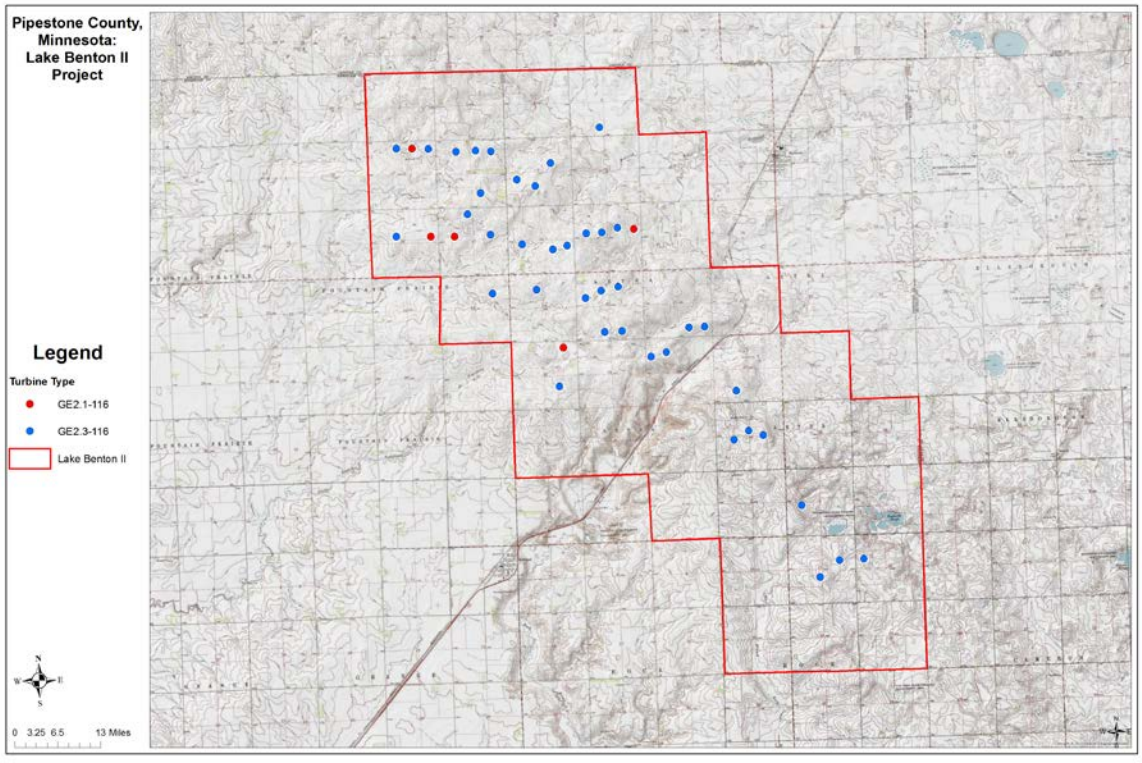


Figure 2: Lake Benton II Turbine Technology Allocation

Data Sources

Within the United States, the location of industrial and commercial telecommunication systems, including microwave links, are collected and maintained by the Wireless Telecommunications Bureau (WTB), a division of the FCC. This data is made publicly available through the Universal Licensing System (ULS) database, which contains licensing information on both current and permit pending facilities for microwave, cellular, media, and several radio services utilized by private industry (non-Federal telecommunication systems). License information supplied within the ULS database is updated daily, and is dependent upon information provided by each individual applicant.

WindLogics used several data sources (ESRI satellite imagery, Google Earth, etc.) of high resolution imagery to aid in assessing the accuracy of the geographic locations of each microwave tower with links intersecting the project boundary or area of interest (AOI).

Methodology

The ULS database, described earlier, was used to identify the microwave towers, microwave links, cellular, AM, FM, and aviation towers within a 25-kilometer radius that may impact the Lake Benton II Wind Farm. Television towers were identified within a 100-kilometer radius. The database provides detailed information for each radio tower and link, which was used to calculate turbine exclusion zones to ensure interference compliance.

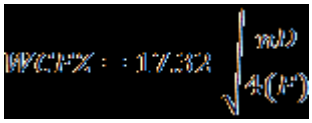
Exclusion zones for wind turbines near microwave links are calculated using a theory proposed by Bacon (2002), which identifies the radius of the 2nd Fresnel zone, a theoretical sphere representative of a propagating radio wave, as an appropriate offset distance. Calculations of the 2nd Fresnel zone can be determined by:

$$2nd\ Fresnel\ zone\ Radius: = \sqrt{\frac{2\lambda d_1 d_2}{d_1 + d_2}} \qquad (1)$$

Where:
d_1, d_2 = distances from each end of the radio path.
λ= wavelength of the corresponding radio frequency.

To account for precision errors within the ULS database, and to further reduce the potential for interference from a wind turbine, a Worst Case Fresnel Zone (WCFZ) was calculated for each microwave link. The WCFZ provides the maximum offset distance required, and is determined by the 2nd Fresnel zone

radius obtained at the midpoint of the link, where $d_1 = d_2$. Adjusting Eq. 1 to calculate the WCFZ in meters yields the following:



(2)

Where:
D = distance between the transmitter and receiver towers.
F = frequency in GHz.
n = Fresnel zone, which for the 2nd Fresnel Zone n = 2.

The calculated radius distance from Eq. 2 provides a three-dimensional turbine exclusion zone around each microwave link that can be used to guide wind turbine array design.

In addition to the WCFZ calculated for each microwave link, WindLogics applies an offset of one-half the rotor diameter plus 10 meter to account for turbine blade overhang. A turbine overhang offset using a 116 m turbine technology is included within this analysis to represent the GE2.3-116 and GE2.1-116 wind turbine generators.

The WTB cannot provide quality assurance for every license within the ULS database, so accuracy of the data relies on applicant certifications, and, in extreme cases, license audits. It has been WindLogics' experience that most inaccuracies occur with regard to the location of the radio towers, where approximation or lack of precision of the geographic coordinates can result in a difference in the position of the tower by as much as 500 meters.

However, for this analysis, WindLogics used high-resolution satellite imagery to identify possible tower location errors. Most microwave, media, and cellular towers can be clearly viewed within high resolution satellite imagery. In addition, WindLogics performed on-site verification to identify the exact location of the transmitter and receiver towers. Adjustments to the location of the microwave, media, and cellular towers are only made if clear evidence shows an inaccuracy.

Microwave Links and Microwave Towers

Two microwave towers were identified within the Project area. However, fourteen microwave links have been identified near the project area and twelve have been found to intersect the AOI. The WCFZ for all of these links have been calculated, and the appropriate turbine offset has been used to minimize any harmful impact from the proposed turbine layout. Note that some of these links share the same trajectory as they represent two one-way communication channels.

Figure 3 below illustrates the position of each microwave link with respect to the project boundary and turbine locations.

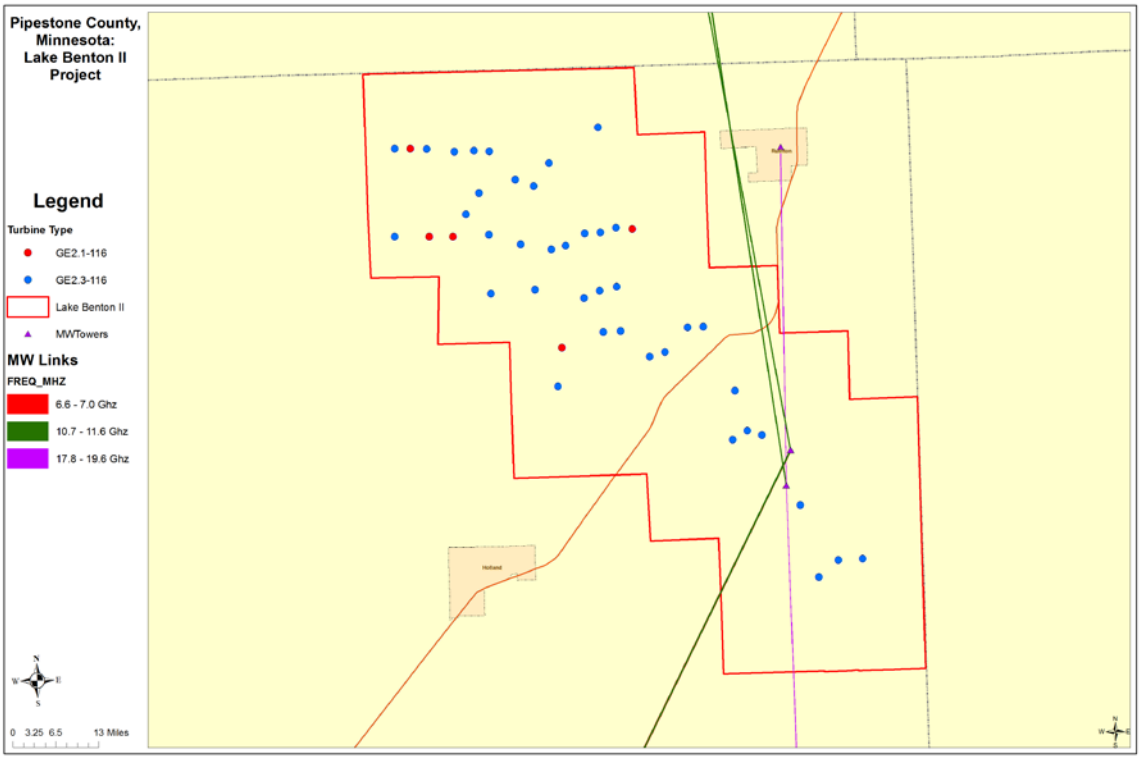


Figure 3: Lake Benton II with Microwave Links

Table 2 provides more detailed information on each microwave link in proximity to the area with the calculated WCFZ.

ID	STATUS	TRANSMITTER CALLSIGN	MICROWAVE NAME	BANDFREQ (Ghz)	WCFZ (m)	BEAM LENGTH (km)
1	Active	WQGD798	Affiniti, LLC	10.8	16.54	19.69
2	Active	WQGD800	Affiniti, LLC	11.3	16.18	19.69
3	Active	WQGD800	Affiniti, LLC	18.0	9.40	10.61
4	Active	WQGD800	Affiniti, LLC	17.8	8.23	8.04
5	Active	WQGD808	Affiniti, LLC	19.6	9.02	10.61
6	Active	WQGE405	Affiniti, LLC	19.4	7.89	8.04
7	Active	WQOR214	Minnesota, State of	6.8	23.97	26.01
8	Active	WQOY458	Minnesota, State of	6.6	24.26	26.01
9	Active	WQXT307	Minnesota Valley Television Improvement Corporation	10.8	15.99	18.34
10	Active	WQXT307	Minnesota Valley Television Improvement Corporation	11.1	18.77	26.01
11	Active	WQXT308	Minnesota Valley Television Improvement Corporation	11.6	18.37	26.01
12	Active	WQXT658	Minnesota Valley Television Improvement Corporation	11.2	15.64	18.34
13	Active	WPNE586	WEST CENTRAL MINNESOTA EDUCATIONAL TV CORP.	7.0	37.35	65.34
14	Active	WPNE587	WEST CENTRAL MINNESOTA EDUCATIONAL TV CORP.	6.9	37.76	65.34

Table 2: Detailed Information on Microwave Links Close to the Project Boundary

The Worst Case Fresnel Zone was calculated for each microwave link and a conservative offset of 68 meters was used to reduce the probability of harmful

interference. Figure 4 provides aerial imagery of the turbine layout relative to the Fresnel zones and their offsets that intersect the project boundary.

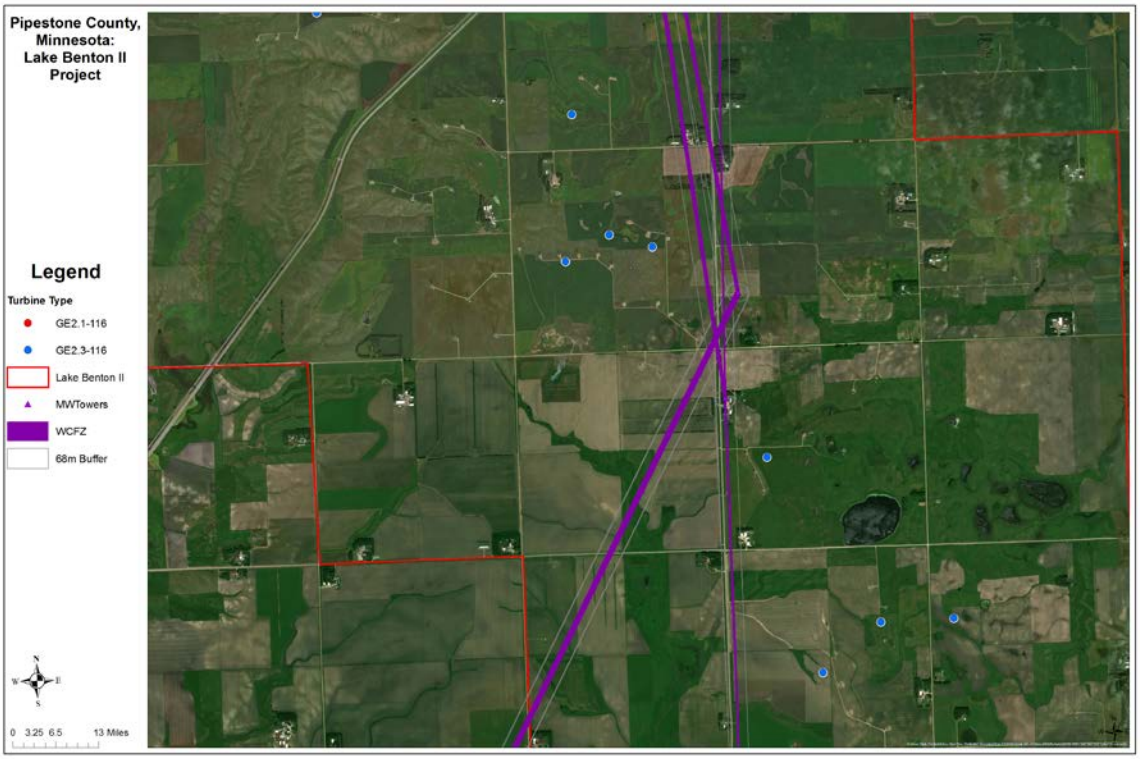


Figure 4: Lake Benton II Fresnel Zone Intersects

Cellular Towers

No cellular towers were identified within the project boundary. Eleven cellular towers were discovered within 25 km of the boundary and are identified below.

Harmful interference associated with cellular towers is not likely as cellular transitions or packet switching occurs when a cellular link becomes unavailable.

ID	STATUS	CALLSIGN	LICENSEE	LATITUDE	LONGITUDE	DISTANCE To AOI (km)
1	Active	KNKN272	AT&T Mobility Spectrum LLC	44.238583	-96.487222	21.8
2	Active	KNKN282	AT&T Mobility Spectrum LLC	44.039667	-96.286250	11.3
3	Active	KNKN282	AT&T Mobility Spectrum LLC	43.994444	-95.971944	10.8
4	Active	KNKN290	Alltel Communications, LLC	43.980528	-96.207806	11.7
5	Active	KNKN290	Alltel Communications, LLC	43.999389	-95.823056	20.7
6	Active	KNKN290	Alltel Communications, LLC	43.999056	-96.319694	17.4
7	Active	KNKN422	Alltel Communications, LLC	44.259722	-96.306944	9.5
8	Active	KNKN422	Alltel Communications, LLC	44.245222	-95.877778	20.7
9	Active	KNKN422	Alltel Communications, LLC	44.280889	-96.118639	9.5
10	Active	KNKN450	AT&T Mobility Spectrum LLC	44.241333	-96.264889	5.8
11	Active	KNKN450	AT&T Mobility Spectrum LLC	44.217417	-96.077194	5.8

Table 3: Cellular Towers within 25 km of the Project Boundary

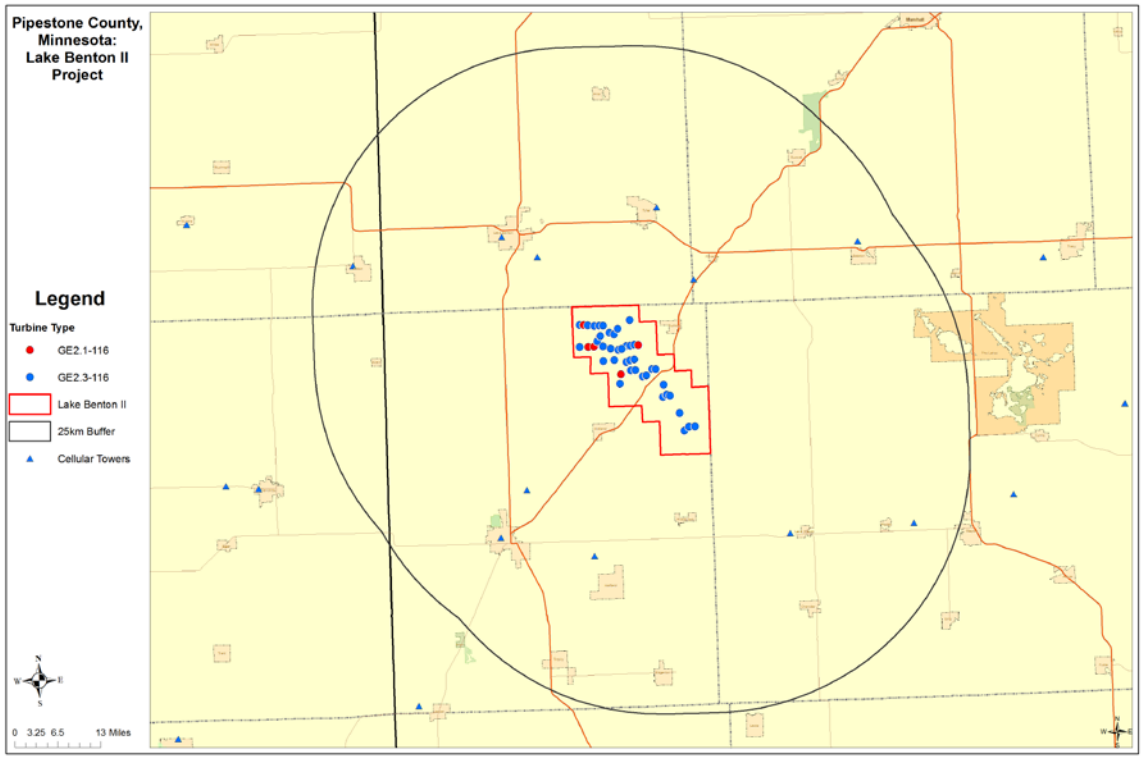


Figure 5: Cellular Towers within 25 km of the Project Boundary

Media Towers

No active AM radio towers were identified within the project boundary. One AM tower was discovered within 25 km of the project boundary and is included in Table 4 and figure 6.

While no harmful interference to the AM towers is expected, reception of AM radio stations near each individual turbine may be impacted, especially for areas

on the edge of AM radio coverage. The exclusion distance from AM towers is 1 wavelength from non-directional antennas and 10 wavelengths or 3 kilometers from directional antennas (Marlowe, 2015). Given most AM radio receptors will be nearby dwellings, which should have a sufficient offset from each turbine, any interruption to reception from the installation of wind turbines is expected to be minimal. The closest AM tower, KLOH, is located 18.5 km from the project boundary, and has a broadcasting frequency of 1050 kHz which corresponds to a wavelength of 285.7 m. Thus, the proposed layout is greater than 10 wavelengths away from the closest station.

ID	STATUS	CALLSIGN	LICENSEE	Frequency kHz	LATITUDE	LONGITUDE	DISTANCE To AOI (km)
1	Active	KLOH	WALLACE CHRISTENSEN	1050	43.995278	-96.344722	18.5

Table 4: AM Transmitter Towers within 25 km of the Project Boundary

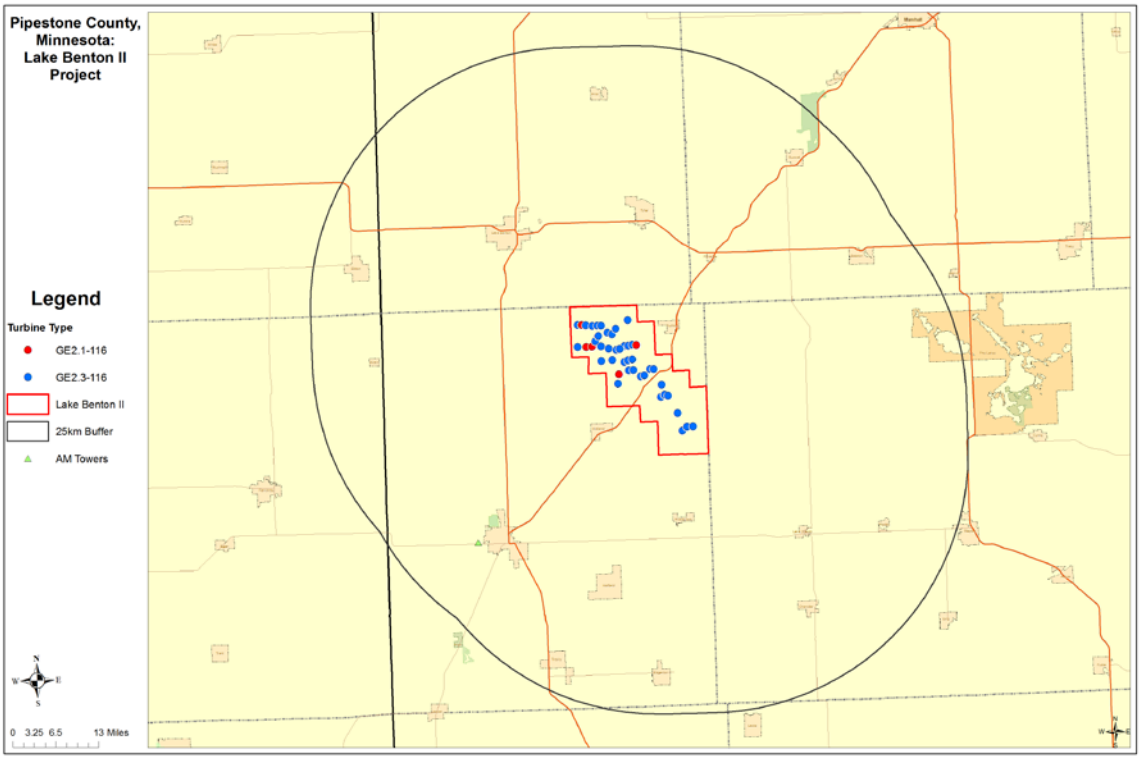


Figure 6: AM Transmitter Towers within 25 km of the Project Boundary

No active FM radio tower was identified within the project boundary. Six FM towers were discovered within 25 km of the project boundary and are included in Table 5 and figure 7.

For frequencies near 100 MHz, it has been shown that wind turbines have minimal effect on the radiation pattern at distances greater than 100m from the FM transmitter (Salema, 1999). FM stations that are closer than 4 kilometers to wind turbines have the potential to experience interference (Marlowe, 2015).

Given most FM radio receptors will be nearby dwellings, which should have a sufficient offset from each turbine, any interruption to reception from the installation of wind turbines is expected to be minimal. No FM towers are located less than 4 km from the AOI.

ID	STATUS	CALLSIGN	LICENSEE	Frequency MHz	LATITUDE	LONGITUDE	DISTANCE To AOI (km)
1	Active	K257FP	WALLACE CHRISTENSEN	99.3	43.995833	-96.345833	18.5
2	Active	KISD	WALLACE CHRISTENSEN	98.7	43.897778	-95.947222	21.6
3	Active	KJOE	WALLACE CHRISTENSEN	106.1	43.897778	-95.947222	21.6
4	Active	KKCK	KMHL BROADCASTING COMPANY	99.7	44.282222	-96.318056	12.0
5	Active	KNSW	MINNESOTA PUBLIC RADIO	91.7	43.883611	-95.928889	23.0
6	Active	KRSW	MINNESOTA PUBLIC RADIO	89.3	43.883611	-95.928889	23.0

Table 5: FM Transmitter Towers within 25 km of the Project Boundary

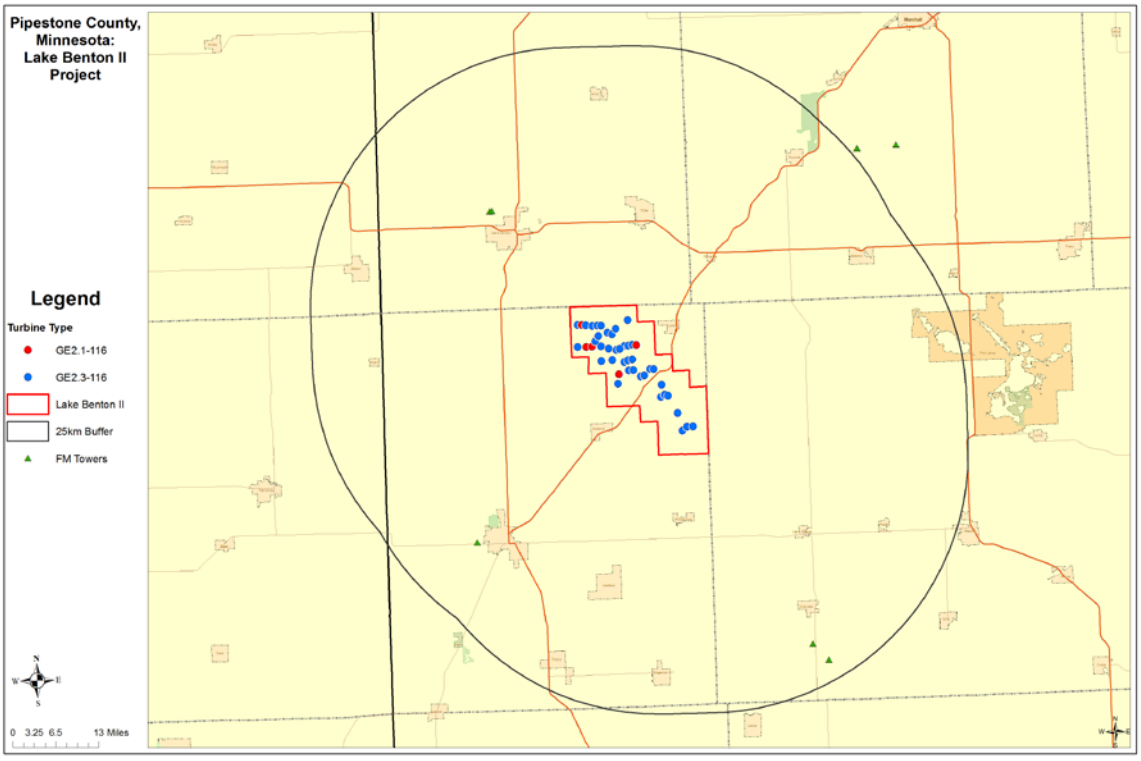


Figure 7: FM Transmitter Towers within 25 km of the Project Boundary

Television Stations

No digital or analog television towers were identified within the project boundary. Table 6 and figure 8 identifies licensed television stations within 100 km of the project boundary as determined by the FCC. There is one channel less than 50 km from the project boundary which is likely to be broadcasting to the region.

ID	CALLSIGN	LICENSEE	SERVICE	STATION	ERP	LATITUDE	LONGITUDE	DISTANCE To AOI (km)
1	KCSD-TV	SOUTH DAKOTA BOARD OF DIRECTORS FOR EDUCATIONAL TELECOMMUNIC	DT	24	80.9 kw	43.574444	-96.655278	69.8
2	KDLT-TV	RED RIVER BROADCAST CO., LLC	DT	47	589 kw	43.505000	-96.556111	72.2
3	KELO-TV	NEXSTAR BROADCASTING, INC.	DT	11	30 kw	43.518611	-96.534722	71.4
4	KESD-TV	SOUTH DAKOTA BOARD OF DIRECTORS FOR EDUCATIONAL TELECOMMUNIC	DT	8	15 kw	44.337778	-97.228333	81.9
5	KRWF	KSAX-TV, INC.	DT	27	58 kw	44.484167	-95.490833	61.2
6	KSFY-TV	GRAY TELEVISION LICENSEE, LLC	DT	13	22.7 kw	43.518611	-96.534722	69.3
7	KSMN	WEST CENTRAL MINNESOTA EDUCATIONAL TV CORP.	DT	15	200 kw	43.897778	-95.947222	20.9
8	KTTW	INDEPENDENT COMMUNICATIONS, INC.	DT	7	7.5 kw	43.505278	-96.571944	72.1
9	KWSD	J.F. BROADCASTING, LLC	DT	36	36.9 kw	43.505278	-96.571944	72.1
10	K35GR-D	RED RIVER BROADCAST CO., LLC	TX	35	11.9 kw	44.487500	-97.238889	87.4
11	K56GF	DIGITAL NETWORKS-MIDWEST, LLC	TX	23	15 kw	43.553889	-96.684722	72.6
12	K56GF	DIGITAL NETWORKS-MIDWEST, LLC	TX	56	10.1 kw	43.553889	-96.684722	72.6
13	KAUN-LP	J.F. BROADCASTING, LLC	TX	42	0.88 kw	43.535556	-96.742778	77.2
14	KCPO-LP	G.I.G., INC.	TX	26	7.57 kw	43.534167	-96.739167	77.1
15	KCWS-LP	J.F. BROADCASTING, LLC	TX	44	0.68 kw	43.535556	-96.742778	77.2

Table 6: Television Stations within 100 km of the Project Boundary

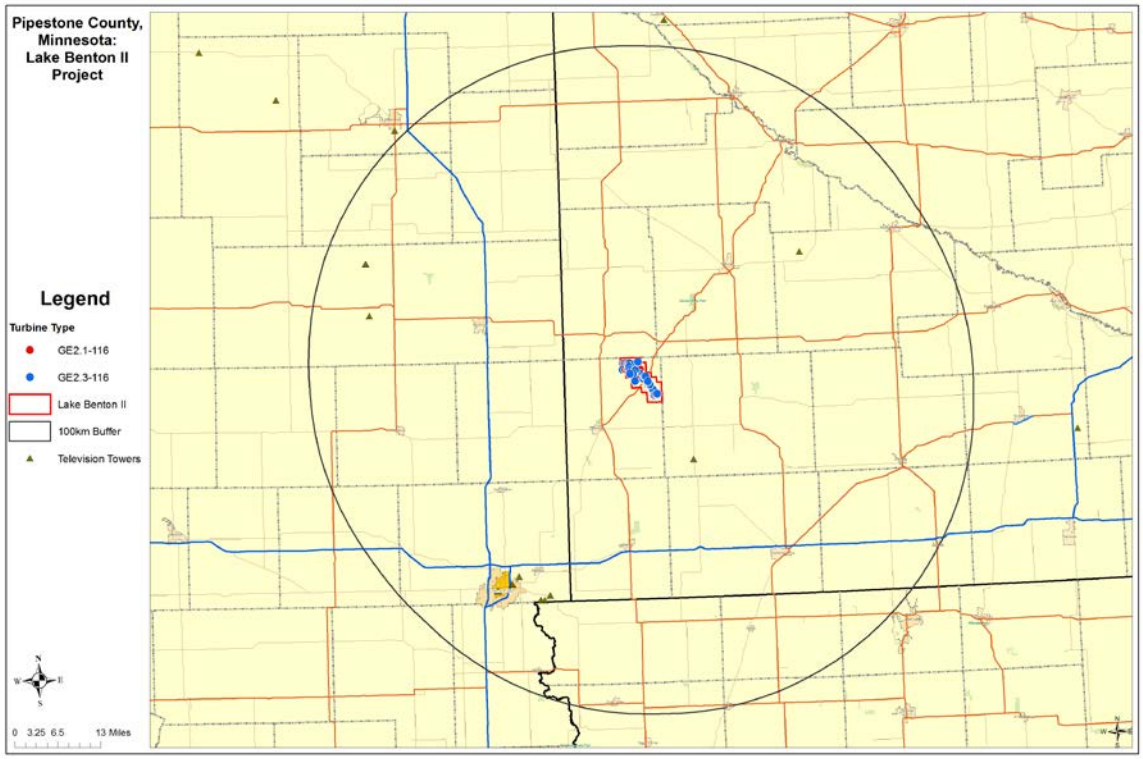


Figure 8: Television Stations within 100 km of the Project Boundary

While the impact of wind turbines on digital television reception is not well known due to limited cases and testing, any interference is expected to be limited to areas near the edge of station reception, areas near a turbine that is within the line-of-sight between the transmit tower and receptor, and areas of complex topography (OfCom, 2009). Most of the stations within 100km are low power stations or translator stations and have limited range and are not anticipated to experience reception degradation. There are two full power stations KDLT-TV and KSMN which have a possibility of experiencing reception degradation if the proposed wind farm is located in the line-of-sight.

It is important to note that this assessment is based on broad assumptions, as it is difficult to accurately pinpoint the impact a large wind farm may have on each individual household due to a large number of external variables (topography, weather, antennae, etc.) which impact the propagation of the television radio signal.

Aviation Towers

No active Aviation towers were identified within the project boundary. Four aviation towers were discovered within 25 km of the project boundary and are included in Table 7 and Figure 9.

While no harmful interference is expected for the aviation towers; Lake Benton II is subject to a FAA study to determine any exclusion zones. Proposed turbine locations will maintain the standard appropriate offset distances in addition to any setbacks set by the agency to minimize harmful impact.

ID	STATUS	CALLSIGN	LICENSEE	SERVICE	LATITUDE	LONGITUDE	DISTANCE To AOI (km)
1	Active	KFP4	State of Minnesota, Dept. of Transportation, Office of Aeronautics	AF Aeronautical and Fixed	43.986278	-96.297611	16.5
2	Active	KNB7	PIPESTONE, CITY OF	AF Aeronautical and Fixed	43.983306	-96.300306	16.9
3	Active	KXI9	MINNESOTA, STATE OF	AF Aeronautical and Fixed	43.983333	-96.300278	16.9
4	Active	WQDA480	State of Minnesota, Dept of Transportation, Office of Aeronautics	AF Aeronautical and Fixed	43.990556	-95.781111	24.2

Table 7: Aviation Towers within 25 km of the Project Boundary

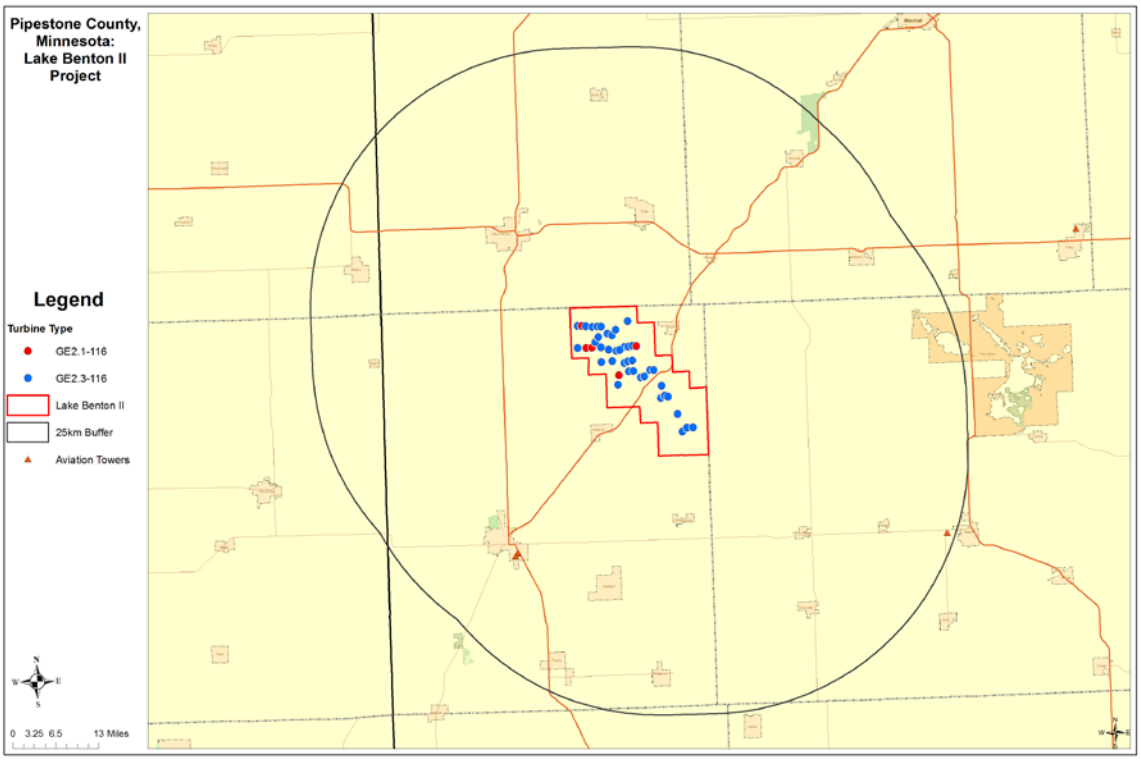


Figure 9: Aviation Towers within 25 km of the Project Boundary

Conclusion and Recommendations

This report summarizes the microwave towers, microwave links, cellular towers, media towers, television towers, and aviation towers within and near the project boundary. Twelve microwave links were found to intersect the project boundary, and an appropriate offset to the WCFZ has been utilized to mitigate harmful interference from the proposed turbine layout. No interference from the proposed turbine layout is expected near microwave, AM, cellular, aviation, and TV towers. This analysis is current as of April 26, 2018. WindLogics recommends a refresh of this analysis if the proposed wind energy generation project has not been constructed after two years.

It is important to note that this report only provides analysis for licensed radio towers and links found within the FCC-ULS database. Many local municipalities (police, fire, etc.) do not license microwave links, WindLogics recommends NextEra Energy Resources coordinate with the appropriate local municipality officials in regard to the Lake Benton II project. Also not included within the database are microwave towers and links utilized by the Federal government (Dept. of Defense, Dept. of Commerce, etc.), again for public safety concerns. A Federal communications study by the National Telecommunications and Information Agency (NTIA) has been conducted stating no harmful interference is expected in the Project area.

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APPENDIX F – Phase 1 Cultural Literature Review

PHASE Ia CULTURAL RESOURCES LITERATURE REVIEW

for the

LAKE BENTON II WIND ENERGY CENTER
PIPESTONE COUNTY, MINNESOTA

Prepared for

Lake Benton Power Partners II, LLC
700 Universe Boulevard MS JES/JB
Juno Beach, Florida 33408

Prepared by: Atwell, LLC

Atwell, LLC Project Number: 17000619

November 14, 2017

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APPENDICES

I. CULTURAL RESOURCES MAP

EXECUTIVE SUMMARY

Lake Benton Power Partners II, LLC requested that Atwell, LLC conduct a Phase Ia Cultural Resources Literature Review (Phase Ia) for the Lake Benton II Wind Energy Center in Pipestone County, Minnesota. Atwell conducted the Phase Ia for the re-development of the existing LBII WEC. The LBII WEC contains approximately 25,597 acres of privately owned land (WRA). The WRA is located in southwest Minnesota (SHPO Regions 1 and 2s) within Fountain Prairie Township (Sections 1, 2, 11, 12, 13, 14, and 24 T108N, R45W), Aetna Township (Sections 5-9, Sections 16-22, and Sections 26-36 T108N, R44W), and Rock Township (Sections 1-4 and Sections 10-15 107N, R44W) Pipestone County. For the purpose of this report, a one-mile buffer was included surrounding the Project Area (WRA Plus).

A Large Wind Energy Conversion System Site Permit will be obtained from the Minnesota Public Utilities Commission. As part of this process, Lake Benton Wind will consult with the Minnesota Historical Society to determine impacts to properties designated or listed on the Minnesota State Historic Sites Network, Minnesota State Register of Historic Places, or National Register of Historic Places. The Phase Ia was conducted following the State Historic Preservation Office Manual for Archaeological Projects in Minnesota (Anfinson 2005).

Atwell conducted the Phase Ia of the Lake Benton II Wind Energy Center by reviewing National Register of Historic Places, State Historic Preservation Office, and Office of State Archaeologist records, available historic atlases, and historic maps. Based on the results of this review, cultural resources designated or listed on the Minnesota State Historic Sites Network, Minnesota State Register of Historic Places, or National Register of Historic Places are not located within the WRA or the WRA Plus. Atwell identified 19 archaeological sites within the WRA, and two additional archaeological sites within the WRA Plus. Atwell recommends avoidance of the 19 archaeological sites identified within the WRA. Establishment of a 100-foot avoidance buffer around these archaeological sites should avoid any potential impacts. If avoidance is not possible additional archaeological investigation would be necessary to evaluate any potential impacts to these resources.

Once the Lake Benton II Wind Energy Center infrastructure has been sited, the Minnesota Historical Society may request additional archaeological survey of ground disturbance locations (wind turbine generators, access roads, collection lines, substation, operations and maintenance building, meteorological towers, etc.) during their review of the Lake Benton II Wind Energy Center. The exact nature of additional archaeological survey would be determined though consultation with the Minnesota Historical Society.

1.0 INTRODUCTION

Lake Benton Power Partners II, LLC (Lake Benton Wind) requested that Atwell, LLC (Atwell) conduct a Phase Ia Cultural Resources Literature Review (Phase Ia) for the proposed re-development of the Lake Benton II Wind Energy Center (LBII WEC) in Pipestone County, Minnesota. The LBII WEC involves the decommissioning and re-development of the existing Lake Benton II Wind Project. The re-developed LBII WEC has a proposed nameplate capacity of approximately 100 megawatts (MW). Although the exact wind turbine generator array has not been determined at this time, currently the planned technology would consist of approximately 44 General Electric (GE) 2.1 MW wind turbine generators (WTGs) and 4 GE 1.79 MW WTGs with associated access roads and collection lines.

1.1. Project Location

The LBII WEC is located in southwest Minnesota in Pipestone County between the City of Holland and the City of Ruthton. The City of Holland in Pipestone County is located approximately 1.0 mile southwest of the LBII WEC. The City of Ruthton in Pipestone County is located approximately 0.5 miles east of the LBII WEC. The LBII WEC utilizes a Wind Resource Area (WRA) of approximately 25,597 acres of privately owned land within Fountain Prairie Township (Sections 1, 2, 11, 12, 13, 14, and 24 T108N, R45W), Aetna Township (Sections 5-9, Sections 16-22, and Sections 26-36 T108N, R44W), and Rock Township (Sections 1-4 and Sections 10-15 T107N, R44W). Pipestone County is part of Archaeological Region 1 and Region 2s (Anfinson 2005). Refer to the Cultural Resource *Map* in **Appendix I** for a depiction of the LBII WEC. Atwell's Phase Ia Cultural Literature Review examined an area that included the WRA and a one-mile buffer (referred to as the "WRA Plus") to take into consideration any resources that might potentially be visually impacted by construction of WTGs. The WRA Plus also includes a small portion of southern Murray County which is in SHPO Region 2 and eastern Lincoln County which is in SHPO Region 2s.

1.2. Agency Involvement and Regulatory Requirements

The LBII WEC will obtain a Large Wind Energy Conversion System (LWECS) Site Permit from the Minnesota Public Utilities Commission (PUC) under Minnesota Statute (MS) 216F Wind Energy Conversion Systems. The Minnesota Historic Sites Act (MS 138.665) requires consultation with the Minnesota Historical Society (MnHS) for any state undertaking (including state funding or licensing of private projects) that will affect designated or listed properties on the Minnesota State Historic Sites Network (MSHSN), the Minnesota State Register of Historic Places (MSRHP), or the National Register of Historic Places (NRHP). The LBII WEC will have an unanticipated finds plan to address Minnesota's *Damages; Illegal Molestation of Human Remains; Burials; Cemeteries; Penalty; Authentication Statute* (MS 307.08), which protects known or suspected human burials and burial grounds regardless of land ownership status.

Currently, Section 106 of the National Historic Preservation Act does not apply to the LBII WEC. The LBII WEC would be located on private land and would not utilize state or federal funds. Lake Benton Wind will attempt to implement an avoidance strategy to reduce the need for federal permits. If Section 106 is triggered by a federal permit need for the LBII WEC, specific consultation related to Section 106 will be coordinated with the lead federal agency at that time.

2.0 ENVIRONMENT

The Environmental Protection Agency (EPA) Ecoregion mapping data (EPA 2015) indicates that the WRA is located within the Big Sioux Basin (BSB) Level IV ecoregion of the Northern Glaciated Plains Level III ecoregion (EPA 2015). The BSB receives approximately 24 to 27 inches of precipitation per year and is characterized by fertile gentle sloping glacial till with a well-developed drainage network and a small number of wetlands (EPA 2015).

The Minnesota Department of Natural Resources (MNDNR) Ecological Classification System (ECS) indicates that the WRA is also located within the Prairie Parkland Province (PPA), a land surface heavily affected by the Wisconsin glaciation (MNDNR 2017a). This PPA is further divided into Sections and Subsections. Specifically, the WRA is located within the Coteau Moraines (251Bb) and Inner Coteau (251Bc) subsections of the North Central Glaciated Plains Section (CGP). The CGP is primarily characterized by upland prairie vegetation communities (MNDNR 2017a). The CGP also supports small amounts of marsh, wetland prairie, and wet meadow communities (MNDNR 2017a). Today little remains of the native, pre-settlement upland prairie because of conversion to cropland and urban development (MNDNR 2017b).The Coteau Moraines and Inner Coteau subsections are areas that were historically dominated by tallgrass prairie with much smaller areas of wet prairies and forested land restricted to narrow stream margins (MNDNR 2017a).

The WRA is located within a rural area and is situated near the small cities of Ruthton (approximately 0.5 miles east) and Holland (approximately 1.0 mile southwest) in Pipestone County. The City of Woodstock is located approximately 2.8 miles southeast of the WRA and the City of Pipestone is located approximately 9.7 miles southwest of the WRA. Small farmsteads are scattered throughout the WRA and public roads are generally situated in a grid-like arrangement. Overall, the primary land use in the WRA is the existing LBII WEC and agricultural cropland. The WRA is covered by an extensive network of agricultural ditches with intermittent and ephemeral streams, many of which support herbaceous riparian buffers. The general topography of the WRA is described as undulating, rolling relief with approximate

elevations between 1,800 and 1,980 feet above mean sea level (MSL). The WRA generally slopes northeast and is mostly comprised of loamy well-drained soils with thick dark surface horizons.

2.1. Paleo-Environment

During the early Pleistocene epoch, circa 60,000 B.P, southwestern Minnesota experienced several glacial ice sheet advances and retreats which contributed to the formation of the landscape (Hudak et al. 2002). As a result of these glaciations cumulative and extensive loess deposits covered the region. The southwestern edge of the WRA is located within the most prominent topographic feature in the region, the Coteau des Prairies, or "highland of the prairie" (Hudak et al. 2002). The Coteau des Prairies formed as a result of reductive glacial activity. The thick accumulation of deposits almost entirely prevented glaciation from forming in Pipestone County at the end of the Pleistocene (60,000 B.P to 17,000 B.P.).

Following the retreat of glaciers, water erosion dissected the landscape, creating a well-drained topography characterized by very gently rolling hills and valleys and virtually no lake development (Hudak et al. 2002). Pipestone County was generally covered by spruce forest dominated by grasses and scattered conifer trees. Approximately 12,000 years ago, a deciduous forest dominated the region which was followed by the rapid spread of oak-elm forest (Hudak et al. 2002). By 9,000 B.P. the forests in the region migrated far to the northeast and prairie covered the region (Gibbon 2012).

The *Mn/Model: A Predictive Model of Precontact Archaeological Site Location for the State of Minnesota Final Report* (Hudak et al. 2002) states four biotic provinces have been used to understand the constantly changing environment present throughout history (30,000 B.P. to 3,000 B.P.) in the State of Minnesota: boreal forest (spruce and pine), mixed hardwood forest (conifer/deciduous forest), deciduous forest (including oak savanna), and prairie (Hudak et al. 2002). From 8000 B.P. to 3000 B.P. the WRA primarily consisted of prairie vegetation. Typical mammals found within the WRA during this period included buffalo, elk, skunk, badger, jackrabbit, ground squirrel, gopher, and coyote. Scattered forests of oak and hickory forests were present along stream valleys, around lakes, and on some plateaus and low hills. The most common tree species were oak, sycamore, cottonwood, elm, hackberry, maple, basswood, and beech. Hunter-gatherers entered prairies seasonally to hunt buffalo. Likewise, small groups lived year-round on the prairies (Gibbon 2012).

Climate had a direct effect on the lifeways of pre-contact hunter-gatherers. A strong line is drawn in Minnesota by growing season length. The southern half of Minnesota sustained a frost

free environment giving pre-contact hunter-gatherers the ability to grow crops. The growing season length generally determined the type of community associated with each region of Minnesota, with crop growing predominately in the south, and hunting and gathering of wild food resources in the north (Gibbon 2012).

2.2. Historical Environment

From 3000 B.P. to present, the tallgrass prairie encompassed much of the WRA. Trees were scarce in the region, but there were narrow river-bottom forests and oak woods along the major river valleys and small patches of woodland in fire-protected areas (peninsulas, islands, isthmuses) at major lakes (Gibbon 2012). Trees were scarce due to regular prairie fires and occasional droughts (Hudak et al. 2002). The climate of the province was still more moderate, with shorter winters, less snowfall, and longer, hotter summers.

The tallgrass prairie was inhabited by major game animals such as bison, elk, and smaller upland mammals (Hudak et al. 2002). Although not a major resource in the prairie, fish and aquatic mammals, muskrats, and waterfowl inhabited areas in the shallow lakes and river drainages within the province (Hudak et al. 2002). Few fish and waterfowl inhabited this region because of the lack of permanent water bodies.

There are significant soil variations within the WRA that can generally be categorized as medium to fine textured prairie soils (Hudak et al. 2002). According to Hudak et al. (2002) bedrock outcrops are rare in this region. Occasional deposits of Sioux Quartzite and Catlinite can be found in the region, however these deposits are not located within the WRA. Catlinite is a soft, clay rich stone used to make Native American pipes, plaques, and other goods.

When Euro-Americans began to settle the region, much of the area was drained for agricultural purposes (Hudak et al. 2002). As a result of Euro-American expansion the lakes and wetlands present in this area were modified from their original characteristics. Today the tallgrass prairie is almost completely gone, replaced by agricultural fields and occasional pastureland.

3.0 BRIEF PREHISTORIC AND HISTORIC CONTEXT

The following prehistoric and historic contexts were generated from previously conducted synthesis for the State of Minnesota and the Upper Midwest (Dobbs 1990a; 1990b; Minnesota SHPO 1993; Hudak et al. 2002; Gibbon 2012). The Pre-Contact period is divided into four traditions: Paleoindian, Archaic, Woodland, and Plains Village and Mississippian/Oneota. These traditions are further defined by significant changes in how Native American communities exploited technology and food sources.

3.1. Paleoindian Tradition (12,000 to 8000 B.P.)

This period is marked by the retreat of glacial ice and the draining of several lakes, including Lake Agassiz and Lake Superior. The Paleoindian occupations in Minnesota were of low population density and often sites were short-term, specialized activity areas that resulted in a low archaeological profile. Paleoindians adapted to a nomadic lifestyle living near game animals, sources of wood, chert, large streams, and other major water sources. The Paleoindians based their movements by season and availability of plants and the migratory patterns of game animals.

Paleoindian Tradition archaeological sites are often identified by isolated projectile points and scatters of few lithic artifacts on the ground surface. Justice (1987) divides these projectile points into Early Paleoindian—Fluted Point Pattern (Clovis, Gainey, and Folsom points) and Late Paleoindian—non-fluted Lanceolate Point Pattern (Plano and Cody complex points). Other lithic tool types associated with the patterns of the Paleoindian Tradition in Minnesota include bifacially flaked knives, simple choppers, adzes, and large scrapers (Dobbs 1990a).

3.2. Archaic Tradition (8000 to 2800 B.P.)

The end of the Pleistocene marked the end of the last Ice Age and the beginning of the Archaic period. The retreating glaciers exposed new land surfaces unlike any in present day Minnesota. Expanses of prairie began to displace the forests, expansive lakes, and large, swift rivers fed by glacial runoff. Dietary and settlement patterns shifted in adaptation to environmental changes. More diverse plant and animal resources were utilized during the Archaic period and the toolkit diversified to include ground and pecked stone tools, copper tools, and a wider variety of projectile point types. Archaic Tradition technology is characterized by a change in projectile point manufacture, shifting from lanceolate to notched and stemmed points.

During the Archaic period, regional differences in material culture began to develop. Four distinct Archaic Tradition contexts identified in Minnesota include: the Shield Archaic, Lake-Forest Archaic, Prairie Archaic, and Eastern Archaic (Dobbs 1990a). Research suggests that community size increased from previous Paleoindian populations, yet remained small with day-to-day activities taking place at a series of small seasonal camps (Anfinson 1987). As with known Paleoindian sites, Archaic sites are relatively small and sparse.

3.3. Woodland Tradition (2800 B.P. to European Contact)

Throughout the Midwest, the Woodland Tradition is generally divided into three periods: Early, Middle, and Late; however (Anfinson 1987) has suggested that a division into Initial and Terminal periods may be more appropriate in Minnesota. The climate during this period shifted

from dry and warm to moist and cool, and began to stabilize to resemble the climate that exists in the state today (Anfinson 1990).

Woodland Tradition cultures exhibit evidence of an increasingly sedentary lifestyle. This is evident in the manufacturing of ceramic vessels, building burial mounds, and cultivating specific plant species (Dobbs 1990a). The original divisions of Early, Middle, and Late Woodland were differentiated by their changes in technology: ceramics during the Early Woodland period are normally thick and crude with cord-marked decoration on the exterior; during the Middle Woodland there is early evidence of earthen burial mounds; and the Late Woodland period continues the tradition of ceramics and burial mounds, but ceramic decorations and styles become more regionalized (Anfinson 1990). Despite significant changes in many aspects of the Woodland culture, archaeological research indicates that life during the Woodland Tradition remained similar to that of the Archaic period, with a dependence upon a diverse, seasonal resource base of plants and animals (Anfinson 1987:222). Site types assigned to the Woodland Tradition throughout the region range from small, limited-use sites to large village and habitation sites.

3.4. Plains Village and Mississippian/Oneota Traditions (1100 B.P. to European Contact)

During the Plains Village and Mississippian/Oneota Traditions, archaeological sites in Minnesota exhibit significant changes in subsistence and settlement patterns. Populations became larger and even more regionalized than was typical during previous periods. In addition, ceramic vessels were manufactured using different forms and decoration, agriculture intensified, and settlement patterns shifted to larger and more permanent villages (usually near river settings). Archaeologists attribute sites that exhibit these cultural changes to two major traditions: Plains Village and Mississippian/Oneota. These traditions are split further based on region: the Plains Village Tradition is typical in the western part of the state, and the eastern part of the state typically exhibits the Mississippian Tradition (Anfinson 1987). These traditions last from the end of the Terminal Woodland Tradition to first contact with European explorers (Anfinson 1987).

Anfinson (1987) has suggested the Plains Village Tradition and the Mississippian/Oneota Traditions developed due to regionalization of groups which allowed the creation of distinctive ideas and life-ways. Archaeological evidence suggests the Plains Village complexes developed out of an indigenous Late Woodland base; however, archaeologists are unsure how the Oneota complexes developed (Dobbs 1990a). Plains Village and Oneota site types are similar to those associated with the Woodland Tradition. The archaeological remains of these complexes range from burial mounds to small, limited-use sites and extensive habitation sites. Site location remains consistent with the Woodland Period.

3.5. Contact/Post-Contact Period (1630 to Present)

The Contact period generally refers to the span of time extending from the first European explorations until intensive Euro-American settlement of the region. Minnesota's historic period began in 1673 when French explorers Marquette and Joliet reached the upper portion of the Mississippi River. At the time of initial contact, the Ojibwa, Yankton (Western Dakota), Teton, and Dakota/Lakota (Sioux) tribes occupied the southwestern portion of Minnesota (Pipestone County Historical Society 1984). Native Americans were drawn to the area because of the Pipestone Quarries, located north of the City of Pipestone, Minnesota. The Pipestone Quarries, also known now as Pipestone National Monument, have been traditionally used for quarrying catlinite, or pipestone, to make ceremonial pipes. Besides containing quarries, this nationally important site contains lithic workshops and some of the first Native American petroglyphs.

Pipestone National Monument is a sacred site to many tribes of North America, especially the Sioux tribe, who were a dominant presence at the pipestone quarries during the 1700s (Scott 2006). During the seventeenth and eighteenth centuries the presence and use of the quarries was not well known. It was not until George Catlin, American artist and writer, visited the Pipestone Quarries that the quarries became well known and sourced. In the mid-nineteenth century, tribal nations ceded their rights to the Pipestone Quarries; however, the Yankton Sioux secured free and unrestricted access to the area by the Treaty of 1858, which also placed them on a reservation in what is today South Dakota.

By the nineteenth century, pipes found their way into Euro-American society through trade (Pipestone County Historical Society 1984). Economic exchange and the fur trade spurred further Euro-American exploration into western Minnesota, but Euro-American settlers stayed away, considering the county "Indian territory," until well after the 1860s (NPS 2017). Pipestone County was established in 1857 and was officially organized in 1879 (NPS 2017). Throughout the late nineteenth century, treaty violations by the United States, increased Euro-American settlement, and unfair annuity payments by Indian agents caused increasing tension among the Dakota tribes who remained in Minnesota (Ginkel et al. 2016). As a result of increasing tensions, battles between the Dakota and the settlers, and later the United States Army, took place throughout the Minnesota River valley in what is known as the Dakota War.

Nearly all the Dakota tribes were expelled from Minnesota when the Dakota War ended on December 26, 1862. The expulsion of the Dakota tribes and treaties with Native Americans opened western Minnesota to Euro-American settlement. After 1878, Pipestone County began experiencing the first land rush in anticipation of railroad construction (Pipestone County

Historical Society 1984). Railroad lines brought many different businesses and people to the growing towns and settlements. At the time, construction of permanent dwellings was difficult due to the lack of trees in the area, but other natural resources such as Sioux quartzite were available. The Pipestone quarry provided building materials for the new City of Pipestone, influencing its architecture and business districts (Scott 2006). Beginning in the 1880s, many buildings in cities as far away as Chicago were constructed of Sioux quartzite from the Pipestone quarry.

The nearby cities of Ruthton and Holland were developed in 1888 in anticipation of the 1889 construction of the Willmar and Sioux Falls branch of the Great Northern Railroad. By 1890, the City of Pipestone was connected to four different rail lines and became the transportation and shipping hub of southwestern Minnesota. The Pipestone quarry was acquired by the federal government in 1893. By the late-1930s the Pipestone Quarries were closed for quarrying to all but Native Americans in an effort to establish the land as a national monument. The Pipestone National Monument was established by an act of Congress on August 25, 1937.

4.0 RESEARCH GOALS

The purpose of this investigation is two-fold. The first is to identify cultural resources documented on SHPO and Office of State Archaeologist (OSA) records located within the WRA or the WRA Plus in order to provide Lake Benton Wind with sufficient information for preliminary infrastructure siting and design. The second is to provide the SHPO with sufficient information for their input into the LBII WEC as part of the PUC LWECS Site Permitting process. These research goals would allow Lake Benton Wind to plan the LBII WEC in a manner which, if possible, would allow avoidance of impacts to significant cultural resources.

5.0 METHODS

Atwell was assisted with the Phase Ia by personnel from The 106 Group, Ltd. (The 106 Group). On June 30, 2017, SHPO and OSA records were reviewed by Tyler Lund-Kyrola and Kathryn Hunt (The 106 Group). Jill Kotwasinski, MS, RPA (Atwell) served as the Principal Investigator. The methods employed for the Phase Ia follow the SHPO Manual for Archaeological Projects in Minnesota (Anfinson 2005).

The state archaeological and historic site files available from the OSA and SHPO, NRHP data available from the National Park Service, and state historic architecture inventory available from the SHPO were reviewed. County and township histories, historic maps including Bureau of Land Management (BLM), General Land Office (GLO) plat maps (BLM 2017), county atlas

(Webb Company 1914), the Andreas Atlas (Andreas 1874), county soil surveys, and current and historic aerial photographs within the WRA and WRA Plus were also examined.

6.0 INVENTORY OF CULTURAL RESOURCES

The file search indicated that Historic Properties listed on the NRHP, MSHSN, or MSRHP are not located within the WRA or WRA Plus. Two architectural resources were identified within the WRA Plus, and 21 archaeological sites were identified within the WRA and WRA Plus. These resources are discussed in more detail below. Maps depicting the location of cultural resources discussed below are provided in **Appendix I**.

6.1. National Register of Historic Places, Minnesota State Historic Sites Network, and Minnesota Register of Historic Places Listed Properties

No historic properties listed on the NRHP, MSHSN, and MSRHP were located within the WRA or the WRA Plus.

6.2. Architectural Resources

Architectural resources were not identified within the WRA. Two architectural resources were identified within the WRA Plus in the City of Ruthton, Minnesota. Historic Property Inventory forms were reviewed for the GN Depot (PP-RTC-001) and the Ruthton Co-op Creamery (PP-RTC-003). Very little information is within the record for the GN Depot and the Ruthton Co-op Creamery. The GN Depot was located at the junction of Main Street and the Great Northern Railroad tracks; on the west side of the Great Northern Railroad tracks. Review of current aerial imagery indicates the GN Depot is no longer extant and therefore would not require additional architectural evaluation or avoidance by the LBII WEC. The Ruthton Co-op Creamery was constructed in 1922. The Ruthton Co-op Creamery was located at the intersection of Railroad Avenue and Smith Avenue. Review of current aerial imagery indicates the Ruthton Co-op Creamery is no longer extant and therefore does not require additional architectural evaluation or avoidance by the LBII WEC.

Review of architectural resources under the Minnesota Historic Sites Act only includes NRHP, MSHSN, or MSRHP designated or listed resources. Architectural resources which are listed on the NRHP, MSHSN, or MSRHP are not present within the WRA or WRA Plus.

6.3. Archaeological Resources

The file search identified 19 archaeological sites within the WRA and two archaeological sites within the WRA Plus. **Table 1** provides additional information related to each archaeological site identified within the WRA and WRA Plus. The 19 archaeological sites located within the WRA and include: 15 prehistoric period archaeological sites, one historic period archaeological site,

two indeterminate archaeological sites, and one multi-component historic and prehistoric archaeological site. Archaeological site 21PP0031 is a prehistoric isolate consisting of two undiagnostic flakes which were recovered from two shovel tests along a ridge (bluff) overlooking Engbarth Slough. Lack of additional archaeological material recovered and lack of diagnostic artifacts led Florin (2008) to consider the site not eligible for listing on the NRHP. The remaining 18 archaeological resources within the WRA consist of archaeological sites that are unevaluated for listing on the NRHP.

Table 1. Archaeological Sites Identified on OSA Records Within the WRA and WRA Plus

Site Number	County	Site Name	Site Type	Site Context	Site Status	Relation to WRA
21MU112	Murray	Unnamed	Artifact Scatter	Pre Contact	Recommended Not Eligible	1.0 mile NE of WRA
21MU114	Murray	Unnamed	Artifact Scatter; Lithic Scatter	Pre Contact	Recommended Not Eligible	0.8 mile NE of the WRA
21PP0022	Pipestone	Hauselog Site	Artifact Scatter	Prehistoric	Unevaluated	WRA
21PP0025	Pipestone	The Disappointing Site	Artifact Scatter	Prehistoric	Unevaluated	WRA
21PP0026	Pipestone	The Kallemeyr Site	Artifact Scatter	Prehistoric	Unevaluated	WRA
21PP0029	Pipestone	The LaBrune Site	Boulder Teepee Ring and Boulder semi-circles	Archaic	Unevaluated	WRA
21PP0031	Pipestone	Unnamed3	Artifact Scatter	Prehistoric	Recommended Not Eligible	WRA
21PP0032	Pipestone	Klaus Site	Artifact Scatter	Historic	Unevaluated	WRA
21PP0033	Pipestone	Francis Jr. Site	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0034	Pipestone	Bouman Site	Pre-Contact Artifact Scatter; Historic Structural Ruin	Pre Contact; Historic	Unevaluated	WRA
21PP0035	Pipestone	LaVon Henry Site	Lithic Scatter	Indeterminate Prehistoric	Unevaluated	WRA
21PP0036	Pipestone	Gangstad	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0037	Pipestone	Gopher Trap Site	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0038	Pipestone	Vander-Sluis Site	Lithic Scatter	Pre Contact/Plains Village	Unevaluated	WRA
21PP0039	Pipestone	Houselog Site	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0040	Pipestone	Brands Site	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0041	Pipestone	Venniewenhuyzen	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0042	Pipestone	Snack Site	Artifact Scatter	Pre Contact	Unevaluated	WRA
21PP0043	Pipestone	Reese Site	Lithic Scatter	Indeterminate Prehistoric	Unevaluated	WRA
21PP0044	Pipestone	Alderson	Single Artifact	Pre Contact	Unevaluated	WRA
21PP0045	Pipestone	Barke	Lithic Scatter	Pre Contact	Unevaluated	WRA

Two archaeological sites (21MU112 and 21MU114) are located within the WRA Plus. Archaeological site 21MU112 is a sparse lithic scatter and is located on level terrain approximately 1.0 mile northeast of the WRA. Archaeological site 21MU114 is a sparse lithic scatter and is located approximately 0.8 miles northeast of the WRA. A lack of additional archaeological material recovered from these two sites and lack of diagnostic artifacts led Florin (2008) to recommend the sites not eligible for listing on the NRHP, but an NRHP eligibility determination has not been conducted by the SHPO.

Direct impacts to archaeological sites located within the WRA should be avoided by the LBII WEC. If the archaeological sites cannot be avoided by 100 feet, additional archaeological investigations would be necessary to evaluate the sites for listing on the NRHP. Archaeological resources located within the WRA Plus would not be directly impacted by the LBII WEC.

6.4. Previous Cultural Resources Investigations

Four previous cultural resources surveys and two literature reviews have been completed within the WRA. One additional previous cultural resources survey has been completed within the WRA Plus. Previous cultural resources surveys included four reports related to wind energy projects, two reports related to the Woodstock Telephone Company's fiber optic placement project, one project related to powerline construction, and one project surveying numerous areas of the Southwest Minnesota Plateau to identify Coteau Des Prairies Effigys (Pederson 1981).

A Phase I investigation for the Moraine Wind Project in Pipestone and Murray counties, Minnesota was conducted in 2003 (Stubbs et al. 2003). The report does not quantify the total acreage examined, but the survey resulted in the identification of two newly recorded archaeological sites (21MU66 and 21MU67). Neither of these two sites is located within the WRA or the WRA Plus. In 2008, an archaeological survey was conducted for the Moraine II Wind Project and examined approximately 500 acres; resulting in five newly recorded pre-contact sites (Florin 2008). Two of these sites, 21MU112 and 21MU114, are located within the WRA Plus and are discussed further above in *Section 6.3.*

Knudsen (2011) conducted a Phase Ia archaeological literature review and windshield survey for the Stoneray Wind Project in Pipestone and Murray counties, Minnesota. In March of 2013 EVS, Inc. (Justin 2013) conducted an updated literature search based on a revised boundary for the Stoneray Wind Project. Based the literature reviews (Knudsen 2011; Justin 2013) EVS, Inc. recommended a Phase I archaeological reconnaissance survey for the Stoneray Wind Project.

Documentation regarding the Phase I reconnaissance survey for the Stoneray Wind Project was not available at the date of this report.

A cultural resources background study and field investigations was completed for the Garvin, Holland, Russell, and Ruthton Exchange portions of the Woodstock Telephone Company Fiber Optic Cable Placement project in Murray and Pipestone counties, Minnesota (Buhta and Kruse 2009b). The investigation involved survey of approximately 34.1 miles of right-of-way and resulted in the identification of one newly recorded archaeological site (21LY129), which is not located within the WRA or WRA Plus. An additional survey for the Woodstock Telephone Company Fiber Optic Cable Placement project was conducted in 2009 and resulted in the identification of one cultural resource, PP-BUR-004 (Buhta and Kruse 2009a). Cultural resource PP-BUR-004 is not located within the WRA or WRA Plus.

Stemper and Associates (2011) conducted a Phase I archaeological investigation for portions of a proposed 48.5-mile-long distribution powerline in parts of Nobles, Pipestone, and Jackson counties, Minnesota. Archaeological sites were not discovered as a result of this investigation. Pederson (1981) conducted a survey of effigies and rock alignments on the Coteau Des Prairies using aerial reconnaissance and field investigations of features that were reported by local residents. Forty-eight sections were surveyed via aerial survey; resulting in portions of six sections investigated further by reconnaissance survey. Four newly recorded archaeological sites were identified as a result of this investigation. One archaeological site, 21PP0029, is located within the WRA. Archaeological site 21PP0029 is a stone circle with three semi-circular stone features. Additional investigation was recommended to further determine the NRHP eligibility of site 21PP0029 because subsurface testing was not conducted. As of the date of this report, documentation of further work on archaeological site 21PP0029 is not available. It should be noted that Pendersen's (1981) survey did not attempt to identify all cultural resources within the area reviewed and it is possible that undocumented cultural resources could be present within the areas examined.

Table 2 provides more specific information related to the previous surveys conducted within the WRA and the WRA Plus. It is likely that additional undocumented cultural resources, especially prehistoric and historic archaeological sites and historic architectural resources (historic structures) could be located within the WRA because relatively small portions of the WRA have been subjected to pedestrian cultural resources survey. Therefore, further cultural resources investigations would likely be necessary to further evaluate the presence/absence of cultural resources within the WRA.

Table 2. Previous Cultural Resources Investigations Within the WRA and WRA Plus.

Report Number	Author	Title	Report Date
MULT-03-01	Donna L. Stubbs, Daniel R. Pratt, Amy L. Ollendorf, and Erika Palmer	Cultural Resources Management: Moraine Wind Project, Pipestone and Murray Counties, Minnesota. Phase I Investigation	2003
MULT-08-30	Frank Florin	Phase I Archaeological Survey For The Moraine II Wind Project in Murray And Pipestone Counties, Minnesota	2008
MULT-09-01	Austin A. Buhta and Jason M. Kruse	A Phase I Archaeological Reconnaissance Survey of Woodstock Telephone Company's Proposed Fiber Optic Cable Placement Project, Garvin, Holland, Russell, and Ruthton Exchange Localities, Lincoln, Lyon, Murray, and Pipestone Counties, Minnesota	2009
MULT-09-02	Austin A. Buhta and Jason M. Kruse	A Phase I Archaeological Reconnaissance Survey of Woodstock Telephone Company's Proposed Fiber Optic Cable Placement Project, Woodstock Exchange Locality, Murray, and Pipestone Counties, Minnesota	2009
MULT-11-26	Garrett L. Knudsen	Stoneray Wind Project: Cultural Resources Phase IA Archaeological Literature Review Survey	2011
MULT-11-28	Stemper and Associates	Phase I Archaeological Field Investigation For Powerline Installation Land Corridors in Nobles County, Murray County, Pipestone County, and Jackson County, Minnesota	2011
MULT-12-25	Michael A. Justin	Supplement to Phase IA Archaeological Literature Review Survey Stoneray Wind Project Pipestone and Murray Counties, Minnesota	2013
MULT-81-07	H. Clyde Pedersen and G. Joseph Hudak	Southwest Minnesota Plateau in Coteau Des Prairies Effigy (And Other Alignments) Field Survey	1981

6.5. Historic Atlas and Map Review

Review of GLO Record Original Survey Maps ranging in dates between 1867 to 1871 (BLM 2017) did not depict potential cultural resources within the WRA or the WRA Plus. The *Illustrated historical Atlas of Minnesota* (Andreas 1874) also did not illustrate historic structures within the WRA or the WRA Plus. Atwell reviewed the 1914 historic atlas for Pipestone County (Webb Company 1914) and determined that residential buildings were evenly scattered throughout the WRA. The 1914 historic atlas indicated that five schools were located within the WRA. Two small villages (typically less than 80 acres) also appear within the WRA Plus on the 1914 historic atlas; Ruthton in Aetna Township and Holland in Grange Township. The Great Northern Railroad traverses Rock and Aetna townships in a north to south orientation centered in the middle of Aetna Township and the north corner of Rock Township.

Review of the 1967 USGS topographic map (ESRI 2017) indicated the WRA was sparsely populated with a generally well-established section-line county road network. Residential structures largely tend to be depicted with several outbuildings and on average are located over 100 feet from roads. Gravel pits are interspersed periodically throughout the WRA. USGS topographic maps (ESRI 2017) were also reviewed to determine if cemeteries were located within the WRA or WRA Plus. Cemeteries were not located within the WRA; however two cemeteries (Ruthton Cemetery and Holland Cemetery) are located within the WRA Plus.

7.0 RECOMMENDATIONS

Atwell conducted a Phase Ia of the WRA and WRA Plus by reviewing NRHP, SHPO, and OAS records and available historic atlases and topographic maps. Based on the results of the Phase Ia, Atwell has the following recommendations:

- MnHS review under the Minnesota Historic Sites Act and comments for the PUC LWECS Site Permit review suggest that only architectural resources designated or listed on the NRHP, MSHSN, and MSRHP would require avoidance during the initial siting of the LBII WEC. Cultural resources designated or listed on the NRHP, MSHSN, and MSRHP are not located within the WRA or WRA Plus. Additional architectural resources within the WRA or WRA Plus which are unevaluated or eligible for listing on the NRHP but are not currently designated or listed on the NRHP, MSHSN, or MSRHP would not require avoidance or further evaluation for MnHS review under the Minnesota Historic Sites Act.

- Nineteen archaeological sites were identified within the WRA and two archaeological sites were identified within the WRA Plus. These archaeological sites are small in area, consist of diffuse lithic or artifact scatters, and have not been evaluated to determine eligibility for listing on the NRHP. Atwell recommends avoidance of the 19 archaeological sites located within the WRA. Establishment of 100-foot avoidance buffers around each of the 19 archaeological sites would avoid potential impacts to these resources. If avoidance is not possible additional archaeological investigation would be necessary to evaluate potential impacts to these archaeological sites.

- Archaeological sites within the WRA Plus would not be impacted by proposed development within the WRA. However, archaeological sites located within the WRA Plus should be avoided if LBII WEC facilities would be sited outside the WRA in the future.

- The Ruthton Cemetery and Holland Cemetery were identified on USGS topographic maps within the WRA Plus. The Ruthton Cemetery and Holland Cemetery would not be impacted by proposed development within the WRA. However, these cemeteries should be avoided if Project facilities would be sited outside the WRA in the future.

Once LBII WEC infrastructure has been sited, it is understood that the MnHS may request additional archaeological survey of ground disturbance locations (wind turbine generators, access roads, collection lines, substation, operations and maintenance building, metrological towers, etc.). The exact nature of additional archaeological survey would be determined though consultation with the MnHS.

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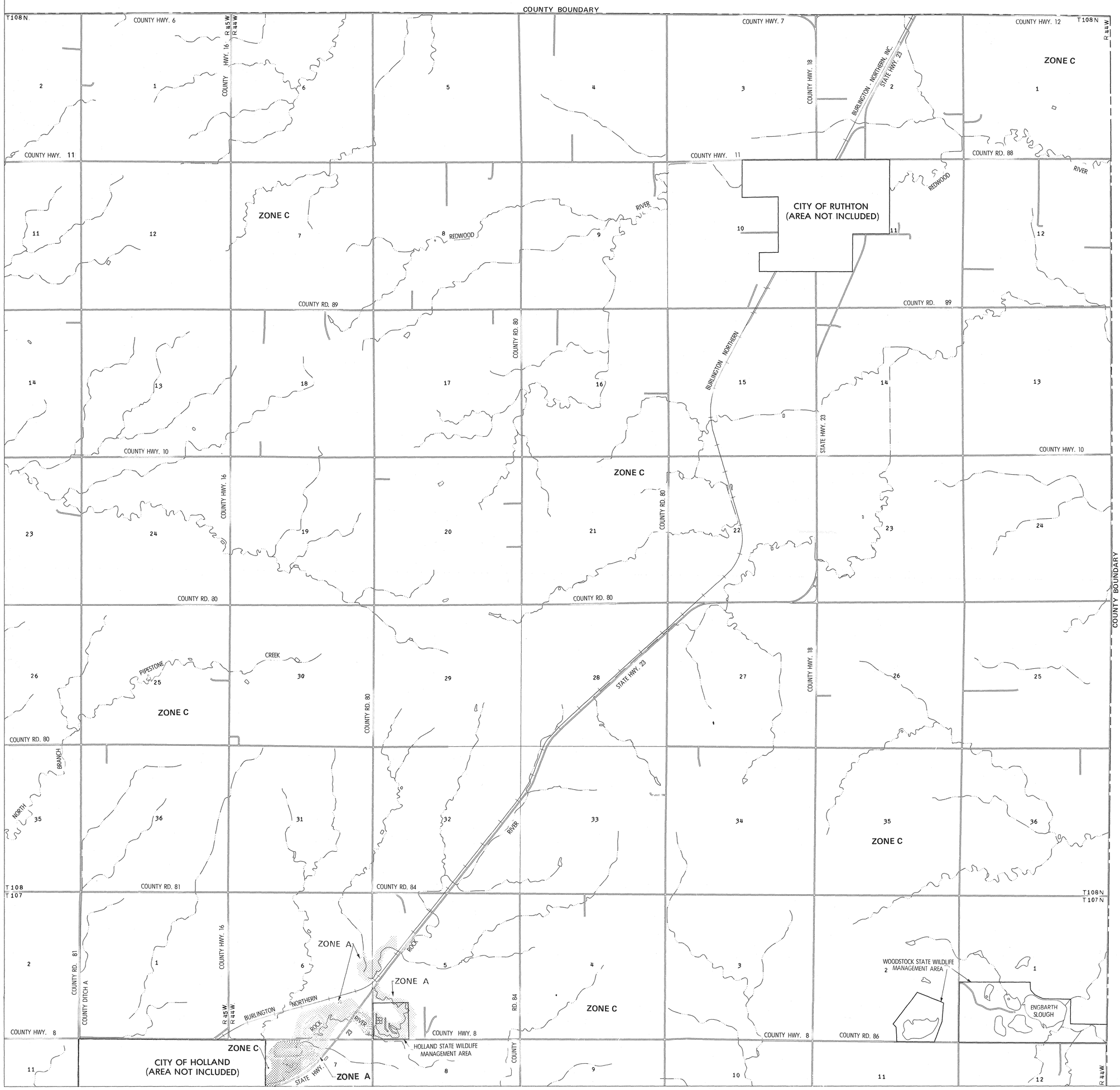
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APPENDIX I:

Cultural Resources Map

APPENDIX G – FEMA Floodplain Panels



KEY TO MAP

Zone Designations*

ZONE C
ZONE A
ZONE C

Base Flood Elevation Line With Elevation In Feet** — 513

Base Flood Elevation in Feet Where Uniform Within Zone** (EL 987)

Elevation Reference Mark RM7×

Zone D Boundary

River Mile •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Map Index.

INITIAL IDENTIFICATION:
JULY 27, 1979
FLOOD HAZARD BOUNDARY MAP REVISIONS:

FLOOD INSURANCE RATE MAP EFFECTIVE:
JULY 3, 1986
FLOOD INSURANCE RATE MAP REVISIONS:

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE
2000 0 2000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

PIPESTONE COUNTY, MINNESOTA
(UNINCORPORATED AREAS)

PANEL 50 OF 150

COMMUNITY-PANEL NUMBER
270627 0050 B

EFFECTIVE DATE:
JULY 3, 1986

Federal Emergency Management Agency

APPENDIX H – Site Characterization Study

SITE CHARACTERIZATION STUDY

for the

Lake Benton II Wind Resource Area
Pipestone County, Minnesota

Prepared for:

Lake Benton Power Partners II, LLC
700 Universe Boulevard
Juno Beach, Florida 33408

Prepared by:

Atwell, LLC - Project No. 17000619

Submitted by: Atwell, LLC

November 22, 2017

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Photographic Log

APPENDIX III

IPaC Results

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MNDNR Natural Heritage Review

APPENDIX V

BBS Route Species List and USFWS Birds of Conservation Concern for Lake Benton II WRA

EXECUTIVE SUMMARY

Atwell, LLC (Atwell) has been requested by Lake Benton Power Partners II, LLC (Lake Benton II) to conduct a Tier 1/Tier 2 Site Characterization Study (SCS) for the proposed Lake Benton II Wind Resource Area (WRA) in Pipestone County, Minnesota, consistent with the *Application Guidance for Site Permitting of Large Wind Energy Conversion Systems in Minnesota* (Minnesota Department of Commerce 2010) and the conducting of a Tier 1/Tier 2 United States Fish and Wildlife Service (USFWS) screening process as described in the *Land-based Wind Energy Guidelines* (USFWS 2012). Thus, the purpose of this Site Characterization Study is to identify and discuss landscape characteristics and biological features occurring within the WRA, and, also, to discuss potential impacts and risks to those features associated with development of the Lake Benton II Wind Project (Project). In addition, a water resources review was conducted to provide an overview of the regulatory framework that governs water resources (e.g., surface water features, wetlands, and floodplains) in the State of Minnesota.

This Site Characterization Study presents the results of an aerial photograph interpretation of the WRA, database review of USFWS and Minnesota Department of Natural Resources (MNDNR) threatened and endangered species (TES) lists, sensitive habitats, land cover, protected areas, water resources, and the observations from the site reconnaissance which took place on June 14, 2017.

The WRA consists of approximately 25,597 acres and is located in the southwestern region of Minnesota, in northeastern Pipestone County. The predominant land use in the WRA is agriculture; however, nearly 31% of the WRA is grassland and state conservation easements, mapped native plant communities, and sites of biodiversity significance are also present.

Based on the information gathered and reviewed during Atwell's natural features review, drainage review, and assessment of key biological features, Atwell has identified several potential biological concerns associated with the WRA, which are typically encountered with wind development as well as regionally-specific constraints related to local resources. Potential concerns include: avian and bat species; threatened and endangered species; federally designated critical habitat, remnant grassland habitats; and wetlands, streams, and floodplains.

Based on this SCS, the TES with at least a moderate likelihood of occurrence within the WRA include the following:

- Burrowing owl (state endangered; grassland associate)
- Henslow's sparrow (state endangered; grassland associate)
- Loggerhead shrike (state endangered; grassland associate)
- Poweshiek skipperling (federal endangered, state endangered, grassland associate)
- Dakota skipper (federal threatened, state endangered, grassland associate)

- Ottoe skipper (state endangered, grassland associate)
- Blanding's turtle (state threatened; wetland/watercourse associate)
- Topeka shiner (federal threatened, small to medium streams)
- Plains topminnow (state threatened, small to medium streams)
- Hair-like beak rush (state threatened; wetland associate)
- Short pointed umbrella sedge (state threatened, wetland associate)

While the state threatened and endangered species listed above have the potential to occur in the general geographic range of the WRA, most of the aforementioned species are restricted to aquatic, wetland, riparian mesic forest, and native or tallgrass prairie habitat types.

1.0 INTRODUCTION

Lake Benton Wind Power Partners II, LLC (Lake Benton IIis planning for the decommissioning of the existing Lake Benton II Wind Energy Center to facilitate the construction of a new 100 megawatt (MW) wind energy generation facility on the site. The existing wind energy center has been in operation since 1999 and is located in Pipestone County in southwestern Minnesota. The new facility would consist of up to 44 wind turbines and associated facilities with the WRA spanning approximately 25,597 acres. To support development of the new project plan, Lake Benton II, an indirect wholly owned subsidiary of Nextera Energy Resources, LLC, contracted Atwell to conduct a Site Characterization Study (SCS) for the proposed WRA.

The purpose of the SCS was to identify and discuss landscape characteristics and biological features to understand the potential presence of threatened and endangered species, eagle use, bat and avian use, wetland and woodland habitat, and sensitive and rare habitats occurring within the WRA. This SCS fulfills the Tier 1/Tier 2 site characterization study as recommended in the USFWS Land-based Wind Energy Guidelines (USFWS 2012) tiered approach which assists developers in identifying wildlife species of concern and minimizing impacts from wind energy development.

1.1 USFWS Land-based Wind Energy Guidelines

1.1.1 Tier 1 & Tier 2 Evaluation Summary

The following Tier 1 and Tier 2 questions are taken from the USFWS Land-based Wind Energy Guidelines (WEG). Tier 1 questions help determine potential environmental risk at the landscape scale, while Tier 2 questions help to determine potential environmental risk at the project scale (USFWS 2012). Answers to these questions are below and provide a general summary of the findings of this site characterization study.

1. *Are there species of concern, or habitat for that species, present in the proposed WRA?*

   There are six (6) ecotypes of native plant communities (as designated by the State of Minnesota) in the WRA which may provide habitat for threatened or endangered plant or animal species. Two (2) ecotypes are native wetlands, three (3) are native prairies, and the last type is a native Prairie Meadow/Carr. The WRA also contains several Sites of Biodiversity Significance as designated by the Minnesota Biological Survey. One of the sites is ranked as having "outstanding" significance, six (6) sites are ranked as having "high" significance, nine (9) sites are ranked as having "moderate" significance, and the remaining sites are ranked as "below" biodiversity significance.

   The outstanding, high, and moderate ranked sites account for approximately 3,343 acres in total. These areas, in combination with wetlands, small prairie streams, and scattered grassland areas within the WRA, may provide habitat for some of the species of concern listed as having a moderate probability of occurring within the WRA (e.g., Henslow's sparrow [*Ammodramus henslowii*],

loggerhead shrike [*Lanius ludovicianus*], Dakota skipper [*Hesperia dacotae*], Poweshiek skipperling [*Oarisma poweshiek*], and Topeka shiner [*Notropis topeka*]), as indicated in Table 1. Two state-owned properties within the WRA are federally designated as critical habitat for the Dakota skipper; one of these properties is also critical habitat for the Poweshiek skipperling. In addition, the entirety of the WRA is located within federally designated critical habitat for the Topeka shiner. Topeka shiner management minimization recommendations for the Big Sioux River and Rock River Watersheds intersect approximately 48% of the WRA.

2. *Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information?*

   There are five (5) Conservation Reserve Enhancement Program (CREP) easements, one (1) Reinvest in Minnesota (RIM) Reserve Program easement, two (2) Permanent Wetland Preserve (PWP's), one (1) Scientific and Natural Area (SNA), and four (4) Wildlife Management Areas (WMAs) located within the WRA. CRP lands within the WRA have not yet been identified. No other areas within the WRA are precluded by law from development.

3. *Are there plant communities of concern present or likely to be present at the site?*

   There are 61 native plant communities (approximately 1,123 acres total) and 25 MBS sites of biodiversity significance (totaling approximately 3,958 acres) within the WRA. Sixteen (16) sites are ranked as "moderate", "high", or "outstanding" biodiversity significance, accounting for approximately 3,343 acres within the WRA, while nine (9) sites are ranked "below" biodiversity significance.

4. *Are there known critical areas of wildlife congregation in the proposed WRA?*

   No.

5. *Are there large areas of intact habitat with the potential for fragmentation, with respect to species of habitat fragmentation concern needing large contiguous blocks of habitat?*

   Yes, there are a few large blocks of prairie habitat present (Prairie Coteau SNA, Woodstock WMA, Buffalo Ridge WMA, and Gromer's Draw WMA); however, the majority of the WRA has already been highly fragmented. The WRA is composed of approximately 63% cultivated cropland with developed open space, wetlands, and grasslands making up the remainder of the WRA. There are numerous prairie areas, grasslands, and pasture areas noted during site reconnaissance that may provide suitable habitat for Henslow's sparrow, Dakota skipper, and Poweshiek skipperling, all species that typically require larger tracts of intact habitat.

6. *Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed site based on an assessment of site attributes?*

   The WRA is located within known northern long-eared bat range. The closest northern long-eared bat hibernacula in Minnesota is located on the border between Nicollet and Le Sueur counties (approximately 105 miles to the east of the WRA) (USFWS 2007, MNDNR and USFWS 2017). The species may occur as a low density migrant within the WRA, but the absence of high quality woodlands or floodplain forests within the WRA limit the species' likelihood to occur as a summering or wintering species within the WRA.

   Bald and golden eagles may also utilize the WRA. Based on publicly available data, both species occur in the regional vicinity of the WRA and may pass through the WRA. Golden eagles are not known to breed in Minnesota; however, they are regular migrants and winter residents in southwestern Minnesota. Golden eagles may be present within or in the vicinity of the WRA during winter or migration periods. Further, avian pre-construction due diligence studies can assist in identifying movement patterns of bald eagles and other raptors within the WRA.

7. *Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above?*

   Based on this preliminary Tier 1 and Tier 2 SCS, species of concern are likely to be present within the WRA. However, careful siting and project planning can avoid areas where species of concern are thought to be present, thus avoiding significant adverse impacts.

2.0 PROJECT SETTING

The WRA consists of approximately 25,597 acres located in southwestern Minnesota in Pipestone County about five (5) miles southeast of the City of Lake Benton and ten (10) miles northeast of the City of Pipestone (see *Figure 1* in **Appendix I)**. The WRA is dominated by agricultural cropland and a moderately extensive network of agricultural ditches and intermittent and ephemeral streams, many of which support herbaceous riparian buffers. The general topography of the WRA is described as undulating, rolling relief with approximate elevations between 1,726 and 1,996 feet above mean sea level (MSL). The WRA generally slopes northeast and east.

According to the 2011 National Landcover Database – Land Use-Land Cover dataset, a large proportion of the WRA is dedicated to agriculture; approximately 63% of the land is classified as cultivated crops (approximately 16,057 acres) and 4.5% is classified as developed, open space (1,154 acres) (Homer et al. 2015). Refer to *Figure 2* in **Appendix I**. Further land cover statistics are provided in *Section 3.0*.

According to the U.S. Environmental Protection Agency (USEPA) Ecoregion mapping data, the WRA is located within the Big Sioux Basin (46M) (Level IV) ecoregion of the Northern Glaciated Plains ecoregion (46) (Level III) (USEPA 2015). This ecoregion receives approximately 16 to 43 inches of precipitation per year and is characterized by a plateau of older loess covered till with row crops, pasture, and no lakes. These precipitation conditions foster a grassland transition between tall and shortgrass prairie, referred to as mixed-grass prairie (USEPA 2015).

According to the MNDNR Ecological Classification System, the WRA is also located within the Prairie Parkland Province (PPA), which was the part of the state that historically was dominated by tallgrass prairie (MNDNR 2017a). This Province is further divided into Sections and Subsections. The WRA is within the North Central Glaciated Plains Section (251B), characterized by mainly treeless fire-dependent communities, with upland prairie communities in a level to rolling region of calcareous till landscape (MNDNR 2017b), and the Inner Coteau Subsection (251Bc) historically dominated by tallgrass prairie and dry prairies over shallow bedrock (MNDNR 2017c, d).

3.0 SITE CHARACTERIZATION STUDY METHODS

3.1 Desktop Review

An extensive desktop analysis of publicly available information from a variety of sources including federal and state agencies, local government offices, Geographic Information System (GIS) databases, and other relevant websites (See *References*) was conducted to characterize the WRA and a 1-mile buffer around the WRA. The potential impacts to wildlife and other sensitive natural resources were assessed. Datasets and resources reviewed include, but are not limited to the following:

- United States Geological Survey (USGS) National Hydrography Dataset (NHD);
- Natural Resources Conservation Service (NRCS) Web Soil Survey;
- USFWS Threatened and Endangered Species Data and Information for Planning and Conservation (IPaC) tool;
- USFWS National Wetlands Inventory (NWI) Data;
- National Land Use-Land Cover Database;
- MNDNR Natural Heritage Information System (NHIS), Biological Survey Data, other Ecological Resources;
- MNDNR State Scientific and Natural Areas, Forests, Parks, Trails, Wildlife Management Areas Data;
- MNDNR Public Waters Inventory (PWI) Maps;
- Conservation easement datasets;
- Local bird occurrence records through the Avian Knowledge Network (AKN), Minnesota Breeding Bird Atlas (MNBBA), and USGS Breeding Bird Survey Routes (BBS); and
- Minnesota Geospatial Commons statewide datasets available through the Minnesota Geospatial Information Office.

Datasets were reviewed and used to develop several maps illustrating the various ecological resources present within the WRA. Refer to *Site Maps* in **Appendix I.**

3.2 MNDNR Natural Heritage Review Letter

On March 28, 2017, Atwell submitted a formal NHIS data request to the MNDNR Natural Heritage Program, which is a collection of databases that contains the most up to date records on rare or significant species occurrences. On July 18, 2017, the MNDNR provided a Natural Heritage Review letter response for the Lake Benton II WRA.. Information provided within the Natural Heritage Review letter is outlined in the respective sections of this SCS (**Appendix IV**).

3.3 Site Reconnaissance

On June 14, 2017, Atwell conducted a one-day site reconnaissance survey (windshield survey) by driving accessible roads within the WRA to document existing ecological conditions and evaluate the potential, based on observable habitat, for threatened, endangered, rare, and sensitive fauna and flora to be present. Photographs documenting existing conditions are available in a *Photographic Log* in **Appendix II**. Atwell recorded wildlife species observed during the site reconnaissance within the WRA and vicinity. Visibility was clear and vegetation within the WRA was green and growing, with full tree canopy leaf-out during the site reconnaissance survey.

4.0 SITE CHARACTERISTICS

4.1 Land Use / Land Cover

Agricultural land is the prevalent feature within the WRA. The 2011 National Landcover Database – Land Use-Land Cover dataset (Homer et al. 2015) indicates that the WRA contains approximately 16,057 acres of cultivated land, or about 63% of the WRA. Approximately 54.8% of the WRA is prime farmland according to the U.S. Department of Agriculture (USDA; 2017). While land dedicated to agriculture can be identified in aerial photography, aerial interpretation does not provide information regarding the exact characteristics of farmed or unfarmed fields; however, aerial photography indicates that the WRA contains a mosaic of cultivated and uncultivated areas. Refer to *Figures 1 & 2* in **Appendix I**.

<u>Pastures and Grasslands</u>

In addition to farmed fields, agricultural regions typically also include idle lands, pastures, and grasslands. The 2011 National Landcover Database – Land Use-Land Cover dataset indicates that the WRA contains approximately 720 acres of pastures and approximately 7,172 acres of grassland/herbaceous habitat. These two landcover types will be collectively refered to as “grasslands” in this SCS and collectively comprise nearly 31% of the WRA.

Pastures are areas where grasses, legumes, or grass-legume mixtures are planted in a perennial cycle for livestock grazing or the production of seed or hay crops. Grasslands are areas dominated by grammanoid or herbaceous vegetation that are not subject to

intensive management such as tilling but can be utilized for grazing (Homer et al. 2015). Areas used as pastures or areas that are not actively farmed can have the ecological functions of grasslands. Filter strips (i.e., buffer strips) are also common within agricultural areas and are distinguishable through aerial interpretation; these are vegetated areas similar to pastures in an ecological sense but function as a buffer to protect surface water from agricultural runoff.

Pastures, inactive agricultural fields, or buffer strips within agricultural areas are likely to provide habitat for avian and butterfly species, including resident and migrating diurnal or nocturnal raptors that may utilize these areas for hunting (e.g., northern harrier [*Circus cyaneus*]). Other listed species that could potentially utilize inactive pastures or buffer strips, include the Dakota skipper, Poweshiek skipperling, loggerhead shrike, burrowing owl (*Athene cunicularia*), and Henslow's sparrow. Because county-element lists of state and federal threatened and endangered species are based on documented records of threatened and endangered species, additional state or federally protected migratory species (e.g., raptors and songbirds) that have not been documented by state and federal agencies specifically in Pipestone County may also utilize these habitats.

Through aerial interpretation coupled with the 2011 Land Use-Land Cover database, Atwell selected survey locations that appeared to contain grassland type habitat. The site visit confirmed that scattered grassland type habitat is prevalent within the WRA. Representative images are included in the *Photographic Log* in **Appendix II**.

Grassland associated avian and butterfly species will likely be attracted to and use these parcels, but it is difficult to predict what species of conservation concern may be attracted or persist throughout the entire breeding period within these areas. Grassland associated avian species listed in either the USFWS IPaC report for Pipestone County or the MNDNR list of Endangered, Threatened or Special Concern Species include the Henslow's sparrow, burrowing owl, and loggerhead shrike. Additional species not included in the Pipestone County TES list may also utilize grassland habitat within the WRA (e.g., short eared owl [*Asio flammeus*]). Further, both the federally threatened Dakota skipper and the western prairie fringed orchid (*Platanthera praeclara*) are listed for Pipestone County, however western prairie fringed orchid has a low probability of occurrence within the WRA.

Forested Habitat

While there are some forested areas scattered throughout the WRA, the 2011 National Landcover Database – Land Use-Land Cover dataset indicates that the WRA contains a total of approximately 48 acres of forested areas, including deciduous, mixed, and evergreen forests. This is a proportionally very small amount of forest when compared to the overall WRA; comprising approximately 0.2 % of the WRA. Most of this acreage corresponds to wind breaks around homes or is associated with stream features such as Redwood River, Rock River or Beaver Creek or their tributaries. Forested areas and those suspected to contain forested wetlands are identified in *Figure 2* in **Appendix I**.

The WRA is located in the PPA that covers over 16 million acres of the western and southwestern parts of the state. Within the province, the WRA falls within the North

Central Glaciated Plains Section (251B) and the Inner Coteau (251Bc) and Coteau Moraines (251Bb) Subsections (MNDNR 2017e, b). Historically, these subsections were dominated by tall-grass prairie. Today, this subsection is primarily farmland, with little to no tall-grass prairie remaining (MNDNR 2017f).

Forested areas are important natural features within an agricultural landscape due to their ecological functions, and, also, because they provide habitat for wildlife, including both commonly found species as well as potentially threatened and endangered species.

4.2 Wetlands, Watercourses, and Riparian Areas

The WRA is located within the Lower Missouri River Basin and the Pipestone County area is partially within the Big Sioux - Pipestone (HUC8 10170203), Redwood River (HUC8 07020006), and Rock River (HUC8 10170204) watersheds (USEPA 2017a, b). Within these drainage basins, numerous intermittent and ephemeral watercourses and a few perennial watercourses are scattered across the WRA (see *Figure 3* in **Appendix I**). Many of these watercourses have mapped emergent, shrub/scrub, and forested wetland buffers ranging from a few feet to several hundred feet. Some are likely used for agricultural purposes. Based on aerial photo interpretation, a moderate number of these watercourses and associated wetlands are also likely jurisdictional Waters of the U.S. (WOUS) due to their proximity to the Red River within the Missouri River Basin, a Traditional Navigable Water (TNW).

According to the USGS NHD dataset, the WRA contains a total of approximately 100 acres (0.39%) of NHD waters (USGS 2017). Five (5) streams are MN public watercourses with designated buffer requirements according to the MN Buffer Law (MNDNR 2017g). All of these have 50-foot designated avoidance buffer requirements; the perennial East Branch Rock River in the west central, Redwood River in the northeast, East Branch Flandreau Creek in the northwest, and the North Branch Pipestone Creek in the west central sections of the WRA and one unnamed perennial tributary to Beaver Creek in the east central portion of the WRA (see *Figure 3* in **Appendix I**).

Floodplains within the WRA have been mapped by the Federal Emergency Management Agency (FEMA). There are no mapped 100-year (Zone A) floodplains within the WRA (see *Figure 3* in **Appendix I**).

According to the USFWS NWI database, the WRA contains a total of approximately 2,032 acres (7.9%) of mapped NWI wetlands and open water features. This total is comprised of 1,745 acres (6.8%) of Palustrine Emergent (PEM) wetlands, 41 acres (0.2%) of Palustrine Forested/Shrub-Scrub (PFO/PSS) wetlands, 172 acres (0.7%) of riverine waters, and 75 acres (0.3%) of freshwater ponds (USFWS 2017a).

Similarly, the 2011 National Land Cover Land Use dataset indicates that the WRA contains approximately 316 acres of emergent herbaceous wetlands (total of 1.2% of WRA).

It should be noted that there is a specific wetland type – calcareous fens that have been identified in the vicinity of the WRA. One calcareous fen has been identified within the WRA and several immediately adjacent to the WRA northeast of the Town of Holland (see *Figure 5* in **Appendix I**). Calcareous fens are unique in that they have upwelling hydrology with dissolved minerals which provide soils and hydrologic conditions specific to a unique assemblage of plants (called "calciphiles"). This wetland type is very rare (less than 200 known locations within the United States) and is protected under both federal (Section 404 of the Clean Water Act) and state law (Minnesota Wetland Conservation Act) (MNDNR 2016).

Although limited in quantity, the five (5) previously identified watercourses and approximately 2,032 acres of identified NWI wetlands have moderate to high potential to support a diverse assembly of wetland dependent fauna and flora. Both the state endangered Blanchard's cricket frog (*Acris blanchardi*) and state threatened Blanding's turtle (*Emydoidea blandingii*) occur in Pipestone County and could use the emergent wetland habitat adjacent to streams and ponds. Additionally, riparian corridors, especially those in otherwise agricultural landscapes serve as important movement corridors for wildlife including small mammals and many other types of amphibians. Refer to *Figure 3* in **Appendix I.**

The Natural Heritage Review from MNDNR indicated that in order to protect the calcareous fens in the vicinity of the WRA, construction activities should avoid the known calcareous fen location within the WRA and avoid altering the hydrological conditions in the surrounding area. If this is not possible and it is determined the project will adversely affect calcareous fens, Lake Benton II would need to coordinate with MNDNR.

Desktop review and the site reconnaissance confirmed that prairie wetlands are present within the WRA. The Natural Heritage Review indicated that if the Wetland Conservation Act (WCA) is applicable to this project, the prairie wetlands within the project boundary may qualify as "rare natural communities" under the WCA. Minnesota Rules, part 8420.0515, subpart 3 states that a wetland replacement plan for activities that modify a rare natural community must be denied if the local government unit determines that the proposed activities will permanently adversely affect the natural community. As such, additional coordination with the MNDNR is recommended to ensure fulfill full compliance will all necessary regulatory requirements.

4.2.1 Wellhead Protection Program

In addition to the state and federal laws regulating the direct impact to calcareous fens mentioned in *Section 4.2*, the State of Minnesota has an additional protection measure in the form of a Wellhead Protection Program which is aimed at protecting ground-water hydrology. The Wellhead Protection Program indirectly benefits calcareous fens by supporting fen maintenance and vegetative structure. Groundwater flow into fens has the potential to be altered by agricultural and residential drainage and wells. If alterations occur to the groundwater flow input, the underlying groundwater table is lowered because of groundwater extraction and the lack of recharge due to drained surface water. The Source Water Protection, Wellhead Protection (see *Figure 4 in*

Appendix I for Wellhead Protection Planning Areas), and MNDNR Appropriation provide protections for groundwater recharge, quality, and extraction.

The State of Minnesota has designated Wellhead Protection Areas which include a portion of the northern half of the WRA (see *Figure 4 in* **Appendix I** for Wellhead Protection Planning Areas). Groundwater protection measures such as this indirectly benefit calcareous fens. Designated wellhead protection measures from the State of Minnesota include the creation of a Wellhead Protection Plan, which includes the following components:

- Isolation distances from contamination sources;
- A map of the wellhead protection area;
- A vulnerability assessment of the well and the protection area;
- An inventory of potential contamination sources;
- A plan to manage and monitor existing contamination sources; and
- An emergency response plan.

4.3 Sensitive Habitats

4.3.1 Native Plant Communities

The Minnesota DNR defines a native plant community as a group of native plants that interact with each other and their environment and have not been greatly altered by human activity or introduced organisms, such as invasive species. Native plant communities provide many ecological functions such as carbon storage, enrichment of the soil, and native habitat for plant and animal species – some of which may be threatened or endangered (MNDNR 2017h). Leaving native plant communities intact is of value as these community types, and the ecological interactions within them, can take hundreds of years to develop.

Six (6) native plant communities are located within the WRA including bulrush marsh, calcareous fen, Prairie Meadow/ Carr, and three (3) native plant communities as summarized below.

- One (1) native plant community type consisting of bulrush marsh (MRp93a) (37.3 acres), ranked as Critically Imperiled (S1) community type and Condition “NR” (Not Ranked) is located within the WRA in the southern portion west of Woodstock WMA (see *Figure 5* in **Appendix I**).
- A native plant community type classified as a calcareous fen (OPp93b) (1 acre), ranked as Imperiled (S2) and Condition “B” (good ecological integrity), is located within the WRA near the western boundary (see *Figure 5* in **Appendix I**).
- Native plant community type WMp73a (164.6 acres), Prairie Meadow/Carr, ranked as Vulnerable to Extirpation (S3) and Condition “C” (fair ecological integrity) is found in several locations in the central and southeastern portion of the WRA (see *Figure 5* in **Appendix I**).

- The remaining three (3) native plant communities within the WRA are native prairies. Refer to *Section 4.3.4* for a discussion on Native Prairies.

Part of the project lies within the Prairie Core Area of the 25-year Minnesota Prairie Conservation Plan (**Appendix IV**) (Minnesota Prairie Plan Working Group 2011). In order to meet the plan's goal, any restoration efforts within the Prairie Core Areas are encouraged per the Natural Heritage Review letter from the MNDNR.

A variety of other native plant communities exist and are mapped within a 1-mile buffer of the WRA (see *Figure 5* in **Appendix I**). The most common communities are Mesic Prairies, Wet Prairies, Dry Sand-Gravel Prairies, Dry Hill Prairies and Prairie Meadows The prairies and wet meadows account for approximately 258 acres within 1-mile of the project boundary, while the calcareous fens account for approximately 3.7 acres of native wetland, located primarily in the southwest portion of the WRA 1-mile buffer. See *Photographic Log* for representative photos of several of the aforementioned native plant communities in **Appendix II**.

4.3.2 MN Biological Survey Sites of Biodiversity Significance

The Minnesota Biological Survey (MBS) is responsible for assigning a biodiversity significance rank to each site they survey at the conclusion of work in a geographic region. These rankings are used to communicate native biodiversity significance to natural resource professionals, state and local government officials, and the public, as well as to guide conservation and management of the State's natural resources (MNDNR 2017i).

The MBS uses four (4) classifications denoting level of biological diversity to rank sites. These rankings are "Outstanding", "High", "Moderate", and "Below". While sites ranked "outstanding" contain the best occurrences of the rarest species (including rarest native plant communities or the most intact native ecosystem), sites ranked "below" lack the occurrence of rare species, intact ecological communities, or are highly disturbed. The "high" and "moderate" rankings fall in between these classifications (MNDNR 2017i).

Twenty-five (25) sites of Biodiversity Significance are located within and/or directly abut the WRA (see *Figure 5* in **Appendix I**); one (1) site is ranked as "outstanding", six (6) sites are ranked as "high", nine (9) sites are ranked as "moderate", and nine (9) sites are ranked as having "below" biodiversity significance.

The sites of Biodiversity Significance are scattered throughout the WRA, with the heaviest concentration of sites occurring in the central portion of the WRA on either side of Highway 23, and in the southeast corner of the WRA. One (1) site ranked as "outstanding" biodiversity significance (472 acres) is associated with the Prairie Coteau Scientific and Natural Area (SNA) in the west-central portion of the WRA (see *Figure 5* and *Figure 6* in **Appendix I**). Within the WRA, this site is also a MNDNR designated native plant community consisting mostly of Southern Dry Prairie (UPs13).

Most of the "high" (1,387 acres) and "moderate" (1,485 acres) ranked sites of Biodiversity Significance are associated with Southern Dry Prairie (UPs13), Southern

Wet Prairie (WPs54), Prairie Wet Meadow (WMp73), and the Prairie Bulrush-Arrowhead Marsh native plant community types. Most of the "below" ranked sites of Biodiversity Significance are not associated with any mapped native plant communities. Refer to *Figure 5* in **Appendix I** for mapped sites of Biodiversity Significance.

In addition to the sites identified within the WRA, 17 sites of Biodiversity Significance were identified within one (1) mile of the WRA (see *Figure 5* in **Appendix I**). These consist of one (1) site with a "high" biodiversity ranking, seven (7) sites with a "moderate" biodiversity ranking, and nine (9) sites with a "below" biodiversity ranking. Sites ranked as "high" or "moderate" account for 1,321 acres. An additional eight (8) sites of Biodiversity Significance previously identified within the WRA also are present the 1-mile buffer of the WRA.

The Natural Heritage Review letter from the MNDNR recommends that:

- MBS Sites be considered avoidance areas due to their ecological significance;
- Disturbance should be minimized near these ecologically significant areas; and
- If any disturbance to MBS Sites comprised of native prairie is proposed, rare species surveys will likely be required.

4.3.3 MN Scientific and Natural Areas (SNA)

Minnesota's state Scientific and Natural Areas are lands that are set aside for scientific study and to promote public understanding. They can consist of native plant and animal communities, rare species, and areas of significant biodiversity. The goals of the program are to preserve Minnesota's natural heritage and to provide opportunities for nature-based recreation, education and research (MNDNR 2017j).

One (1) state SNA is located within the WRA. Prairie Coteau SNA is located in the west-central portion of the WRA and accounts for approximately 420 acres of the WRA (see *Figure 6* in **Appendix I)**. Refer to *Section 4.4.2* for more information on Scientific and Natural Areas (MNDNR 2017j).

4.3.4 Native Prairies

Native prairies fall under the native plant communities heading discussed in *Section 4.3.1*. They are groups of native plants that interact with each other and their environment that have not been greatly altered by human activity or introduced organisms, such as invasive species. While one-third of Minnesota was covered in native prairie prior to European settlement, less than 2% of this prairie remains today (Minnesota Prairie Plan Working Group 2011). Protecting native plant communities helps to preserve the unique ecological interactions that exist within these communities.

There are 49 native prairies within the WRA (see *Figure 5* in **Appendix I**). The 49 prairies consist of three (3) different types. Forty-four (44) of these prairies are classified as UPs13d, Dry Hill Prairie (Southern). Minnesota DNR describes this prairie type as grass dominated, but forb rich, occurring on medium- to fine-textured soils on moderate to steep slopes in glacial till or loess-mantled till (MNDNR 2017k). Altogether,

the Dry Hill Prairie (Southern) prairie type makes up approximately 868 acres within the WRA. These Dry Hill Prairie remnants are specifically mentioned in the MNDNR Natural Heritage Review letter for recommended protection.

Four (4) prairies are classified as WPs54b, Wet Prairie (Southern), accounting for approximately 47 acres of the WRA. Minnesota DNR describes this prairie type as grass dominated, but forb rich, occurring on poorly drained to very poorly drained loam soils formed in lacustrine sediments, unsorted glacial till, or less frequently outwash deposits. Saturation typically persists in the lower part of the rooting zone for much of the season (MNDNR 2009). One (1) prairie is classified as UPs23a, Mesic Prairie (Southern), and is characterized as grass dominated, forb rich, and occurring on somewhat poorly drained to well-drained loamy soils (MNDNR 2017k). This prairie type accounts for approximately six (6) acres of the WRA (see *Figure 5* in **Appendix I**).

There are eight (8) native prairies within one (1) mile of the project boundary (see *Figure 5* in **Appendix I**). Of these, four (4) prairies are classified as UPs13b, making up 29.3 acres of the WRA, three (3) are classified as UPs13d (43.5 acres), and the remaining native prairie is classified as WPs54b (12.7 acres). In addition, the Natural Heritage Review letter sent by MNDNR on July 11, 2017 in response to the NHIS data request noted that a portion of the WRA lies within the Prairie Core Area of the 25 year Minnesota Prairie Conservation Plan (**Appendix IV**) (Minnesota Prairie Plan Working Group 2011). In order to meet the plan's goal, any restoration efforts within the Prairie Core Areas are encouraged per the Natural Heritage Review letter from the MNDNR. The MNDNR Natural Heritage Review letter also noted that if disturbance to native prairie is proposed, rare species surveys will likely be required.

4.3.5 Railroad Rights-of-Way Prairies

Railroad rights-of-way (ROW) prairies are important remnants of native prairie dating back to the time at which the railroads were built, many in the late 19th century. As much of Minnesota's native prairie was intact during this time, this prairie was able to naturally reseed disturbed areas within the ROW following track construction. Additionally, fires that were periodically sparked by passing trains served the purpose of simulating historic wildfires, helping to maintain these important prairie remnants until today (MNDNR 1999).

Three (3) railroad ROW prairies are located within the WRA (see *Figure 5* in **Appendix I**). The Burlington Northern and Santa Fe Railroad runs southwest to northeast and supports intermittent patches of fair to good quality mesic prairie habitat within the WRA. These three (3) railroad ROW prairies account for approximately 2.6 miles of linear ROW prairie collectively within the WRA.

An additional two (2) sections of designated railroad ROW prairies exist within one (1) mile of the WRA. They account for approximately 0.9 miles of linear ROW prairie collectively within the one-mile buffer of the WRA.

These limited and fragmented corridors are not expected to draw threatened or endangered or sensitive species into the WRA and impacts to these prairies are not expected to occur.

The Natural Heritage Review letter from the MNDNR recommends that:

- Railroad ROW prairies be considered avoidance areas due to their ecological significance;
- Disturbance should be minimized near Railroad ROW prairies; and
- If disturbance of Railroad ROW prairie is proposed, rare species surveys will likely be required.

4.3.6 Regionally Significant Ecological Areas

No MNDNR designated regionally significant ecological areas exist within the WRA or within a one (1) mile buffer of the WRA.

4.4 Public Lands

4.4.1 Federal Lands

No Federal lands such as National Wildlife Refuges or Waterfowl Production Areas are located within the WRA.

4.4.2 State Lands

WMAs are owned by the state and are established to protect and manage lands and waters for wildlife production, public hunting, trapping, fishing, or other recreation. Minnesota has approximately 1,500 WMAs, consisting of over 1.3 million acres of public land.

Four (4) WMAs are either within the WRA or are partially within the WRA (*Figure 6* in **Appendix I**). Most of these areas are also associated with an MBS Site of Biodiversity Significance. The Woodstock West and Woodstock East WMAs are ranked as “high” biodiversity significance, Gromer’s Draw WMA is ranked as “moderate”, while the Buffalo Ridge WMA is not ranked for biodiversity significance.

The WMA’s are all within the western or southern portion of the WRA. No state parks or recreational trails are located within the WRA.

WMA	Acreage	Location
Buffalo Ridge WMA	41.1	T108 R44 S29
Woodstock West WMA	46.4	T107 R44 S2
Woodstock East WMA	204.1	T107 R44 S1
Gromer’s Draw WMA	87.4	T107 R44 S10

SNAs, as discussed in *Section 4.3.3*, are state owned lands that are set aside for scientific study and to promote public understanding. Prairie Coteau SNA is the only

SNA present within the WRA and is ranked as an "outstanding" site of biodiversity significance. See *Figure 6* in **Appendix I** and the *Photographic Log* in **Appendix II**.

SNA	Acreage	Location
Prairie Coteau SNA	420	T108 R44 S32

4.5 Conservation Easements

4.5.1 Conservation Reserve Program

CRP easements may exist within the WRA; however, publically available CRP spatial data were not readily available for this SCS. Spatial data for CREP easements were available. There are five (5) CREP easements within the WRA (see *Figure 6* in **Appendix I**). According to the USDA Farm Service Agency (FSA), CREP is an offshoot of, and very similar to, the Conservation Reserve Program. CREP targets high-priority conservation issues that have been identified by local governments or non-governmental organizations. In exchange for removing environmentally sensitive land from production and introducing conservation practices, farmers, ranchers, and agricultural land owners are paid an annual rental rate. The program is voluntary, contracts are typically 10 to 15 years in duration, and landowners may receive other federal or state incentives as part of their CREP agreement (USDA-FSA 2017).

The five (5) CREP easements consist of approximately 195 acres of wetland, riparian, and pasture habitat located in the northeast section of the WRA. The wetland CREP parcel is approximately 21 acres, the riparian parcel is 169 acres, and the pasture parcel is 5 acres (*Figure 6* in **Appendix I**). The contract for the pasture parcel of CREP land shows an expiration date in the year 2052, while the remaining parcels do not show an expiration date.

4.5.2 USFWS Easements

No USFWS easements are present within the WRA or within the one-mile buffer of the WRA.

4.5.3 Reinvest in Minnesota and Permanent Wetland Preserves

The RIM Reserve Program was established in 1986 and is managed by the Minnesota Board of Water and Soil Resources (BWSR) (2017). Much like the federally-managed CREP lands, RIM seeks to identify high-priority conservation issues such as wetland restoration or sensitive groundwater areas, and work with landowners of marginal agricultural land to restore land to its original functions. This can include restoring previously drained wetlands or planting permanent native vegetation. The program provides direct payment to landowners for conservation easement acquisition.

One RIM easement is present within the WRA. It is located in the southeast portion of the WRA and consists of approximately 0.2 acres.

Two PWP parcels are present within the WRA. The PWP is similar to RIM and is managed by BWSR. The two parcels are located in the west central section of the WRA and account for approximately 3.2 acres of the WRA.

Any violations of either a RIM easement or PWP parcel easement by the landowner or any third party are liable for enforcement and damages per Chapter 103F of The State of Minnesota Office of the Revision of Statutes (2016).

5.0 THREATENED AND ENDANGERED SPECIES

Atwell requested a USFWS IPaC report for the WRA located in Pipestone County, Minnesota. In addition, Atwell conducted a database review of state-listed threatened and endangered species that could potentially be present within the WRA or vicinity. Table 1 presents the results of Atwell's TES review and incorporates both MNDNR NHIS occurrence records (see Table 2 below) and AKN occurrence records (AKN 2017). A number of the species listed in the table are aquatic species. Wind Farm impacts upon aquatic species, if any, are typically extremely limited.

Table 1. Federal and state-listed threatened and endangered species with the potential to occur within the Lake Benton II WRA.

Common Name (*Scientific Name*)	Status	Occurrence Probability	Habitat Requirements
Northern Long-eared Bat *(Myotis septentrionalis)*	FT	Low	Roosts under bark, cavities, or crevices of dead and living trees during summer. Colonies can be found in manmade structures as well. May occur as a migrant within the WRA, but the absence of high quality woodlands or floodplain forests within the WRA limit the species' likelihood to occur as a summering or wintering species' within the WRA.
Burrowing Owl *(Athene cunicularia)*	SE	Moderate	Burrowing owls are typically found in open, grazed pastures or native prairies populated by burrowing mammals. Areas of intensive agricultural are generally not used. As grasslands are prevalent on the WRA, this species may occur. However, this portion of Minnesota is on the margin of this owl's range and as a result its likelihood of occurring as a breeding species in the WRA is moderately low.
Blanchard's Cricket Frog *(Acris blanchardi)*	SE	Low	Shallow wetlands, streams, or rivers and areas along water's edge with muddy shorelines and abundant emergent vegetation. Suitable habitat may be present in the WRA, but there are no NHIS occurrence records from the WRA or 1-mile buffer and the only known extant populations of this species are in Hennepin and Winona counties (MNDNR 2017l).
Henslow's Sparrow *(Ammodramus henslowii)*	SE	Moderate	Older grassland habitat with a lot of structure or thatch available. Henslow's sparrows prefer uncultivated grasslands and old fields with stalks for singing perches and a substantial litter layer. AKN and MNBBA data indicates records in the regional vicinity of the WRA and there is moderate occurrence probability for the WRA.
Loggerhead Shrike *(Lanius ludovicianus)*	SE	Moderate	Upland grasslands, prairie, pastures, old fields, sometimes agricultural areas with perching areas such as hedgerows or shrubs. Suitable habitat exists within the WRA, and recent AKN data from just east of the WRA indicates moderate potential for this species' occurrence in the WRA.
Poweshiek Skipperling	FE/SE	Moderate	Habitats used by the Poweshiek skipperling in Minnesota include a wide range of native prairie but not sand prairie. Habitats

Common Name (*Scientific Name*)	Status	Occurrence Probability	Habitat Requirements
(Oarisma poweshiek)			dominated by nonnative grasses are not suitable for this skipper. Federal designated critical habitat is present within the WRA at Prairie Coteau SNA and NHIS data reveal that surveys at this site during the late 1980s through the mid-1990s detected 50-200 individuals each summer at this protected site. This species has declined precipitously throughout its range since then, but may still occur in pockets of remnant prairie such as those designated as critical habitat.
Dakota Skipper (*Hesperia dacotae***)**	FT/SE	Moderate	In Minnesota, the Dakota skipper seems to prefer native dry-mesic to dry prairie, where medium grasses are a large component of the vegetation plant community. The most productive sites in Minnesota feature some topographic relief. Federal designated critical habitat for this species is present within the WRA at both Prairie Coteau SNA and Woodstock WMA. NHIS data reveals two occurrence records at each of the aforementioned sites as recently as 2007/2008.
Ottoe Skipper *(Hesperia ottoe)*	SE	Moderate	The Ottoe skipper's habitat requirements are very specific and consist of native prairie or barrens habitat. These habitat preferences largely overlap with those of the Dakota skipper and Poweshiek skipperling. Adults will forage into nearby, moister prairie (mesic and wet prairie) for nectar. Suitable habitat is present within the WRA and there is one NHIS record from Prairie Coteau SNA in 1995 but suitable habitat is prevalent at that site. Suitable habitat at that state protected site is prevalent and this species' is found in similar habitat as the two previous federally listed butterfly species.
Blanding's Turtle *(Emydoidea blandingii)*	ST	Moderate	Ponds, marshes, swamps, bogs, wet prairies, river backwaters, embayment areas, inlets, and slow moving rivers. Utilize sandy and agricultural uplands adjacent to water features for foraging and nesting. The WRA may provide habitat for this species.
Topeka Shiner (*Notropis topeka)*	FE/SC	Moderate	Topeka shiners are found in slow-moving, small to mid-size, prairie streams with sand or gravel bottoms. Pool and oxbow areas that are outside main channel courses are preferred. The entirety of the WRA is located within federal designated critical habitat for this species, but suitable habitat within the WRA is limited. There are two NHIS occurrence records along the southwestern 1-mile buffer of the WRA but none within the WRA. However, USFWS recommendations for the Big Sioux River and Rock River Watersheds have the potential to be a constraint for some construction related activities for the WRA.
Plains Topminnow *(Fundulus sciadicus)*	ST	Moderate	Plains topminnows preferred habitat consists of spring-fed backwaters of clear to moderately turbid watercourses that have a sand or rock bottom and a high density of aquatic plants. There is one NHIS occurrence record in the southern portion of the WRA from 2006. Suitable habitat may be present in the WRA, but is limited.
Western Prairie Fringed Orchid (*Platanthera praeclara)*	FT	Low	The western prairie fringed orchid is found almost exclusively in remnant native prairies and sedge meadows. This species prefers full sunlight sites on moist, calcareous till or sandy soils. Suitable habitat may be present in the WRA, but there are no NHIS occurrence records from the WRA or 1-mile buffer.

Common Name (*Scientific Name*)	Status	Occurrence Probability	Habitat Requirements
Hair-like Beak Rush *(Rhynchospora capillacea)*	ST	Moderate	Hair-like beak rush is difficult to detect even when present as a result of its diminutive size and its penchant for growing below much thicker sedge and grass dominated calcareous fen margins At least one calcareous fen is known to occur in the WRA which has a corresponding NHIS occurrence record of this species at it.
Hairy Waterclover *(Marsilea vestita)*	ST	Low	Hairy waterclover prefers moist soil along the margins of ephemeral rainwater pools found on rock outcrops. These areas have little vegetation but receive direct sunlight. The species has been confirmed at less than seven locations within southwestern Minnesota (MNDNR 2017m). Suitable habitat availability is unknown, but appears to be limited in the WRA.
Mud Plantain *(Heteranthera limosa)*	ST	Low	All but one of the *H. limosa* populations in Minnesota occur in aquatic habitats. These habitats are located in association with outcrops of Sioux quartzite in the prairie region of the state. Where outcrops occur as flat terraces with gentle slopes, vernal pools may form among the outcrops and depressions in the rock (MNDNR 2017n). Suitable habitat does not appear to be present in the WRA.
Prairie Quillwort *(Isoetes melanopoda)*	SE	Low	Prairie quillwort is exclusively found in the prairie region of Minnesota, primarily on exposed Sioux quartzite bedrock. Where these outcrops occur as flat terraces or with gentle slopes, vernal pools may form among the outcrops or in depressions in the rock (MNDNR 2017o).. This is a distinct and uncommon habitat type in Minnesota. It is also the preferred habitat of other rare species. Suitable habitat does not appear to be present in the WRA.
Short-beaked Arrowhead *(Sagittaria brevirostra)*	SE	Moderate	Short-beaked arrowhead occurs along the muddy margins of slightly acidic to alkaline ponds and wetlands. The species is confirmed to occur at Woodstock WMA with one NHIS occurrence record from 2006 at that location in the southeastern portion of the WRA.
Short-pointed Umbrella-sedge *(Cyperus acuminatus)*	ST	Low	Short-pointed umbrella sedge is found in the disturbed, wet, sandy or muddy shores of lakes, ponds and streams, on mud flats and sloughs (MNDNR 2017p). The WRA may provide limited habitat for this species, but there are no NHIS occurrence records from the WRA or the 1-mile buffer.
Waterhyssop *(Bacopa rotundifolia)*	ST	Low	Waterhyssop is found in short-lived, rainwater pools of rock outcrops and prairie ponds. These pools typically dry up in early summer and waterhyssop disappears (MNDNR 2017q). Suitable habitat does not appear to be present in the WRA.
Wolf's Spikerush *(Eleocharis wolfii)*	SE	Low	The Minnesota population of Wolf's spikerush is limited to five confirmed locations in Renville, Scott, Pipestone, and Rock counties. These locations are all associated with rock outcrops, specifically the margins of bedrock pools that collect or concentrate precipitation runoff (MNDNR 2017r). Suitable habitat does not appear to be present in the WRA.
FT – Federally listed as threatened, **FE** – Federally listed as endangered, **FC**–Federal Candidate Species, **SE** – State listed as endangered, and **ST** – State listed as threatened			

5.1.1 Federally-listed Species

Although the WRA is situated within an agricultural region, habitats that could potentially support threatened and endangered species may still occur within the WRA. As indicated in this report, flora and fauna documented within certain portions of the WRA may include federal or state listed species.

Federally listed species are protected under federal law by the Endangered Species Act of 1973 (16 U.S.C §1531-1544) and by state law under Minnesota Rules, Chapter 6134. The Minnesota Endangered Species statute also authorizes the MNDNR to adopt rules that regulate treatment of species designated as endangered and threatened. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300.

The USFWS provides distribution lists of federally listed threatened, endangered, and candidate species on a county-by-county basis. The USFWS list for Pipestone County indicates that Pipestone County is within the range (i.e., has documented records and/or has the potential to harbor critical habitat for the designated species) of the federally threatened northern long-eared bat, Topeka shiner, Dakota skipper, western prairie fringed orchid, and federally endangered Poweshiek skipperling. In the state of Minnesota, each of these species (except Topeka shiner) is state listed as endangered and the Topeka shiner is state listed as a special concern species. All of these federal and state listed species except for northern long-eared bat and western prairie fringed orchid have a moderate potential (based on habitat and past occurrence records) to occur on the WRA and are discussed in more detail below

<u>Northern Long-eared Bat</u>

The northern long-eared bat is federally threatened and state endangered species. The impetus for this species' listing by USFWS was primarily due to the threat posed by the white-nose syndrome (WNS), a fungal disease that has affected several bat populations (USFWS 2016). The decision to list the bat as threatened with a 4(d) rule provides protection to address conservation needs of this bat species (USFWS 2016). For areas in the United States where WNS affects bat populations, the conservation measures provided in the 4(d) rule exempt "take" (defined under the ESA as harming, harassing, or killing of protected species) as a result from certain activities (i.e., wind turbine operation, forest management, maintenance of utility right-of-ways, tree/shrub removal for prairie maintenance, and limited tree-removal activities, etc.) (USFWS 2016). The USFWS consider all Minnesota counties to be a part of the WNS zone as of June 30, 2017 (USFWS 2017b) and thus the WRA is within the WNS zone. The 4(d) rule applies to the WRA, but would only affect the project in terms of tree clearing restrictions if a roost tree was confirmed within the WRA.

The northern long-eared bat ranges from eastern Quebec west to central Saskatchewan, Canada to northern Florida (Sparks et al. 2011, USFWS 2014a). In Minnesota, the northern long-eared bat is considered relatively common, likely to occur in the eastern half of the state within forested habitat (Baker 2016), and hibernate from mid-October to early April in caves and mines (USFWS 2015a). This species of bat has been known to be found in the same hibernacula as several other bat species, including

the Indiana bat (*Myotis sodalis*). The closest northern long-eared bat hibernacula in Minnesota are located on the border between Nicollet and Le Sueur counties (approximately 105 miles to the east of the WRA) (USFWS 2007, MNDNR and USFWS 2017). Although there is limited information on the movement of this species between winter and summer habitat, a maximum migration distance of 35 miles was reported farther south in the species' range (from Missouri), but further research may determine longer migrations (Boyles et al. 2009).

The northern long-eared bat roosts under bark, cavities, or crevices of dead and living trees during summer (Carter and Feldhamer 2005, USFWS 2015b). Summer roosting is generally sexually segregated; females form maternity colonies and males roost singly or in small groups in trees; however, colonies can be found in manmade structures as well (Boyles et al. 2009). Foraging habitat is generally located within forests interiors beneath the forest canopy, but above the shrub strata; however, northern long-eared bats have been known to forage over tallgrass prairie habitat where insects are gleaned from vegetation (Boyles et al. 2009). The bat may occur as a migrant within the WRA, but the absence of high quality woodlands or floodplain forests within the WRA limit the bat's likelihood to occur as a summering or wintering species within the WRA.

Topeka Shiner

The Topeka shiner is a federally endangered species that occurs in small prairie streams in pools containing clear, clean water (Berg et al. 2004). The Topeka shiner is known to occur in portions of South Dakota, Minnesota, Kansas, Iowa, Missouri, and Nebraska. Most Topeka shiner streams are perennial (flow year-round), but some are small enough to stop flowing during the drier summer months (MNDNR 2017t). Topeka shiner preferred habitat generally consists of streams with clean gravel, rock, or sand bottoms. The Topeka shiner is restricted to small, prairie streams that are tributaries to the Missouri River in Lincoln, Murray, Nobles, Pipestone, and Rock counties in southwestern Minnesota (MNDNR 2017t).

Final critical habitat was designated by USFWS for the Topeka shiner on July 27, 2004 and encompasses streams within the entirety of the WRA and approximately 196 miles of 21 stream segments in Pipestone County, Minnesota (USFWS 2004). The closest NHIS occurrence records to the WRA consist of two records in the 1-mile buffer along the southern and western margins of the WRA (the most recent of which was in 2015). However, the USFWS Twin Cities Field Office has prepared specific recommendations for projects impacting waters containing Topeka shiners in Minnesota (USFWS-Twin Cities Field Office 2016). These recommendations are restricted to the Big Sioux River and Rock River watersheds within Pipestone County. These two watersheds make up approximately 48% of the WRA (refer to *Figure 3* in **Appendix I**).

The Topeka shiner management minimization recommendations for the Big Sioux River and Rock River Watersheds (approximately 47.7% of the WRA; *Figure 3* in **Appendix I**) prepared by the USFWS Twin Cities Field Office (2016) include (but are not limited to) the following:

- Do not dewater or temporarily divert streams for construction;
- Do not conduct in-stream work before August 15 to avoid disrupting spawning;
- Follow all applicable requirements and best management practices for stormwater permits from the Minnesota Pollution Control Agency (MPCA);
- Minimize removal of riparian vegetation;
- Mulch areas of disturbed soil and reseed promptly;
- Implement appropriate erosion and sediment prevention measures;
- Ensure that erosion control features are in place;
- Design and install instream structures (e.g., box culverts) in a manner that will not impair passage of Topeka shiners after construction is completed;
- Do not operate motorized vehicles instream;
- Backfill placed in the stream shall consist of rock or granular material free of fines, silts, and mud; and
- Prevent materials and debris from falling into the water during construction.

Following the above minimization recommendations (particularly in the portions of the WRA that fall within the two specifically identified watersheds) may help avoid more extensive coordination with USFWS regarding construction impacts, particularly involving any stream crossings and MPCA Stormwater Permit requirements. However, additional coordination with USFWS Twin Cities Field Office may be warranted depending on various project-related construction design/impacts.

Dakota Skipper

The Dakota skipper is a federally–listed threatened species and state listed endangered species in Minnesota. The Dakota skipper is thought to prefer native drier prairie, where medium grasses are a major element of the vegetation. The most productive sites in Minnesota feature some topographic relief (Swengel and Swengel 1999). Adults will forage into nearby lowland prairie (mesic and wet prairie) for nectar. Final critical habitat was designated by USFWS for the Dakota skipper on October 1, 2015 and includes about 19,900 acres in units in Minnesota, North Dakota, and South Dakota (USFWS 2014b). Two federally designated critical habitat units for the Dakota skipper occur within the WRA and are associated with Woodstock WMA East Unit in the eastern portion of the WRA and Prairie Coteau SNA in the western portion of the WRA. NHIS data reveals two (2) occurrence records at each of these designated critical habitat sites as recently as 2007/2008.

A desktop analysis aimed at identifying potential suitable habitat for the Dakota skipper and Poweshiek skipperling was contracted via Atwell and conducted by SWCA Environmental Consultants in June 2017. The desktop analysis, based off aerial imagery, identified a patchwork of potentially suitable habitat (remnant native prairie and wetlands) for both the Dakota skipper and Poweshiek skipperling scattered throughout the WRA (see *Figure 5* in **Appendix I**).

In recent decades, the skipper has disappeared from states to the south and east of Minnesota and has become increasingly rare and local in its remaining range (Cochrane and Delphey 2002). Despite recent targeted survey effort for this species, recent

confirmed records of this species in western Minnesota have become very rare (MNDNR 2017s). However, these survey results provide a limited picture of the species, as this species' survey window is extremely limited each summer (a three week period from late June to mid-July during calm periods in the morning only). Furthermore, there are a very small number of qualified surveyors who can identify this inconspicuous species in the field. As a result this species does have the potential to occur in appropriate grassland habitats within the WRA.

Poweshiek Skipperling

The Poweshiek skipperling is a small butterfly listed as state and federally endangered in Minnesota. Poweshiek skipperlings require wet mesic prairie or southern fen habitat. In Minnesota this includes wet to dry native prairie with native grasses, sedges, and a significant component of plants in the sunflower family. Final critical habitat was designated by USFWS for the Poweshiek skipperling on October 1, 2015 and includes about 25,900 acres in units in Minnesota, Iowa, Michigan, North Dakota, South Dakota, and Wisconsin (USFWS 2014b). One critical habitat unit for the Poweshiek skipperling occurs within the WRA is associated with the Prairie Coteau SNA in the western portion of the WRA. Furthermore, the desktop analysis contracted by Atwell and conducted by SWCA Environmental Consultant in June 2017 identifies additional potentially suitable habitat for both the Poweshiek skipperling and Dakota skipper scattered throughout the WRA (see *Figure 5* in **Appendix I**).

NHIS data reveals that surveys at Prairie Coteau SNA (in the western portion of the WRA) during the late 1980s through the mid-1990s detected 50 to 200 individuals of Poweshiek skipperling each summer at this protected site. However, the last confirmed sighting of this species in Minnesota occurred in 2007, despite targeted annual surveys since 2013. However, this species does have the potential to occur in appropriate grassland habitats within the WRA.

Western Prairie Fringed Orchid

The Western prairie fringed orchid is a federally threatened and state listed endangered species in Minnesota. Western prairie fringed orchids are very local in their distribution and are largely restricted to remnant native prairies or sedge meadows. These sites typically occur in full sunlight on moist till or sandy soils. There are very few remaining suitable sites for this orchid within its range as this species requires no cattle grazing and limited if any historical mowing for wild hay (MNDNR 2017u). Remnant native prairie and wetlands occur in the WRA; however there are no NHIS records of this species within the WRA or the 1-mile buffer. As such, this species is expected to have a low chance of occurring within the WRA.

5.1.2 State-Listed Species

The overall Pipestone County TES list from MNDNR was reviewed to populate a list of species that may pose a concern for development within the WRA. Each species' preferred habitat, land cover attributes and the results of the site reconnaissance were considered to assess the likely presence of each state species. The state list includes a total of 19 species that may be present within the WRA. Three (3) of these species are also federally listed and are discussed above in *Section 5.1.1*: the Poweshiek

skipperling, Dakota skipper, and western prairie fringed orchid. The remaining 16 species listed for Pipestone County consist of eight (8) plants, four (4) birds, one (1) reptile, one (1) amphibian, one (1) insect, and one (1) fish.

While the state threatened and endangered species listed in Table 1 have the potential to occur in the general geographic range of the WRA, most of the species listed in Table 1 are restricted to aquatic, wetland, riparian mesic forest, and native or tallgrass prairie habitat types. Appropriate planning and strategic siting of turbines, roads, and infrastructure to avoid these unique habitat types would likely reduce or eliminate potential risks to the threatened and endangered species found within those habitats.

Native prairie is present within the WRA, along with a significant amount of grassland that is not entirely native but includes native grasses and forbs. These grassland and prairie habitat areas provide valuable habitat for grassland nesting or foraging birds and, potentially, state or federally listed plant species (e.g., western prairie fringed orchid). Not only may state-listed bird species such as the Henslow's sparrow or loggerhead shrike utilize such grassland areas, but many other species such as Ottoe skipper (*Hesperia ottoe*), upland sandpiper (*Bartramia longicauda*), waterfowl, various small mammals, and other types of songbirds may utilize this habitat type as well.

A closer examination of suitable habitat for state listed species can be found in the section below. Habitat for eight (8) state listed endangered or threatened species may be present within the WRA: Henslow's sparrow (MN endangered), loggerhead shrike (MN endangered), burrowing owl (MN endangered), Blanding's turtle (MN threatened), plains topminnow (MN threatened), Ottoe skipper (MN endangered), hair-like beak rush (MN threatened), short-beaked arrowhead (MN endangered), and short-pointed umbrella sedge (MN threatened).

Henslow's Sparrow

Henslow's sparrow occur throughout the Upper Midwest in older grassland habitat with a lot of structure or thatch available (Herkert et al. 2002). Their habitat is ephemeral and the species can occur for several years at a site before leaving as the grassland habitat becomes too thick/thin or woody plants start encroaching (MNDNR 2017v). The Minnesota Breeding Bird Atlas (2009-2014; MNBBA) recorded multiple probable and possible breeding records within the regional vicinity of the WRA in Pipestone and Lyon County to the northeast of the WRA (MNBBA 2014). In addition, AKN data indicates that there are multiple records of this species from Prairie Coteau SNA within the WRA from 2012 and 2013. Additional recent AKN observations occur and within a similar mixed grassland-agriculture habitat matrix in the regional vicinity of the WRA (AKN 2017). Isolated pockets of potentially suitable grassland habitat were observed during the course of the site visit, so this species could continue to utilize grasslands within the WRA as nesting habitat.

Loggerhead Shrike

Loggerhead shrike have declined throughout their historic range in the eastern and Midwestern portions of the species' range (Yosef 1996). The species' utilizes a variety of grassland and scrub-shrub or early successional type habitats. The NHIS occurrence

data indicates one record of the species from the WRA in 1995. In addition, a loggerhead shrike was observed approximately seven miles south of the WRA in July 2017 in eastern Pipestone County based on available AKN data. Furthermore, western Murray County (the county adjacent to Pipestone County to the east) has four (4) records of the species over the past six years (MNBBA 2014, AKN 2017). Potentially suitable grassland habitat and early successional shrubby edges and wind breaks were observed during the course of the site reconnaissance. As a result, this species may occur as a thinly distributed breeding species within the WRA.

Burrowing Owl

Burrowing owls are typically found in open, grazed pastures or native prairies populated by burrowing mammals. Areas of intensive agricultural are generally not used (MNDNR 2017w). Minnesota is on the northeastern margin of the species range, and is a rare to very uncommon breeding species confined to southwestern Minnesota (Poulin et al. 2011). NHIS data indicates that this owl species was confirmed breeding within the western portion of the WRA for three consecutive years from 1987-1989. In addition, there are at least three records since 2002 within Pipestone County or western Murray County (just east of the WRA) within a similar grassland-agriculture habitat matrix (AKN 2017). While potentially suitable habitat is present within the WRA, the general scarcity of this species as a breeder anywhere in the state suggests that burrowing owls have a moderately low likelihood of occurring in the WRA.

Blanding's Turtle

Blanding's turtle is a state threatened species which prefers clean shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates. These habitats include ponds, marshes, swamps, bogs, wet prairies, river backwaters, and slow moving rivers. Sunny and well-drained terrestrial habitats are utilized during mating and nesting periods, and occasionally in the fall (MNDNR 2017x). In the southwestern region of Minnesota, the species is adaptable, utilizing a wide variety of wetland types, streams, and prairie pothole habitats. Females have been widely documented placing their nests in agricultural fields adjacent to wetland or riverine habitats, creating additional hazards for the species (MNDNR 2017x). NHIS occurrence data indicates one record of this species from within the WRA in 2007 and an additional record from 2004 was documented in the 1-mile buffer of the WRA. In addition to the various wetlands and streams within the WRA, agricultural uplands adjacent to these habitat types may provide nesting habitat for the Blanding's turtle within the WRA.

The Natural Heritage Review letter recommendations for the WRA include:

- Setting up silt fencing to keep the turtles out of construction areas;
- Utilizing larger, specified culverts that are at least 36 inches in diameter and flat-bottomed or elliptical; and
- Managing vegetation in infrequently mowed areas such as ditches, along access roads, or under power lines such that it is conducted mechanically and occurs after October 1 and before June 1.

Plains Topminnow

The plains topminnow is a state threatened species. Plains topminnows preferred habitat consists of spring-fed backwaters of clear to moderately turbid watercourses that have a sand or rock bottom and a high density of aquatic plants (MNDNR 2017y). There is one NHIS occurrence record from 2006 from along the East Branch Rock River in the southern portion of the WRA. Suitable habitat may be present in the WRA, but is likely limited.

Ottoe Skipper

The Ottoe skipper is a state endangered species in Minnesota. The Ottoe skipper's habitat requirements are very specific and consist of native prairie or barrens habitat. These preferred habitats overlap broadly with the two previously mentioned federally listed butterflies address in *Section 5.1.1*. To date, there is no evidence that restored prairies provides suitable habitat for this species, as such the species is declining throughout its restricted range throughout the Great Plains and in the Upper Midwest (MNDNR 2017z). Historically, Pipestone County supported a small but persistent population of this species in the vicinity of Prairie Coteau SNA. The last NHIS record from within the WRA occurred at Prairie Coteau SNA in 1995 but suitable habitat is prevalent at that site. Given that locations' protected status as state land and the historic prevalence of the two federally listed butterfly species there, there is a moderate likelihood that the species still occurs in suitable habitat in and around that SNA within the WRA. Furthermore, the 2017 desktop habitat evaluation that SWCA Environmental Consultants conducted for the other listed butterflies revealed scattered suitable habitat within the WRA (refer to *Figure 5* in **Appendix I**).

Hair-like Beak Rush

Hair-like beak rush is difficult to detect even when present as a result of its diminutive size and its penchant for growing below much thicker sedge and grass dominated calcareous fen margins (MNDNR 2017aa). Calcareous fens are unique groundwater-fed wetlands that have a deep accumulation of peat and are a rare wetland type that is found in small numbers in the vicinity of the WRA. At least one (1) calcareous fen is known to occur in the WRA which has a corresponding NHIS occurrence record of this species at it. While this species may occur within the WRA, its distribution is likely very limited and will correspond strictly to the locations of any calcareous fens that are present within the WRA.

Short-beaked Arrowhead

Short-beaked arrowhead occurs along the muddy margins of slightly acidic to alkaline ponds and wetlands (Flora of North America 2017). NHIS data indicates that this species was documented in 2006 at Woodstock WMA in the southeastern portion of the WRA, and as such may occur in limited numbers around the margin of acidic or alkaline wetlands within the WRA.

MNDNR NHIS Data

A formal NHIS data request was submitted to the MNDNR Natural Heritage Program, which is a collection of databases that contains the most up to date records on rare or significant species occurrences, on March 28, 2017.

Atwell received a formal Natural Heritage Review letter from the MNDNR for the Lake Benton II WRA on July 18, 2017 (**Appendix IV**). In addition to the formal Natural Heritage Review letter from MNDNR, Atwell queried the electronic database for rare species occurrences within one mile of the WRA.

Results from the MNDNR NHIS database review for the WRA indicated 13 records of threatened or endangered species occurs within the WRA and that two (2) records of threatened or endangered species occur within the 1-mile of the WRA boundary (MNDNR 2017ab). Table 2 presents the results of Atwell's NHIS electronic database review for the WRA.

Table 2 NHIS TES Species Recorded within the WRA

Type	State Status	Scientific Name	Common Name	No. of Mapped Occurrences within One Mile of WRA	Year of Most Current Observation
Vertebrate Animal	State Endangered	*Athene cunicularia*	Burrowing Owl	1	1989
Vertebrate Animal	State Endangered	*Lanius ludovicianus*	Loggerhead Shrike	1	1995
Vertebrate Animal	State Threatened	*Emydoidea blandingii*	Blanding's Turtle	2	2007
Vertebrate Animal	State Threatened	*Fundulus sciadicus*	Plains Topminnow	1	2006
Invertebrate Animal	Federal Threatened, State Endangered	*Hesperia dacotae*	Dakota Skipper	2	2008
Invertebrate Animal	State Endangered	*Hesperia ottoe*	Ottoe Skipper	1	1995
Invertebrate Animal	Federal Endangered, State Endangered	*Oarisma poweshiek*	Poweshiek Skipperling	4	2007
Vascular Plant	State Endangered	*Sagittaria brevirostra*	Short-beaked Arrowhead	1	2006
Vascular Plant	State Threatened	*Rhynchospora capillacea*	Hair-like Beak Rush	2	2006

All of the state threatened or endangered species listed in Table 2 above are discussed earlier in this section. While the NHIS database review indicates 15 occurrence records of nine species, the MNDNR NHIS letter notes that the absence of rare species records should not be construed as a lack of occurrence. It may mean that the area has not been surveyed or that species avoided detection. Furthermore, the NHIS maintains that it is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Ecologically significant features for which the NHIS has no records may exist within the WRA.

6.0 AVIAN

6.1.1 USFWS Birds of Conservation Concern

The USFWS maintains a Birds of Conservation Concern (BCC) list of declining species that, in the absence of additional conservation actions, are likely to become candidates

for eventual listing (USFWS 2008). The IPaC results for the WRA indicate 17 BCC species for consideration (refer to **Appendix III**). Of these 17 species, three (3) species, the dickcissel (*Spiza americana*), pied-billed grebe (*Podilymbus podiceps*), and upland sandpiper were confirmed during site reconnaissance. However, up to nine (9) of these species are likely to occur during migration and/or breed within suitable grassland or wetland habitat within the WRA.

Limiting ground/vegetation disturbance construction activities to occur only between September to March would ensure no impacts to breeding birds occur. In addition employing best management practices during direct habitat disturbance activities may reduce impacts to breeding birds.

6.1.2 Local Occurrence Records

The MNBBA (2014) and AKN (2017) data were assessed for other species of conservation concern. The suite of expected species that occurs within the greater Pipestone County Minnesota region is not higher than any other surrounding habitat or counties. In addition, the USGS Breeding Bird Survey (BBS) was analyzed and the two (2) BBS routes within approximately ten (10) miles of the WRA were reviewed for birds of conservation concern (Sauer et al. 2014). Both routes cumulative species list have been included as **Appendix V**. Nearly 200 species of birds occur in this area on an annual basis, with over 100 species breeding in the regional vicinity of the WRA (MNBBA 2014, AKN 2017, National Audubon Society 2017).

6.1.3 Eagles and Other Raptors

6.1.3.1 Eagle Occurrence

Bald eagle occurrence has been documented in the vicinity of the WRA (e.g., near Prairie Coteau SNA in the western portion of the WRA, and near Pipestone, Minnesota approximately 10 miles southwest of the WRA). Minnesota's breeding bird atlas (2009-2014) documented no confirmed breeding bald eagles in Pipestone County (MNBBA 2014). The closest area with a notable presence of confirmed bald eagle breeding data is located over 30 miles to the northeast of the WRA, near Green Valley, in Lyon County (MNBBA 2014). In addition, there are three (3) June records from 2014-2017 of bald eagle in the vicinity of Prairie Coteau SNA along the western margin of the WRA that may indicate breeding in the regional vicinity of the WRA (AKN 2017). Additional USFWS Land-based Wind Energy Guidelines (WEG) Tier 3 eagle use surveys and raptor nest surveys are being conducted for Lake Benton Power Partners II, LLC. Preliminarily, the spatial extent of land cover indicates that nesting bald eagles within the WRA may be uncommon to rare due to the lack of larger bodies of water or riverine habitat.

Bald eagle winter roosts likely do not occur within the WRA, but this region of Pipestone County does include winter observation data for bald eagles in several locations (AKN 2017). USFWS does not provide winter roost data, therefore this information was not available as part of this SCS. There generally appear to be limited favorable habitat and landscape signatures that could attract roosting eagles within a 10-mile buffer from the WRA. Specifically, there appear to be few undisturbed forested oxbows along relatively larger riverine systems.

Golden eagles (*Aquila chrysaetos*) do not nest within Minnesota (Kochert et al. 2002), but are known to have a limited and scattered presence in southwestern Minnesota from fall through spring (AKN 2017). Western Minnesota is on the margin of the wintering range and migratory path of both the eastern and western subspecies of golden eagles. The eastern Canadian population of this species is most often found in more heavily wooded habitats, which is not prevalent in the vicinity of the WRA (Brodeur et al. 1996). The western population of golden eagle prefers open habitats during migration and winter, and this habitat signature is prevalent in the vicinity of the WRA (Kochert et al. 2002). Satellite tracking data of golden eagles wintering in Iowa uncovered that some of the Iowa wintering population migrate to the Northwest Territories of Canada to breed, further supporting the hypothesis that golden eagles from the western subspecies are more likely to occur within the western portion of Minnesota (Iowa Department of Natural Resources 2016). Furthermore, existing hawk watching data from both the northeast and due south of the WRA (e.g., fall migration patterns preliminarily established through the Bethany and Hitchcock Nature Center hawk watch locations [100 miles east of the WRA in Blue Earth County and 180 miles south of the WRA in Pottawattamie County, Iowa) indicate that golden eagles move through this region of Minnesota and western Iowa with regularity (HMANA 2017a, b). As such, golden eagle passage over the WRA during migration periods is likely.

Both bald and golden eagles are protected by the Bald and Golden Eagle Protection Act (BGEPA 1940).

6.1.3.2 Bald Eagle and Raptor Migration

Portions of the WRA have significant topographic relief that may function as concentration points for raptors transiting the region during migratory periods. Specifically, the ridges in the west-central portion of the WRA which roughly parallel Highway 23 may provide enough upslope winds for soaring so as to reduce the energetic expenditure required of migrating raptors. Further, avian pre-construction due diligence studies will assist in identifying movement patterns of bald eagles and other raptors within the WRA.

6.1.3.3 Stage 1 Eagle Conservation Plan Guidance Questions

The Eagle Conservation Plan Guidance (USFWS 2013) lists questions that should be considered as part of the avian due diligence efforts associated with the Stage 1 Initial Site Assessment. Below are the questions as well as responses as they relate to the WRA:

1. *Does existing or historical information indicate that eagles or eagle habitat may be present within the geographic region under development consideration?*

   Yes, a number of bald and golden eagle observations have been recorded within the vicinity of the WRA (AKN 2017). Additional data from ongoing avian use field studies were not available at the time of this report, nor were eagle nest data from USFWS.

2. *Within a prospective project site, are there areas of habitat known to be or potentially valuable to eagles that would be destroyed or degraded due to the project?*

   No known potentially valuable eagle habitat is known within the WRA or is proposed for destruction or degradation as a part of the proposed WRA development.

3. *Are there important eagle use areas or migration concentration sites documented or thought to occur in the WRA?*

   No habitat resources are available within the regional vicinity of the WRA that are likely to attract higher eagle use. In addition, existing occurrence data of eagles indicate small numbers of birds widely scattered throughout the predominately agricultural landscape of Pipestone County.

4. *Does existing or historical information indicate that habitat supporting abundant prey for eagles may be present within the geographic region under development consideration?*

   No existing or historical information indicates an abundance of prey for eagles within the larger geographic region of the WRA.

5. *For a given prospective site, is there potential for significant adverse impacts to eagles based on answers to above questions and considering the design of the proposed project?*

   Based on desktop analysis and a Tier II site reconnaissance visit, the potential for significant adverse impacts to eagles at this site is low. Further avian pre-construction due diligence studies will assist in identifying any potentially unknown eagle nest locations. Further investigation and collaboration with USFWS will help determine the anticipated level of impact to eagles by the proposed project.

6.1.4 Sensitive Avian Habitat

Of note during site reconnaissance was the prevalence of flooded agricultural fields within the WRA. These flooded fields are likely a seasonally common habitat resource contributed to by local topographic features, precipitation rates and available drainage features. These ephemeral wet areas provide an often critical resource to migrant shorebirds (e.g., American golden-plover [*Pluvialis dominica*], sandpipers, etc.), waterfowl (e.g., tundra swan [*Cygnus columbianus*]), and other avian species that may migrate through the region. Species such as tundra swan and American golden-plover use agricultural areas regularly and can concentrate in very large numbers. American golden-plover is not a state or federal listed species; however, it is a species of conservation concern as defined by groups, such as the American Bird Conservancy's

Yellow List Species (Butcher et al. 2007) and the Western Hemisphere Shorebird Reserve Network (Clay et al. 2010).

Grassland habitat is present within the WRA that could potentially support breeding Henslow's sparrows. Several of these larger tracts of grassland areas were noted during June 2017 site reconnaissance scattered throughout the WRA and included portions of the Prairie Coteau SNA, Woodstock WMA, and a CREP easement. Additional grasslands not associated with protected lands were also noted to have the potential to support Henslow's sparrows and other grassland species of conservation concern.

6.1.4.1 Important Bird Areas

The Important Bird Area (IBA) program works to identify and conserve areas that are essential to birds and biodiversity. The program works with Audubon chapters, non-profit organizations, public agencies, and private landowners to manage and conserve land within the IBAs. Historically, western Minnesota was dominated by Northern Tallgrass Prairie, interspersed with prairie potholes and associated wetlands. Today, tallgrass prairie is under increasing threat of fragmentation, or disappearance altogether, due to agriculture and other development.

The Prairie Coteau IBA was designated to help protect remaining grassland habitat in southwestern Minnesota. The Prairie Coteau IBA is a complex of six (6) separate areas within the Prairie Pothole and Eastern Tallgrass Prairie Bird Conservation Regions ,occurring mostly within Pipestone County, but with portions in Yellow Medicine, Lincoln, Murray, and Rock Counties. The six areas making up the IBA are not contiguous, though are ecologically similar and represent prairie and grassland bird habitat in a landscape that is otherwise highly fragmented and dominated by agriculture (National Audubon Society 2017).

Of the six separate areas that comprise the Prairie Coteau IBA complex, one area overlaps the WRA, encompassing approximately 57% of the WRA, or 14,700 acres. (refer to *Figure 7* in **Appendix I**) While this is a significant portion of the WRA, several WMAs, CREP easements, and an SNA, which are precluded from development, are encompassed by both the IBA and WRA and are not expected to be impacted during development of the Project. These lands account for approximately 824 acres. Additionally, a number of sites of Biodiversity Significance ranked "outstanding" or "high", as well as mapped native prairies, are encompassed by the IBA that account for approximately 1,859 and 920 acres respectively. Impacts to "outstanding" and "high" ranked sites of biodiversity, as well as grasslands, will be avoided to the greatest extent possible. Of the remaining approximately 11,100 acres of the IBA within the WRA, over half of this area is cultivated crops, with much of the remaining pasture and grassland habitat fragmented and isolated.

7.0 BATS

The federally threatened northern long-eared bat was listed as part of the USFWS IPaC analysis and is discussed above in *Section 5.1.1*. No additional federal or state listed

bat species are identified for Pipestone County. However, the MNDNR has noted that although there are no NHIS records for bats in the vicinity of the proposed project, bat species known to occur in Minnesota can generally be found throughout the state.

The overall habitat within the WRA is not overly attractive to bat species (open cultivated cropland or hayfields with small wooded copses scattered around adjacent to homesteads). The highest quality habitat for bats is along the Redwood and Rock Rivers in the northeastern and southwest region of the WRA, respectively and Beaver Creek in the southeast. Most of the river and creek corridors and its associated riparian woodland are within the WRA boundary.

8.0 INSECTS

The federally and state listed Dakota skipper and Poweshiek skipperling are discussed above in *Section 5.1.1* and the state endangered Ottoe skipper is discussed in *Section 5.1.2*. No additional federal or state listed insect species are identified for Pipestone County.

9.0 SUMMARY AND CONCLUSIONS

This SCS identified a limited number of potential biological concerns associated with the WRA. These potential concerns include items that are typically encountered with wind development as well as regionally-specific constraints related to local resources. Potential concerns include avian and bat species; threatened and endangered species (there are three federal and eight state TES with a moderate or higher likelihood of occurrence within the WRA); remnant grassland habitats; and wetlands, streams, and floodplains.

Grasslands comprise approximately 31% of the WRA. Six (6) of the TES species identified as having a moderate likelihood of occurrence are associated primarily with grasslands. There are six (6) MNDNR designated native plant community types within the WRA that total approximately 1,123 acres of native prairie habitat (see *Figure 5* in **Appendix I**). In addition, part of the project lies within the Prairie Core Area of the 25 year Minnesota Prairie Conservation Plan (**Appendix IV**) (Minnesota Prairie Plan Working Group 2011). In order to meet the plan's goal, any restoration efforts within the Prairie Core Areas are encouraged per the Natural Heritage Review letter from the MNDNR. The Natural Heritage Review letter from the MNDNR recommends that:

- MBS Sites (n=25) and Railroad ROW prairies (n=3) be considered avoidance areas due to their ecological significance;
- Disturbance should be minimized near these ecologically significant areas; and
- If any disturbance to MBS Sites consisting of native prairie, Railroad ROW prairies, or native prairies are proposed, rare species surveys will likely be required.

Wetlands comprise approximately 7.9% of the WRA based on NWI data. There are five (5) TES species with a moderate or higher likelihood of occurrence which are associated with wetlands or watercourses. There are five (5) streams in the WRA which are MN public watercourses with 50-foot designated avoidance buffer requirements

(see *Figure 3* in **Appendix I**). The Natural Heritage Review indicated that if the WCA is applicable to this project, the prairie wetlands within the project boundary may qualify as "rare natural communities" under the WCA. As such, additional coordination with the MNDNR is recommended to ensure full compliance with all necessary regulatory hurdles. Impacts to wetlands may require additional permitting under both federal (Section 404 of the Clean Water Act) and state law (Minnesota Wetland Conservation Act) (MNDNR 2016).

The Natural Heritage Review letter provided specific construction best management practice guidance relative to the state threatened Blanding's turtle since the WRA is known to be an area occupied by this species. Management minimization recommendations for the federally threatened Topeka shiner in the Big Sioux River and Rock River Watersheds have the potential to impact Project construction practices in approximately 48% of the WRA (*Figure 3* in **Appendix I**). Additional coordination with USFWS Twin Cities Field Office may be necessary depending on various project-related construction design/impacts.

Four (4) state WMAs, one (1) state SNA, one (1) state RIM easement, and two (2) PWP's occur in the WRA and are precluded from development and include buffer setback requirements. Five (5) CREP easements consisting of parcels totaling approximately 195 acres of wetland, riparian, and pasture habitat and are located in the northeast section of the WRA (see *Figure 6* in **Appendix I**).

Avian and bat resources are of concern during the planning phase of every wind development site. As is typical with wind energy development, avian and bat species are found to be at risk more than most other wildlife species. Avian species are likely to use Pipestone County's extensive farmland during migration periods and are known to feed in plowed and flooded agricultural fields as they move through the region. Existing occurrence data suggests limited bald eagle use in the vicinity of the WRA.

Finally, the MNDNR Natural Heritage Review letter recommends further MNDNR Natural Heritage Review once project infrastructure details have been developed and coordination with the USFWS Twin Cities Field Office regarding federally listed species and designated critical habitat within the WRA.

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APPENDIX I

Figure 1 - Overview Map
Figure 2 - Land Cover Map
Figure 3 – FEMA and Surface Water Map
Figure 4 – Wellhead Protection Areas Map
Figure 5 - Native and Rare Species Map
Figure 6 – Public Lands Map
Figure 7 – Important Bird Areas Map

Lake Benton II Wind Energy Center

Figure 1- Overview Map

Pipestone County, Minnesota

Client:

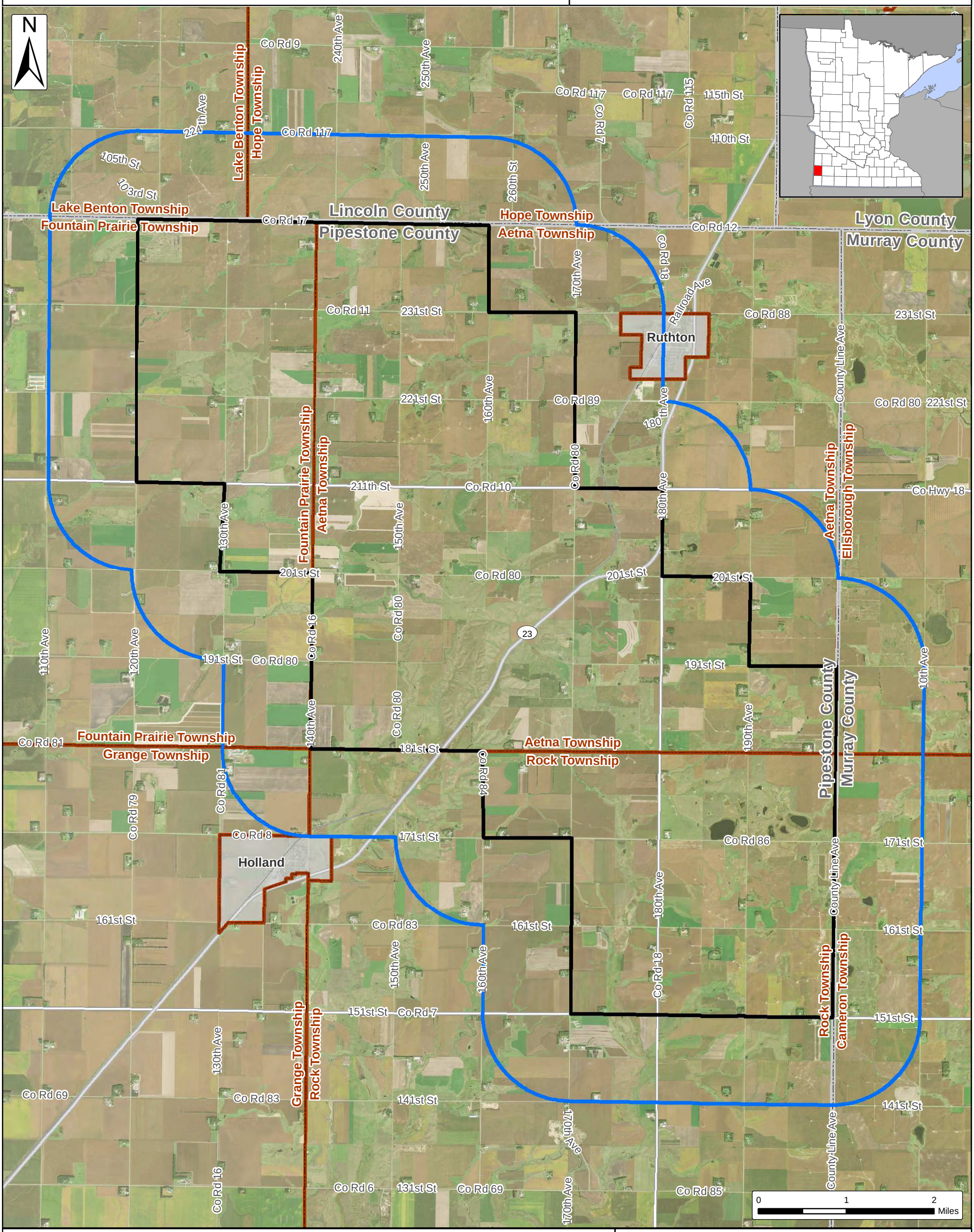
Lake Benton Wind, LLC

Issue Date:

10/16/2017

Atwell, LLC Project:

17000619



- Wind Resource Area 07/12/2017 (±25,597 Ac.)
- 1 Mile Buffer (WRA Plus)
- City Boundary
- Township Boundary
- County Boundary

SOURCE: USDA NAIP 2015 IMAGERY

ATWELL

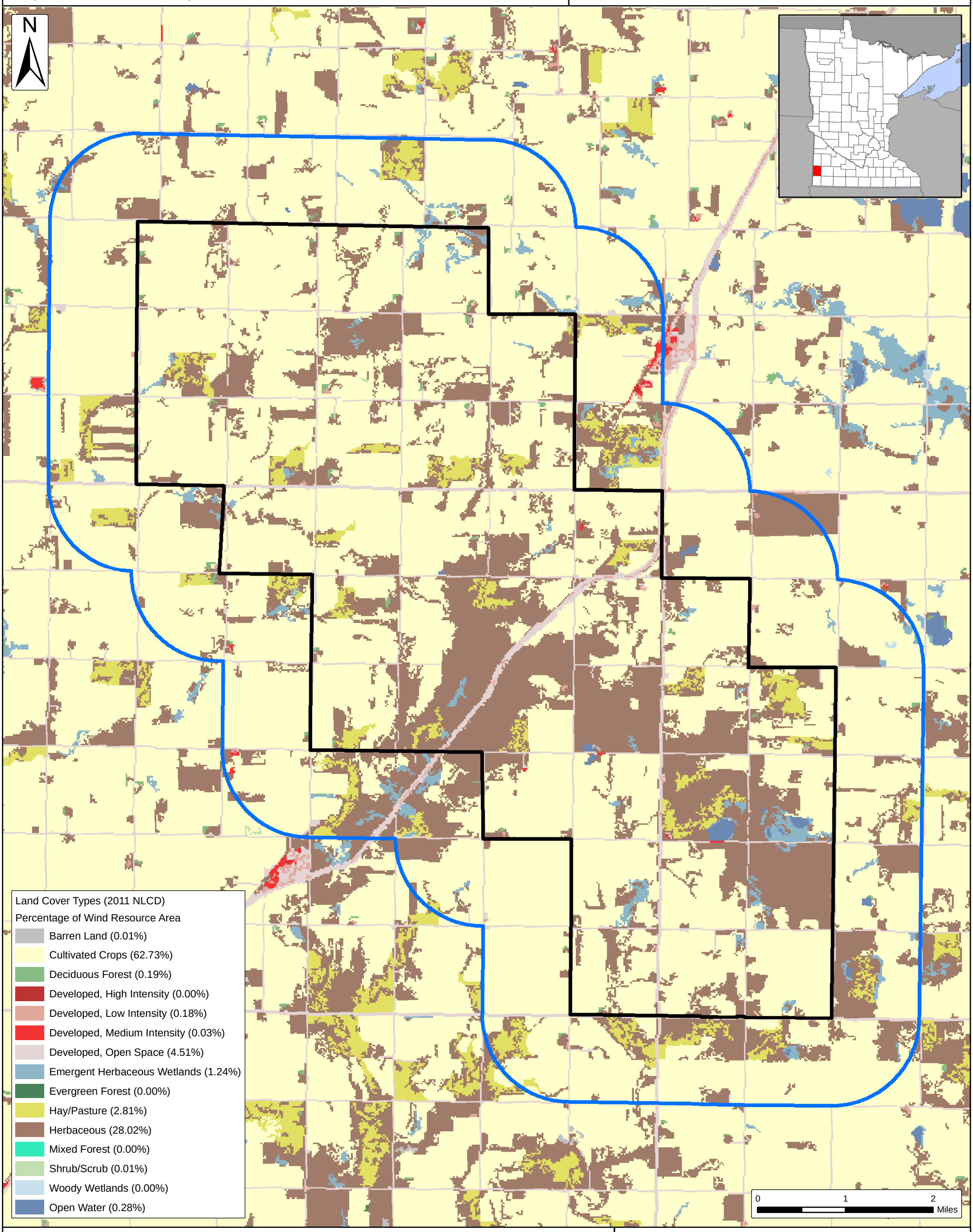
The information contained on this map is proprietary and confidential. The use or disclosure of this information by you to third parties is prohibited by law and may give rise to civil or criminal liability.

Lake Benton II
Wind Energy Center
Figure 2- National Land Cover Dataset 2011
Pipestone County, Minnesota

Client:
Lake Benton Wind, LLC

Issue Date:
10/16/2017

Atwell, LLC Project:
17000619



Wind Resource Area 07/12/2017 (±25,597 Ac.)

1 Mile Buffer (WRA Plus)

SOURCE: NATIONAL LAND COVER DATASET 2011 (USGS)

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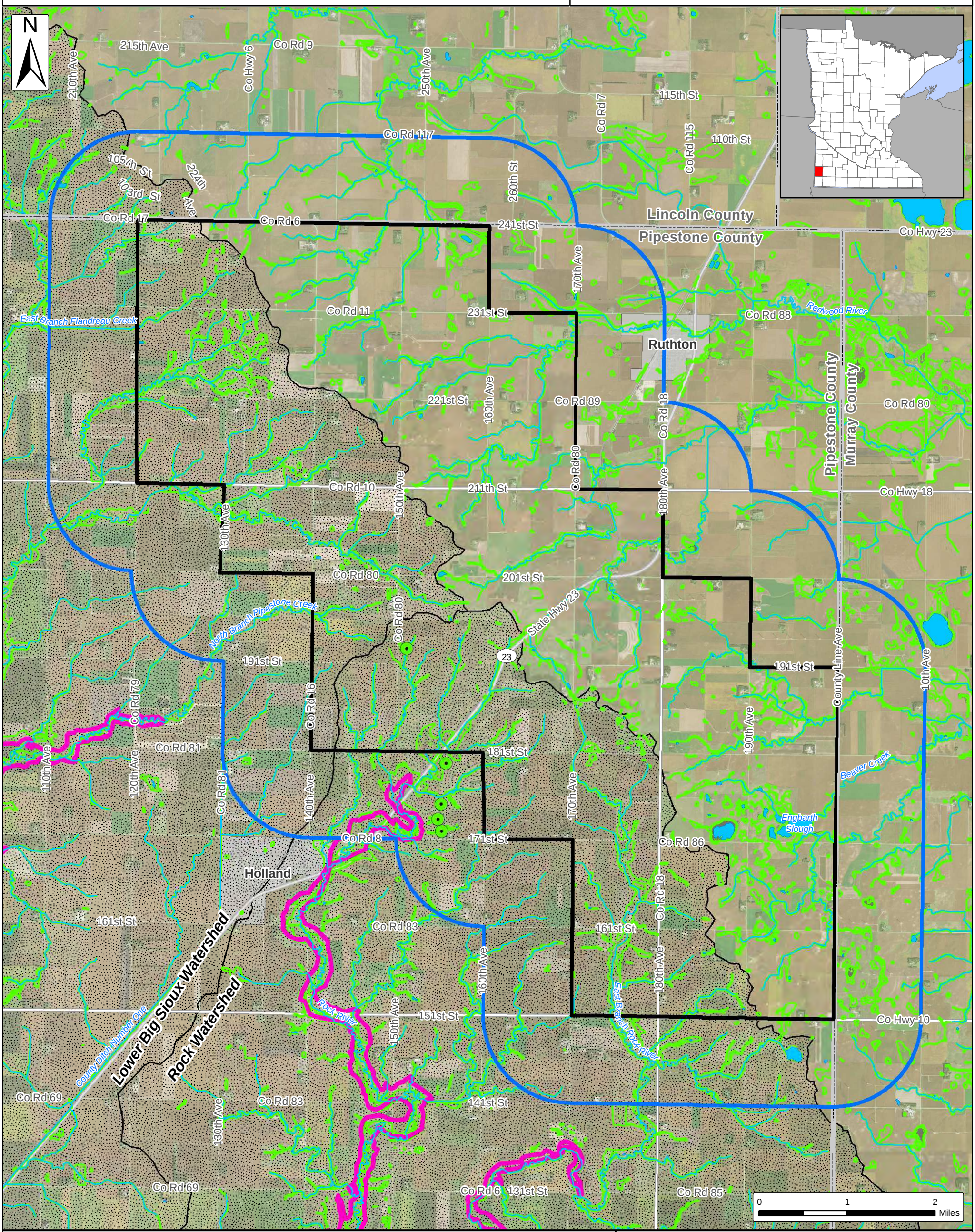
The information contained on this map is proprietary and confidential. The use or disclosure of this information by you to third parties is prohibited by law and may give rise to civil or criminal liability.

Lake Benton II
Wind Energy Center
Figure 3- FEMA & Surface Water Map
Pipestone County, Minnesota

Client:
Lake Benton Wind, LLC

Issue Date:
10/16/2017

Atwell, LLC Project:
17000619



- Calcareous Fens (MNDNR)
- Watercourses (NHD)
- Waterbodies (NHD)
- Wetlands (NWI)
- Lower Big Sioux Watershed & Rock River Watershed (NHD)

Pipestone County FEMA Firmette Flood Zones
- Zone A: Area of 100-year flood, base flood elevations and flood hazard factors not determined.
- Zone C (Unshaded): Areas of minimal flooding.

- Wind Resource Area 07/12/2017 (±25,597 Ac.)
- 1 Mile Buffer (WRA Plus)
- Cities
- Counties

SOURCE: USDA NAIP 2015 IMAGERY

ATWELL

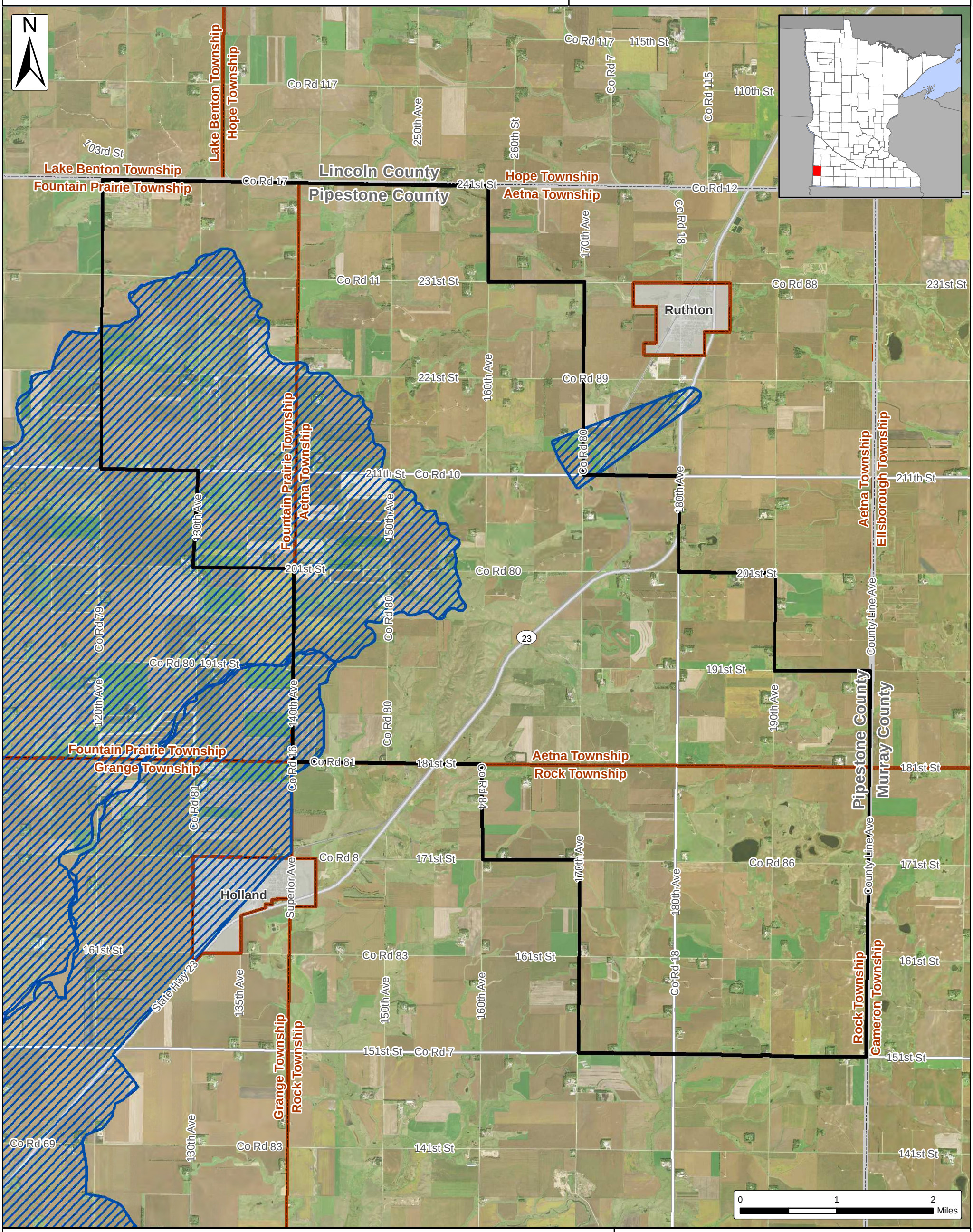
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Lake Benton II
Wind Energy Center
Figure 4- Wellhead Protection Areas
Pipestone County, Minnesota

Client:
Lake Benton Wind, LLC

Issue Date:
10/16/2017

Atwell, LLC Project:
17000619



Wellhead Protection Areas (MDH, 2016)

Wind Resource Area 07/12/2017 (±25,597 Ac.)

City Boundary

Township Boundary

County Boundary

SOURCE: USDA NAIP 2015 IMAGERY

ATWELL

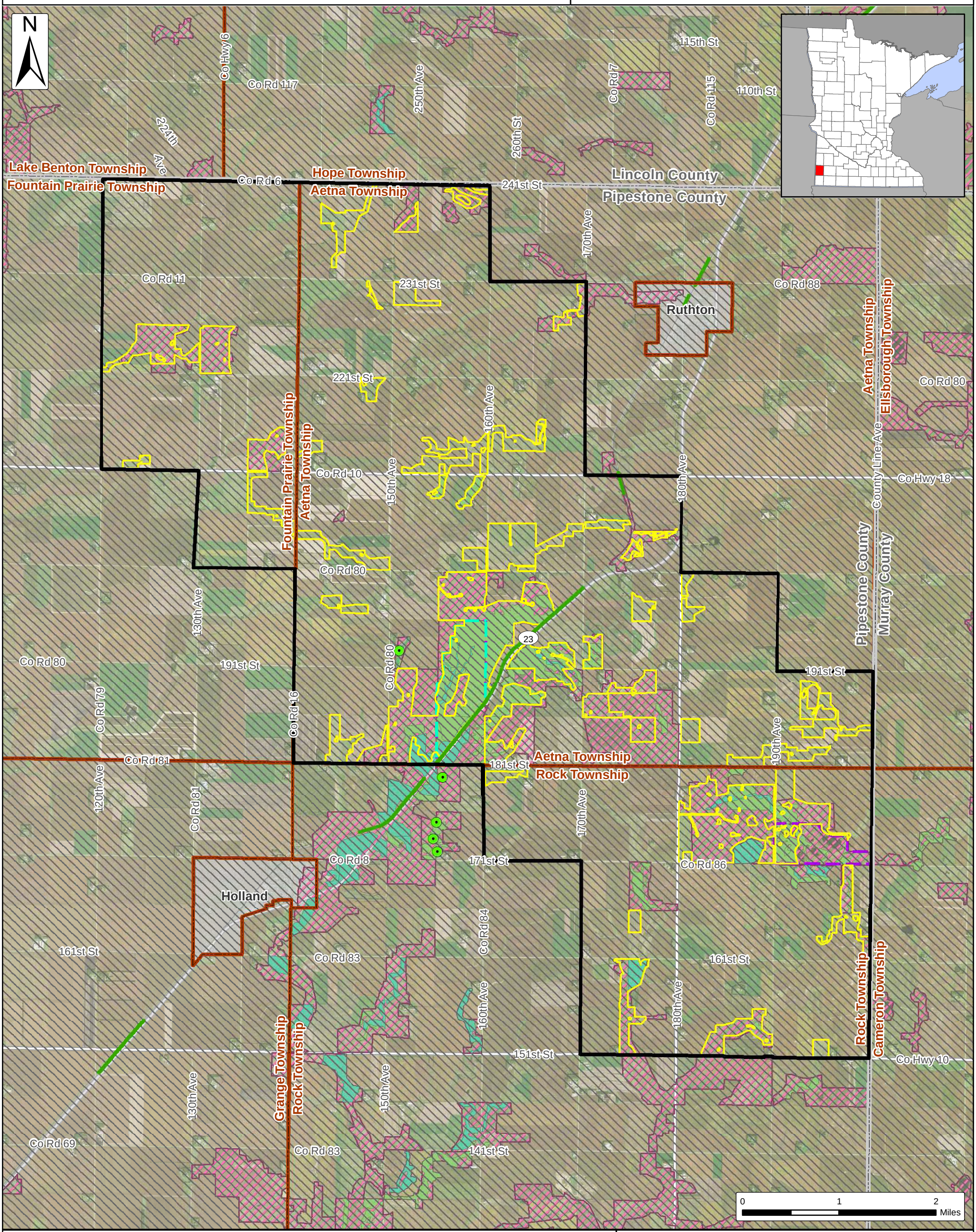
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Lake Benton II
Wind Energy Center
Figure 5- Native & Rare Species Map
Pipestone County, Minnesota

Client:
Lake Benton Wind, LLC

Issue Date:
10/16/2017

Atwell, LLC Project:
17000619



- Calcareous Fens (MNDNR)
- Railroad ROW Prairies (MNDNR)
- Critical Habitat (USFWS)
  - Poweshiek skipperling
  - Dakota Skipper
  - Topeka shiner
- Dakota Skipper and Poweshiek Skipperling Habitat (SWCA, 2017)
- Native Prairies (MNDNR)
- Native Plant Communities (MNDNR)
- Sites of Biodiversity Significance (MNDNR)
- Wind Resource Area 07/12/2017 (±25,597 Ac.)
- City Boundary
- Township Boundary
- County Boundary

Copyright 2016, State of Minnesota, Department of Natural Resources (DNR).
Rare Features Data included here were provided by the Division of Ecological and Water Resources, Minnesota DNR, and were current as of (03/14/2017). These data are not based on an exhaustive inventory of the state.
The lack of data for any geographic area shall not be construed to mean that no significant features are present.

SOURCE: USDA NAIP 2015 IMAGERY

ATWELL

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Lake Benton II Wind Energy Center

Figure 6- Public Lands Map

Pipestone County, Minnesota

Client:

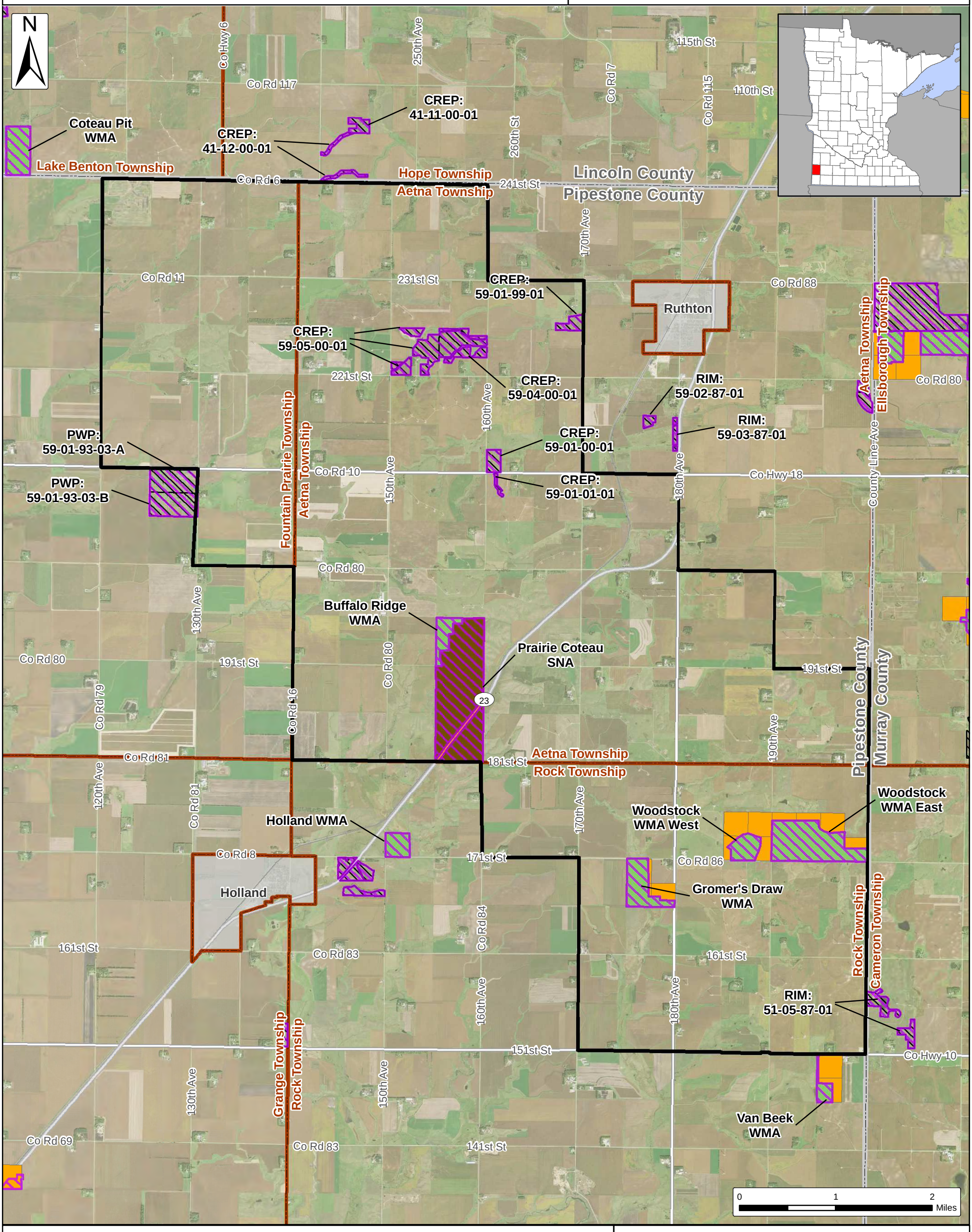
Lake Benton Wind, LLC

Issue Date:

10/16/2017

Atwell, LLC Project:

17000619



- Protected Areas (USGS)
- State Funded Conservation Easements RIM Reserve (BWSR)
- State Surface Interests (MNDNR)
- Wildlife Management Areas (MNDNR)
- Scientific and Natural Areas (MNDNR)
- Wind Resource Area 07/12/2017 (±25,597 Ac.)
- City Boundary
- Township Boundary
- County Boundary

SOURCE: USDA NAIP 2015 IMAGERY

ATWELL

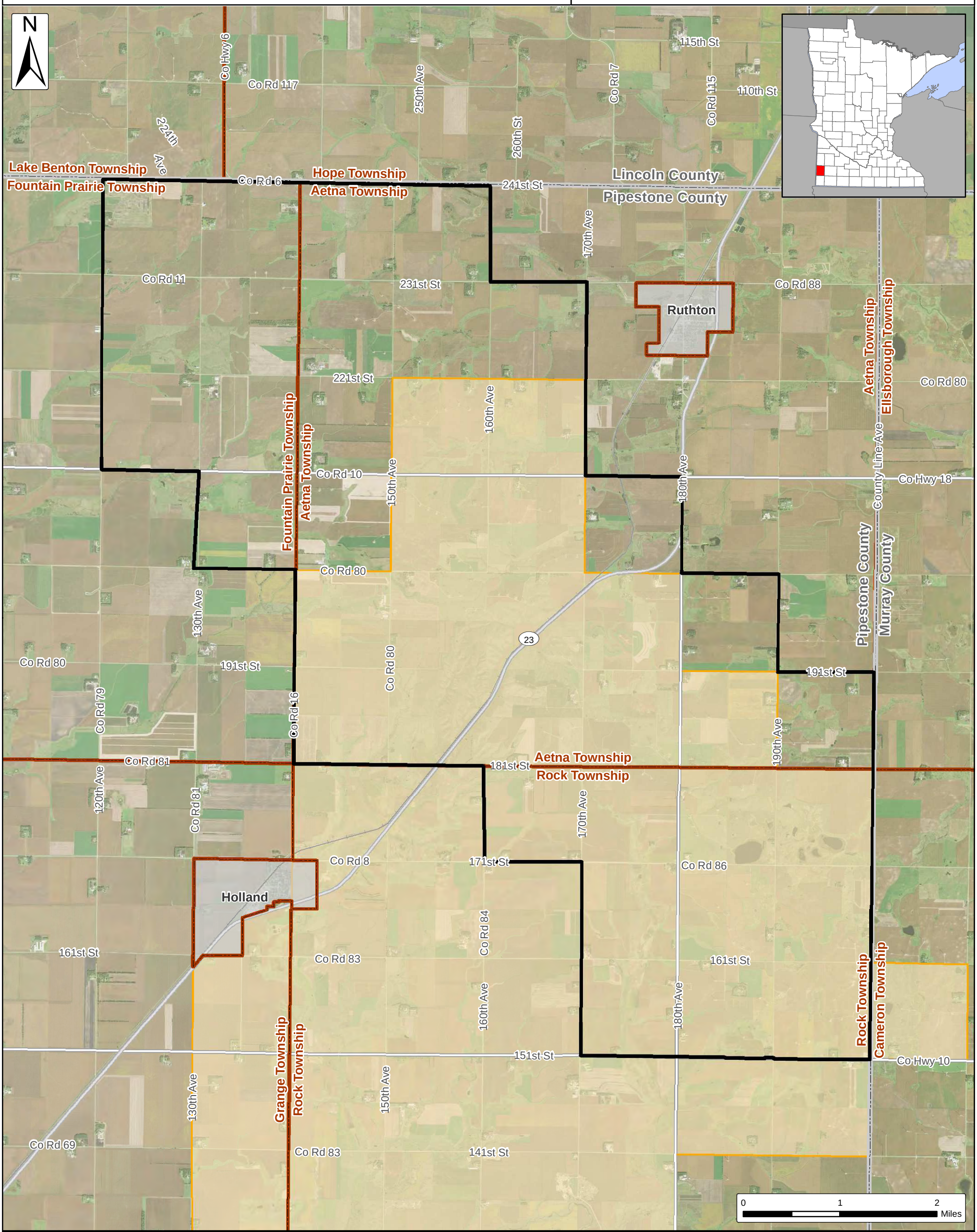
The information contained on this map is proprietary and confidential. The use or disclosure of this information by you to third parties is prohibited by law and may give rise to civil or criminal liability.

Lake Benton II
Wind Energy Center
Figure 7- Important Bird Areas
Pipestone County, Minnesota

Client:
Lake Benton Wind, LLC

Issue Date:
10/16/2017

Atwell, LLC Project:
17000619



Important Bird Areas
(National Audubon Society, 2017)

Wind Resource Area 07/12/2017
(±25,597 Ac.)

City Boundary

Township Boundary

County Boundary

SOURCE: USDA NAIP 2015 IMAGERY

ATWELL

The information contained on this map is proprietary and confidential. The use or disclosure of this information by you to third parties is prohibited by law and may give rise to civil or criminal liability.

APPENDIX II
Photographic Log

PHOTOGRAPHIC LOG

Photo # 1	
Date: 6/14/2017	
Direction: southeast	
Lat/ Long: 44.152132, -96.124342	
Description: Representative photo of open agricultural landscape with "pothole" open water features within WRA. These features serve as an important resource for migrating waterfowl and shorebirds.	

Photo # 2	
Date: 6/14/2017	
Direction: northeast	
Lat/ Long: 33.23758, -111.58589	
Description: Prairie Coteau Scientific and Natural Area grasslands. Representative photo of rolling topography and grasslands that are present within the WRA. These grasslands may provide suitable habitat for a variety of ground-nesting birds including the dickcissel, a USFWS Bird of Conservation Concern.	

PHOTOGRAPHIC LOG

Photo # 3 Date: 6/14/2017 Direction: north Lat/ Long: 44.089878, -96.064520 Description: Representative photo of seasonally flooded agricultural field.	

Photo # 4 Date: 6/14/2017 Direction: west Lat/ Long: 44.131999, -96.183003 Description: Representative photo of a calcareous fen within the WRA. These unique wetlands have a moderate potential to support state-listed species such as Blanding's turtle.	

PHOTOGRAPHIC LOG

Photo # 5 Date: 6/14/2017 Direction: south Lat/ Long: 44.095214, -96.154645 Description: Gromer's Draw WMA. Managed as a wet prairie (WPs54b) for deer, small game, and pheasants.	

Photo # 6 Date: 6/14/2017 Direction: north Lat/ Long: 44.095323, -96.093145 Description: Woodstock West WMA. This WMA has bulrush marsh (MRp93a) native plant community type on the periphery of the water, which is ranked S1 (Critically Imperiled) and represents a high biodiversity ranking. A nesting pied-billed grebe (USFWS Bird of Conservation Concern) was observed at this location.	

PHOTOGRAPHIC LOG

Photo # 7 Date: 6/14/2017 Direction: south Lat/ Long: 44.095323, -96.093145 Description: Representative photo of grasslands and rolling topography throughout the WRA. This grassland has the potential to support breeding Henslow's sparrows. The WRA contains a significant amount of this habitat type both on public and private land.	

Photo # 8 Date: 6/14/2017 Direction: north Lat/ Long: 44.020063, -92.925168 Description: Woodstock East WMA. Both wet (WPs54b) and dry (UPs13d) native prairie are present at this location, both of which have an S2 (Imperiled) ranking. This site has been designated as Critical Habitat for the federally threatened/state endangered Dakota skipper.	

PHOTOGRAPHIC LOG

Photo # 9 Date: 6/14/2017 Direction: north Lat/ Long: 44.020063, -92.925168 Description: Additional view of grasslands associated with Woodstock East WMA	

Photo # 10 Date: 6/14/2017 Direction: west Lat/ Long: 44.171106, -96.145018 Description: Representative view of a CREP easement. Suitable grassland habitat for Henslow's sparrow is present. Additionally, early successional/shrubby vegetation component is visible farther out which may provide suitable habitat for the loggerhead shrike.	

APPENDIX III
IPaC Results

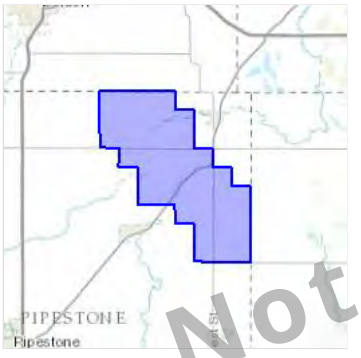
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Lincoln, Murray and Pipestone counties, Minnesota



Not for consultation

Local office

Minnesota-Wisconsin Ecological Services Field Office

(952) 252-0092
(952) 646-2873

MAILING ADDRESS
4101 American Blvd E
Bloomington, MN 55425-1665

PHYSICAL ADDRESS
4101 American Blvd E
-
Bloomington, MN 55425-1665

http://www.fws.gov/midwest/Endangered/section7/s7process/step1.html

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population, even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species[1] are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
Northern Long-eared Bat Myotis septentrionalis No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045	Threatened

Fishes

NAME	STATUS
Topeka Shiner Notropis topeka (=tristis) There is a **final** critical habitat designated for this species. Your location overlaps the designated critical habitat. https://ecos.fws.gov/ecp/species/4122	Endangered

Insects

NAME	STATUS
Dakota Skipper Hesperia dacotae There is a **final** critical habitat designated for this species. Your location overlaps the designated critical habitat. https://ecos.fws.gov/ecp/species/1028	Threatened

Flowering Plants

NAME	STATUS
Western Prairie Fringed Orchid Platanthera praeclara No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/1669	Threatened

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

This location overlaps the critical habitat for the following species:

NAME	TYPE
Dakota Skipper Hesperia dacotae https://ecos.fws.gov/ecp/species/1028#crithab	Final designated
Poweshiek Skipperling Oarisma poweshiek https://ecos.fws.gov/ecp/species/9161#crithab	Final designated
Topeka Shiner Notropis topeka (=tristis) https://ecos.fws.gov/ecp/species/4122#crithab	Final designated

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location. It is not a list of every bird species you may find in this location, nor a guarantee that all of the bird species on this list will be found on or near this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

NAME	SEASON(S)
American Bittern Botaurus lentiginosus https://ecos.fws.gov/ecp/species/6582	Breeding
Bald Eagle Haliaeetus leucocephalus https://ecos.fws.gov/ecp/species/1626	Wintering
Black Tern Chlidonias niger https://ecos.fws.gov/ecp/species/3093	Breeding
Black-billed Cuckoo Coccyzus erythropthalmus https://ecos.fws.gov/ecp/species/9399	Breeding
Dickcissel Spiza americana	Breeding
Hudsonian Godwit Limosa haemastica	Migrating
Least Bittern Ixobrychus exilis https://ecos.fws.gov/ecp/species/6175	Breeding
Loggerhead Shrike Lanius ludovicianus https://ecos.fws.gov/ecp/species/8833	Breeding
Marbled Godwit Limosa fedoa https://ecos.fws.gov/ecp/species/9481	Breeding
Peregrine Falcon Falco peregrinus https://ecos.fws.gov/ecp/species/8831	Breeding
Pied-billed Grebe Podilymbus podiceps	Breeding
Red-headed Woodpecker Melanerpes erythrocephalus	Breeding
Short-eared Owl Asio flammeus https://ecos.fws.gov/ecp/species/9295	Wintering

Swainson's Hawk Buteo swainsoni https://ecos.fws.gov/ecp/species/1098	Breeding
Upland Sandpiper Bartramia longicauda https://ecos.fws.gov/ecp/species/9294	Breeding
Western Grebe aechmophorus occidentalis https://ecos.fws.gov/ecp/species/6743	Breeding
Willow Flycatcher Empidonax traillii https://ecos.fws.gov/ecp/species/3482	Breeding

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Facilities

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

WETLAND INFORMATION IS NOT AVAILABLE AT THIS TIME

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the NWI map to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

APPENDIX IV
MNDNR Natural Heritage Review

Minnesota Department of Natural Resources
Division of Ecological & Water Resources
500 Lafayette Road, Box 25
St. Paul, MN 55155-4025

July 18, 2017
Correspondence # ERDB 20110518-0006

Mr. Sean Fitzgerald
Atwell, LLC
4700 E Southern Ave
Mesa, AZ 85206

RE: Natural Heritage Review of the proposed Lake Benton II Wind Repower,

County	Township (N)	Range (W)	Section(s)
Pipestone	108	45	1,2,11-14,24
Pipestone	108	44	5-9,16-22,26-36
Pipestone	107	43	1-4, 10-15

Dear Mr. Fitzgerald,

As requested, the Minnesota Natural Heritage Information System has been queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project. Based on this query, rare features have been documented within the search area (for details, please visit the Rare Species Guide at http://www.dnr.state.mn.us/rsg/index.html for more information on the biology, habitat use, and conservation measures of these rare species). Please note that the following rare features may be adversely affected by the proposed project:

Ecologically Significant Areas

- The proposed project overlaps with a Prairie Core Area as identified in the Minnesota Prairie Conservation Plan, a twenty-five year strategy for accelerating prairie conservation in the state. To meet the Plan's goals, approaches within Prairie Core Areas will need to include restoration. As such, any efforts toward prairie or grassland restoration after project construction are encouraged. For information on landowner incentive programs to protect prairie and for guidance on restoration, please visit http://www.dnr.state.mn.us/prairierestoration/index.html.

- The Minnesota Biological Survey (MBS) has identified several Sites of Biodiversity Significance and Railroad Rights-of-Way Prairie within the project boundary. Sites of Biodiversity Significance have varying levels of native biodiversity and are ranked based on the relative significance of this biodiversity at a statewide level. Factors taken into account during the ranking process include the number of rare species documented within the site, the quality of the native plant communities in the site, the size of the site, and the context of the site within the landscape. These particular Sites contain several high quality upland and wetland prairie remnants, the Prairie Coteau Scientific and Natural Area (SNA), and several protected species (see below). Sites ranked High and Outstanding are located in T108N R44W Sections 28, 29, 32, and 33 centered around the SNA.

Given the ecological significance of these areas, the DNR recommends that MBS Sites and Railroad Rights-of-Way Prairies be considered avoidance areas. Based on aerial photos, there are existing turbines within the MBS Sites and within native prairie remnants. **If any additional impacts to native prairie are proposed, rare species surveys will likely be required.** (GIS shapefiles of MBS Sites of Biodiversity Significance, MBS Railroad Rights-of-Way Prairie and DNR Native Plant Communities can be downloaded from the MN Geospatial Commons at https://gisdata.mn.gov/.)

As activities in adjacent areas can negatively affect these ecologically significant areas, especially through the introduction of invasive plant species, disturbance near these ecologically significant areas should be minimized. Actions to minimize disturbance may include, but are not limited to, the following recommendations:

- Do not park equipment or stockpile supplies in MBS Sites;
- Do not place spoil within MBS Sites;
- Inspect and clean all equipment prior to construction activities to prevent the introduction and spread of invasive species;
- Use effective erosion prevention and sediment control measures;
- As soon as possible after construction, revegetate disturbed soil with native species suitable to the local habitat (see http://www.bwsr.state.mn.us/native_vegetation/ and http://www.dot.state.mn.us/environment/erosion/seedmixes.html;
- Use only weed-free mulches, topsoils, and seed mixes. Of particular concern are birdsfoot trefoil (*Lotus corniculatus*) and crown vetch (*Coronilla varia*), two invasive species that are sold commercially and are problematic in prairies and disturbed open areas, such as roadsides;
- Ideally, do not bring in topsoil to this site, as this introduces invasive species.

The Minnesota Biological Survey considered several areas within the project boundary for Sites of Biodiversity Significance, but these areas were determined to be below the minimum biodiversity threshold for statewide significance. These areas, however, may have conservation value at the local level as habitat for native plants and animals, corridors for animal movements, buffers surrounding higher quality natural areas, or as areas with high potential for restoration of native habitat. They may also contain native prairie that was not delineated by the MBS.

Native Prairie

- As noted above, the Minnesota Biological Survey has identified several Dry Hill Prairie remnants within the project boundary. In the mid-1800's, Minnesota had eighteen million acres of prairie. Less than 1% remains. Given that more than 99% of Minnesota's prairies have been destroyed, and more than one-third of Minnesota's endangered, threatened, and special concern species are now dependent on the remaining small fragments of Minnesota's prairie ecosystem, we feel that all prairie remnants merit protection. We also recommend that turbines and other infrastructure be distant enough from native prairies as to allow for prairie management, such as prescribed burning.

  Additional prairie remnants may exist in the area. To ensure that prairie is avoided, I recommend that a desktop analysis of historical aerial photos and applicable GIS layers (see attached guidance) be conducted

for any grassland areas that have the potential to be impacted by the project. Any on-site prairie surveys should be conducted by a qualified surveyor (see attached list) following the attached guidance.

Rare Wetlands

- One calcareous fen is located directly within the project area (T108N R44W Section 29) and multiple are located within one mile of the project area (T107N R44W Section 5). Hair-like beak-rush (Rhynchospora capillacea), a state-listed threatened plant species, has been documented within these fens. A calcareous fen is a rare and distinctive peat-accumulating wetland (please see the attached fact sheet) that is legally protected in Minnesota. The Wetlands Conservation Act, authorized by Minnesota Statutes, section 103G.223, states that calcareous fens may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, except as provided for in a management plan approved by the commissioner of the Department of Natural Resources. Many of the unique characteristics of calcareous fens result from the upwelling of groundwater through calcareous substrates. Because of this dependence on groundwater hydrology, calcareous fens can be affected by nearby activities or even those several miles away.

  To protect these rare features, construction activities need to avoid the MBS Site in the SW ¼ of T108N R44W Section 29 and avoid altering the hydrological conditions in the surrounding area. If this is not possible and it is determined the project will adversely affect calcareous fens in any way, you will need to consult with Doug Norris, Wetlands Program Coordinator, at 651-259-5125. In addition, if the project will impact any fens, contact Lisa Joyal, the Endangered Species Environmental Review Coordinator, at lisa.joyal@state.mn.us or 651-259-5109 before construction is initiated to discuss the endangered and threatened species permitting process.

- If the Wetland Conservation Act (WCA) is applicable to this project, please note that the prairie wetlands within the project boundary may qualify as "rare natural communities" under this Act. Minnesota Rules, part 8420.0515, subpart 3 states that a wetland replacement plan for activities that modify a rare natural community must be denied if the local government unit determines that the proposed activities will permanently adversely affect the natural community. If you have any questions regarding this provision of the WCA, please contact Doug Norris, DNR Wetlands Program Coordinator, at 651-259-5125.

Please contact Lisa Joyal if avoidance of MBS Sites and/or native prairie is not feasible, as surveys for rare species may be needed. We will need to discuss potential surveyors, survey protocol, and other requirements before any survey work for rare species is initiated. Project planning should also take into account that surveys (if needed) will need to be done during the appropriate time of the year, which may be limited. For your information, I have attached a document outlining the Rare Species Survey Process.

Prairie-dependent Butterflies

- The Dakota skipper (*Hesperia dacotae*), federally-listed as threatened and state-listed as endangered, the Poweshiek skipperling (*Oarisma poweshiek*), federally-listed and state-listed as endangered, Ottoe skipper (*Hesperia ottoe*), state-listed as endangered, have been documented within the project area. All

of these species are found exclusively on remnant native prairie habitats and each of their populations have declined precipitously throughout Minnesota in recent years. To protect these and other prairie obligate butterfly species, it is imperative that the destruction and disturbance of native prairie is avoided. Please contact Lisa Joyal if avoidance is not feasible. Also, please note that the project boundary contains federally designated critical habitat for the Poweshiek skipperling.

Birds

- The loggerhead shrike (*Lanius ludovicianus*) and burrowing owl (*Athene cunicularia*), both state-listed endangered birds, have been documented in the vicinity of the project site. These birds use grasslands and can be found in native prairie, pastures, shelterbelts, old fields or orchards, cemeteries, grassy roadsides, and farmyards. To minimize potential impacts to these species, avoid construction activities during their breeding season from late April through July. Please contact Lisa Joyal if avoidance is not feasible.

  Given the extreme rarity of these species, the existence of suitable habitat within the project boundary, the proximity of past nesting records, and the potential risk of this species for collisions with wind turbines, we recommend that construction and operation crew be alerted to the potential presence of these rare birds and that any sightings be reported immediately to the DNR.

- The proposed project overlaps with the Prairie Coteau Complex Important Bird Area (IBA). Important Birds Areas, identified by Audubon Minnesota in partnership with the DNR, are part of an international conservation effort aimed at conserving critical bird habitats. They are voluntary and non-regulatory, but the designation does demonstrate the biological value of this surrounding area. This particular IBA consists of six non-contiguous areas that emphasize the remaining prairie and grassland habitat in this agricultural landscape. In total, 251 species have been observed in this IBA, including 71 Species of Greatest Conservation Need (SGCN; as identified in Minnesota's Wildlife Action Plan).

- It should be noted that many SGCN are not tracked in the Natural Heritage Information System (NHIS), and the NHIS does not include records of migrating birds. Wind farms can affect birds due to collision mortality, displacement due to disturbance, habitat fragmentation, and habitat loss. Potential impacts to grassland birds are a concern because many of these species are declining in number nationwide. Even if collision mortality rates are low, the additional mortality may be significant for rare species. We recommend post-construction avian fatality monitoring to provide information regarding unexpected impacts, if any, to rare birds. Knowledge of these types of extraordinary events would allow for the implementation of additional measures to minimize disturbance, such as the curtailment of turbine operations during certain conditions.

Bats

- The Natural Heritage Information System (NHIS) tracks bat roost trees and hibernacula plus some acoustic data, but this information is not exhaustive. Although there are no NHIS records for bats in the vicinity of the proposed project, all seven of Minnesota's bats can be found throughout Minnesota. The northern

long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern. Actions to minimize impacts include, but are not limited to, feathering turbine blades below cut-in speeds and conducting post-construction fatality monitoring. As the northern long-eared bat is federally threatened, please coordinate with the U.S. Fish and Wildlife Service regarding this species.

Reptiles

- Blanding's Turtles (*Emydoidea blandingii*), a state-listed threatened species, have been documented in the vicinity of the proposed project. The project area is also within an area of statewide importance to the Blanding's turtle. These areas are relied upon to maintain the species' security within Minnesota, and the DNR considers them of the highest priority for Blanding's turtle research and management activities. In southwestern Minnesota Blanding's turtles use streams as well as wetlands as core aquatic habitat. As elsewhere, they also depend on nearby uplands for nesting, basking, and travel among aquatic habitats.

  For your information, I have attached a Blanding's turtle fact sheet that describes the habitat use and life history of this species. The fact sheet also provides two lists of recommendations for avoiding and minimizing impacts to this rare turtle. The first list is relevant for all areas inhabited by Blanding's turtles while the second list contains additional protective measures for areas known to be of statewide importance to this species. **Because the proposed project is within one of these areas, please refer to both lists of recommendations.** In addition, if erosion control mesh will be used, I recommend that the mesh be limited to wildlife-friendly materials (see enclosed fact sheet). Please coordinate with DNR Regional Nongame Specialist, Lisa Gelvin-Innvaer at 507-359-6033 or lisa.gelvin-innvaer@state.mn.us, to discuss any additional concerns or recommendations she may have regarding the proposed project.

  The attached flyer should be given to all contractors working in the area. If Blanding's turtles are encountered on site, please remember that state law and rules prohibit the destruction of threatened or endangered species, except under certain prescribed conditions. If turtles are in imminent danger they must be moved by hand out of harm's way, otherwise they are to be left undisturbed.

Fish

- Topeka shiner (*Notropis topeka*), a federally-listed endangered and state-listed special concern species, and plains topminnow (*Fundulus sciadicus*), a state-listed threatened species, have been document in the vicinity of the proposed project. Also, the Rock River, the East Branch of the Rock River, and several unnamed streams within the project boundary flow into waterways that are federally designated as critical habitat for the Topeka shiner. These fish species are adversely impacted by actions that alter stream hydrology or decrease water quality. To minimize potential impacts, please see the enclosed recommendations for working in Topeka shiner habitat.

Environmental Review and Permitting

- Please reference Kevin Mixon's letter for further recommendations.
- **In consideration of the many state-protected species in the vicinity of the project, further Natural Heritage Review will be needed once project details (e.g., crane walk pathways) have been finalized.**
- Given the federal status of several of the above species, I also recommend that you coordinate with the U.S. Fish & Wildlife Service's Twin Cities Field Office (612-725-3548) regarding this project.
- The DNR looks forward to receiving the results of the avian surveys and acoustic bat surveys and may have additional comments regarding state-listed birds and bats at that time.
- Please include a copy of this letter in any state or local license or permit application. **To the extent applicable, measures to avoid or minimize disturbance to the above rare features should be included as restrictions or conditions in any required permits or licenses.**

The Natural Heritage Information System (NHIS), a collection of databases that contains information about Minnesota's rare natural features, is maintained by the Division of Ecological and Water Resources, Department of Natural Resources. The NHIS is continually updated as new information becomes available, and is the most complete source of data on Minnesota's rare or otherwise significant species, native plant communities, and other natural features. However, the NHIS is not an exhaustive inventory and thus does not represent all of the occurrences of rare features within the state. Therefore, ecologically significant features for which we have no records may exist within the project area. If additional information becomes available regarding rare features in the vicinity of the project, further review may be necessary.

For environmental review purposes, the results of this Natural Heritage Review are valid for one year; the results are only valid for the project location (noted above) and the project description provided on the NHIS Data Request Form. Please contact me if project details change or for an updated review if construction has not occurred within one year.

The Natural Heritage Review does not constitute review or approval by the Department of Natural Resources as a whole. Instead, it identifies issues regarding known occurrences of rare features and potential effects to these rare features. If you have not done so already, please contact your DNR Regional Environmental Assessment Ecologist to determine whether there are other natural resource concerns associated with the proposed project (contact information available at http://www.dnr.state.mn.us/eco/ereview/erp_regioncontacts.html). Please be aware that additional site assessments or review may be required.

Thank you for consulting us on this matter, and for your interest in preserving Minnesota's rare natural resources. An invoice will be mailed to you under separate cover.

Sincerely,



Samantha Bump
Natural Heritage Review Specialist
Samantha.Bump@state.mn.us

enc. Rare Species Survey Process
Dakota Skipper Fact Sheet
Poweshiek Skipperling Fact Sheet
Blanding's Turtle Fact Sheet & Flyer
Wildlife Friendly Erosion Control
Topeka Shiner Fact Sheet
Kevin Mixon's Letter

Links: USFWS Key to the Northern Long-Eared Bat 4(d) Rule for Non-Federal Activities
http://www.fws.gov/midwest/endangered/mammals/nleb/KeyFinal4dNLEB.html
USFWS Key to the Northern Long-Eared Bat 4(d) Rule for Federal Actions
http://www.fws.gov/midwest/endangered/mammals/nleb/KeyFinal4dNLEBFedProjects.html
USFWS Northern Long-eared Bat Website
http://www.fws.gov/midwest/endangered/mammals/nleb/index.html
USFWS Northern Long-eared Bat Fact Sheet
http://www.fws.gov/midwest/endangered/mammals/nleb/nlebFactSheet.html
MBS Sites of Biodiversity Significance
http://www.dnr.state.mn.us/eco/mcbs/biodiversity_guidelines.html
DNR Native Plant Communities
http://www.dnr.state.mn.us/npc/index.html
MN Geospatial Commons
https://gisdata.mn.gov/

cc: Kevin Mixon
Cynthia Warzecha
Lisa Gelvin-Innvaer

APPENDIX V

BBS Route Species List and USFWS Birds of Conservation Concern for Lake Benton II WRA

BBS Route Species List and USFWS Birds of Conservation Concern for Lake Benton Wind

Species list of BBS routes in close proximity to the Project: Chandler (50005) & Ash Creek (50006)

Canada Goose	Belted Kingfisher	Common Yellowthroat
Wood Duck	Red-headed Woodpecker	American Redstart
Gadwall	Red-bellied Woodpecker	Yellow Warbler
Mallard	Yellow-bellied Sapsucker	Eastern Towhee
Blue-winged Teal	Downy Woodpecker	Chipping Sparrow
Hooded Merganser	Hairy Woodpecker	Clay-colored Sparrow
Northern Bobwhite	Northern Flicker	Field Sparrow
Gray Partridge	American Kestrel	Vesper Sparrow
Ring-necked Pheasant	Eastern Wood-Pewee	Lark Sparrow
Wild Turkey	Willow Flycatcher	Lark Bunting
Pied-billed Grebe	Least Flycatcher	Savannah Sparrow
Rock Pigeon	Eastern Phoebe	Grasshopper Sparrow
Eurasian Collared-Dove	Great Crested Flycatcher	Henslow's Sparrow
Mourning Dove	Western Kingbird	Song Sparrow
Yellow-billed Cuckoo	Eastern Kingbird	Swamp Sparrow
Black-billed Cuckoo	Loggerhead Shrike	Northern Cardinal
Common Nighthawk	Yellow-throated Vireo	Rose-breasted Grosbeak
Chimney Swift	Warbling Vireo	Blue Grosbeak
Sora	Red-eyed Vireo	Indigo Bunting
American Coot	Blue Jay	Dickcissel
Killdeer	American Crow	Bobolink
Upland Sandpiper	Horned Lark	Red-winged Blackbird
Wilson's Snipe	Purple Martin	Eastern Meadowlark
American Woodcock	Tree Swallow	Western Meadowlark
Spotted Sandpiper	No. Rough-winged Swallow	Yellow-headed Blackbird
Wilson's Phalarope	Bank Swallow	Brewer's Blackbird
Franklin's Gull	Cliff Swallow	Common Grackle
Black Tern	Barn Swallow	Brown-headed Cowbird
Forster's Tern	Black-capped Chickadee	Orchard Oriole
Double-crested Cormorant	White-breasted Nuthatch	Baltimore Oriole
American Bittern	House Wren	
Least Bittern	Sedge Wren	
Great Blue Heron	Marsh Wren	
Great Egret	Eastern Bluebird	
Green Heron	American Robin	
Black-crowned Night-Heron	Gray Catbird	
Turkey Vulture	Brown Thrasher	
Cooper's Hawk	European Starling	
Northern Harrier	Cedar Waxwing	
Swainson's Hawk	House Sparrow	
Red-tailed Hawk	House Finch	
Great Horned Owl	Purple Finch	
Short-eared Owl	American Goldfinch	

USFWS Birds of Conservation Concern (2008) as indicated in Project specific IPAC

American Bittern
Bald Eagle
Black Tern
Black-billed Cuckoo
Dickcissel
Hudsonian Godwit
Least Bittern
Loggerhead Shrike
Marbled Godwit
Peregrine Falcon
Pied-billed Grebe
Red-headed Woodpecker
Short-eared Owl
Swainson's Hawk
Upland Sandpiper
Western Grebe
Willow Flycatcher

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APPENDIX I – Lake Benton Avian Use Report

Avian Baseline Studies for the Lake Benton II Wind Energy Center Pipestone County, Minnesota

Final Report

September 2016 – August 2017



Prepared for:

Lake Benton Power Partners II, LLC

700 Universe Boulevard JES/JB
Juno Beach, Florida 33408

Prepared by:

Jennifer Stucker, Cecily Foo, and Diem Pham

Western EcoSystems Technology, Inc.
7575 Golden Valley Road, Suite 350
Golden Valley, Minnesota 55427

February 7, 2018

Confidential Business Information

EXECUTIVE SUMMARY

Lake Benton Power Partners II, LLC, an indirect wholly owned subsidiary of NextEra Energy Resources, LLC, is planning for the decommissioning of the existing Lake Benton II Wind Energy Center to facilitate the construction of a new 100-megawatt wind energy generation facility on the site (Project). The existing wind energy center has been in operation since 1999 and is located in Pipestone County in southwestern Minnesota. The new facility would consist of up to 44 wind turbines and associated facilities with the Project spanning 25,597 acres (10,359 hectares). To support development of the new Project plan, Lake Benton Power Partners II, LLC contracted Western EcoSystems Technology, Inc. (WEST) to conduct avian baseline studies at the Project pursuant to Tier 3 of the US Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines*, the *Eagle Conservation Plan Guidance* (ECPG), and the *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota*. Avian use surveys were conducted for a year, from September 2016 to August 2017. Research at the Project was designed to help address the questions posed under Tier 3 of the USFWS *Land-Based Wind Energy Guidelines* and Stage 2 of the ECPG. The principal objectives of the study were to: 1) provide site-specific bird resource and use data that would be useful for evaluating potential impacts from repowering the Project, 2) provide information that could be used for Project planning and design of the facility to minimize impacts to birds, and 3) collect data on eagle use in the area following the USFWS ECPG.

WEST conducted avian and eagle use surveys for a full year, from September 2, 2016 through August 23, 2017. Surveys at each of the point count locations were completed once per month. This survey approach is consistent with the recommendations included in Appendix C of Stage 2 – Site-Specific Surveys and Assessments in the USFWS ECPG (April 2013). Survey methodology changed in February 2017 in order to be consistent with the December 2016 revisions to the eagle incidental take permitting rules.

A total of 192 surveys were conducted during the 12 months and 75 unique species were observed. A cumulative total of 10,828 bird observations were recorded within 1,208 separate groups (defined as one or more individuals) during small- and large-bird surveys as well as incidental observations. The most abundant species observed were Canada goose, greater white-fronted goose, and snow goose. Large flocks of mixed species of blackbirds were also observed during the fall of 2016.

No federal- or state-threatened or endangered species were observed. Three special status species were observed in the Project. Two state species of special concern were observed: American white pelican and Franklin's gull. American white pelicans were only observed in the spring and Franklin's gulls were only observed in fall, indicating that they are likely migrating through the Project. Four bald eagles, a species protected under the Bald and Golden Eagle Protection Act, were observed during surveys in the southern portion of the Project (one observed in winter, two were observed in spring, and one was observed in summer). Two additional bald eagles were observed incidentally in the center of the Project. These eagles were seen circling together at a height of approximately 200 meters in December 2016, above

the rotor swept zone of the current and proposed turbines. The results of this year of surveys indicate a relatively low use of this existing wind energy facility by eagles.

STUDY PARTICIPANTS

Western EcoSystems Technology

Jennifer Stucker	Project Manager and Biologist
Carmen Boyd	Data and Report Manager
Diem Pham	Statistician
Cecily Foo	Report Writer
Wendy Bruso	Technical Editing Manager
Katie Michaels	Technical Editing Coordinator
Katie Michaels	Technical Editor
Todd Mattson	Senior Reviewer

REPORT REFERENCE

Stucker, J.H., C. Foo, and D. Pham. 2018. Avian Baseline Studies for the Lake Benton II Wind Energy Center , Pipestone County, Minnesota. Final Report: September 2016 – August 2017. Prepared for Lake Benton Power Partners II, LLC, Juno Beach, Florida. Prepared by Western EcoSystems Technology, Inc. (WEST), Golden Valley, Minnesota. February 7, 2018.

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INTRODUCTION

Lake Benton Power Partners II, LLC (Lake Benton Power Partners II), an indirect wholly owned subsidiary of NextEra Energy Resources, LLC, is considering repowering the Lake Benton II Wind Center (Project) in Pipestone County, Minnesota. Lake Benton Power Partners II contracted with Western EcoSystems Technology, Inc. (WEST) to conduct avian baseline studies at the Project pursuant to Tier 3 of the US Fish and Wildlife Service (USFWS) 2012 *Land-Based Wind Energy Guidelines,* the USFWS *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013), and the *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (Mixon et al. 2014). This document provides results from fixed-point large bird use surveys, fixed-point small bird use surveys, and incidental observations. These studies were designed to address questions posed under Tier 3 of the USFWS *Land-Based Wind Energy Guidelines* (USFWS 2012).

The principal objectives of the study were to: 1) provide site-specific bird resource and use data that would be useful for evaluating potential impacts from repowering the Project, 2) provide information that could be used for Project planning and design of the facility to minimize impacts to birds, and 3) collect data on eagle use in the area following the USFWS ECPG (USFWS 2013).

STUDY AREA

The Project is located in Pipestone County, Minnesota, encompassing 25,597 acres (10,359 hectares) of private land approximately five miles (eight kilometers [km]) to the southeast from the town of Lake Benton (Figure 1). The Project has rolling topography on top of the Buffalo Ridge (Figure 2). Land use is dominated by agriculture, with 62.7% of lands under cultivation, and 28% in herbaceous cover, which includes pasture and hayfields in addition to native grasslands (US Geological Survey [USGS] National Land Cover Database 2011, Homer et al. 2015; Table 1, Figure 2). There are scattered residences and farms throughout the area. Lakes in this area are limited to the southeastern portion of the Project, east of the town of Holland, within Woodstock Wildlife Management Area.

The proposed wind turbine layout for repowering the Project has not been finalized. Expected plans include the decommissioning of 137 existing wind turbines installed in 1999, and installation of up to 44 wind turbines, to generate total capacity of 100 megawatts of electricity.

Table 1. Land cover types, coverage, and percent composition within the current Lake Benton II Wind Energy Center , Pipestone County, Minnesota.

Land cover (habitat)	Acres	Hectares	% Composition
Cultivated Crops	16,057	6,498	62.73%
Herbaceous	7,167	2,900	28.00%
Developed, Open Space	1,154	467	4.51%
Hay/Pasture	719	291	2.81%
Emergent Herbaceous Wetlands	317	128	1.24%
Open Water	72	29	0.28%
Deciduous Forest	49	20	0.19%
Developed, Low Intensity	46	19	0.18%
Developed, Medium Intensity	8	3	0.03%
Barren Land	3	1	0.01%
Shrub/Scrub	3	1	0.01%
Developed, High Intensity	0.2	0.1	0.00%
Total[1]	**25,597**	**10,359**	**100**

Data from the National Landcover Database (US Geological Survey National Land Cover Database 2011, Homer et al. 2015)

[1] Sums of values may not add to total value shown, due to rounding

METHODS

Avian use surveys were conducted at the Project during 2016-2017 to assess the status of the area. Avian use surveys summarized in this report include 1) fixed-point large bird and eagle use surveys, 2) fixed-point small bird use surveys, and 3) incidental wildlife observations.

Eagle and Other Large Bird Use Surveys

Eagle and large bird use surveys were conducted within the Project from September 2, 2016, through August 23, 2017. The objective of the fixed-point bird use surveys was to provide information that could be used to predict potential impacts, and identify methods of avoiding and/or mitigating impacts based on overall, temporal, and spatial use of the Project by eagles and other large birds. Eagle data were collected following the USFWS ECPG (USFWS 2013) as well as the revised eagle permit rules published on December 16, 2016 (USFWS 2016). It should be noted that the ECPG eagle use survey guidelines were designed for pre-construction situations, and the Project contains existing turbines. Therefore, while not pre-construction, the data collected from September 2016 – August 2017 reflect the current baseline for the site.

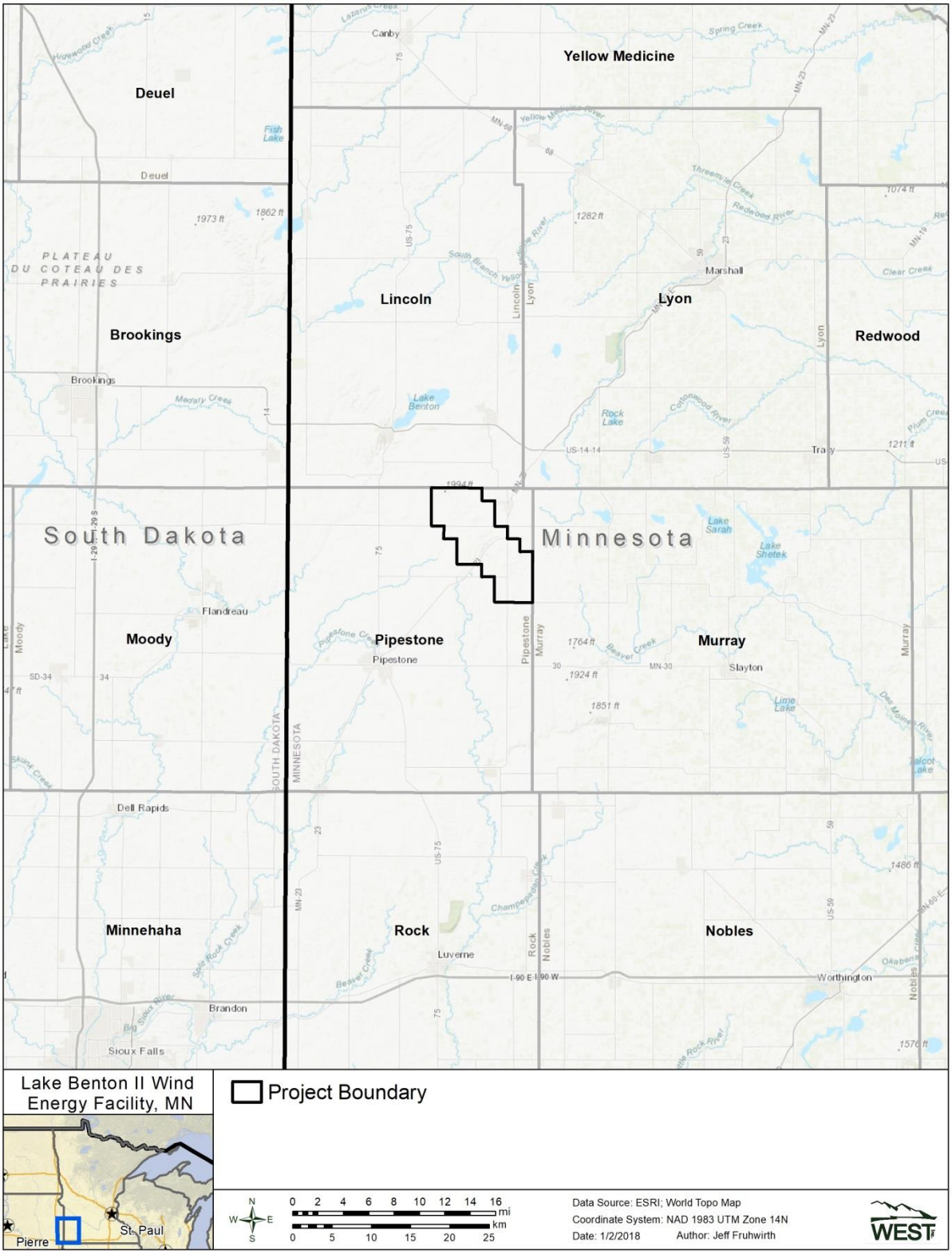


Figure 1. Location of the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

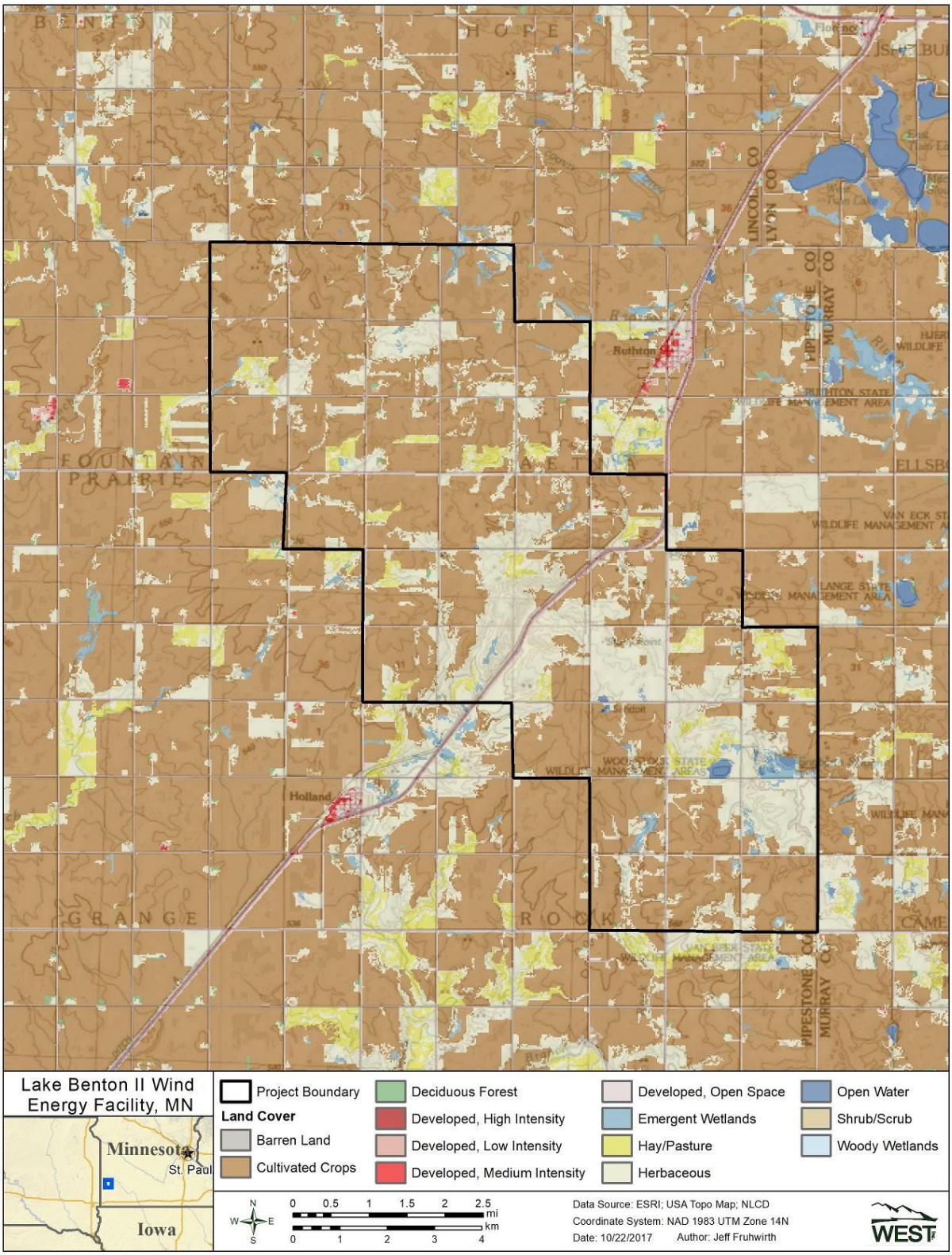


Figure 2. Land cover in the Lake Benton II Wind Energy Center (US Geological Survey National Land Cover Database 2011, Homer et al. 2015) in Pipestone County, Minnesota.

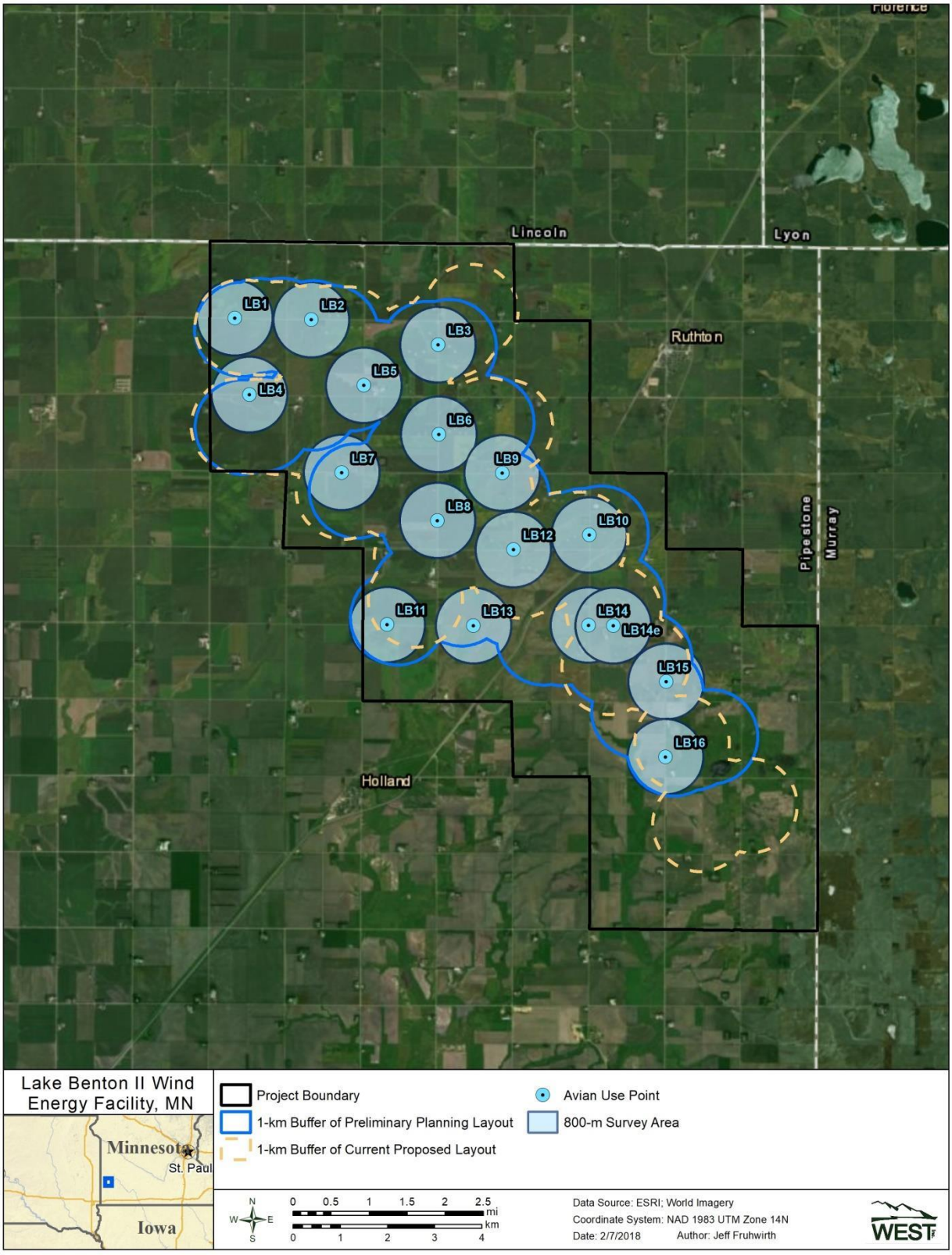


Figure 3. Overview of the Lake Benton II Wind Energy Center, the 1-kilometer buffer of existing turbine locations, and avian use survey points.

Survey Plots

Surveys consisted of counting eagles and other large birds within circular plots centered on an observation point. The maximum survey radius around each observation point was 800 meters (m; 2,625 feet [ft]). For eagle use surveys, the ECPG recommends that at least 30% of the area within one km of turbines be covered by bird observation plots. The 1-km buffer of the existing turbine layout was used as a proxy for the proposed repower Project footprint. This proxy area encompasses 104 square kilometers (km^2), and therefore 16 points were set up, with a total area of 32 square kilometers, or 30.7% of the proxy area . Following the ECPG's recommendations, sixteen observation points were surveyed during each month. We shifted one location, LB14, 500 m east (LB14e) in early spring due to adjacent landowner concerns. Survey point locations were selected to: maximize the spatial coverage of the Project area, ensure good visibility for the survey observers, provide ready access to the survey point locations from public roads, and minimize potential conflicts with landowners (i.e., observation points were set away from residences. Following release of the revised eagle permit rules published on December 16, 2016, the survey order of the point locations was initiated at a randomly selected point location on each day when surveys occurred.

Observation Schedule

Surveys were conducted for one hour at each point once per month. Beginning in February 2017, and in keeping with the USFWS December 2016 revised eagle permit rules (USFWS 2016), each survey day was initiated with a randomly selected survey location from available points remaining to be surveyed. In order to increase spatial and temporal coverage, even-numbered points were generally visited in one week and odd-numbered points surveyed later in month. Surveys were conducted during daylight hours, and survey times were varied across daylight hours during a season.

Survey Methods

Every eagle and other large bird observed during each survey were documented. Standardized fixed-point bird use estimates of large birds detected within the 800-m radius plot during the 60-minute (min) survey were used to generate descriptive statistics. Observations of large birds beyond the 800-m radius were recorded, but were not included in statistical analyses. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves and pigeons, large corvids (i.e., ravens, magpies, and crows), and goatsuckers.

For each observation, estimated distance to each eagle or other large bird was recorded to the nearest five m. The date, start, and end time of observation period, plot number, species or a best possible identification, number of individuals, sex and age class, distance from plot center when first observed, closest distance, height above ground, activity, and habitat were recorded. For eagles, flight height and behavior were recorded at 1-min intervals for as long as the eagle remained visible, based on the recommendations in the ECPG. Observations of eagles and other large birds outside of the 800-m observation plot may have been recorded, but data collected on these birds were analyzed separately from data collected on birds observed within

the plot. Behavior categories included perching, soaring, flapping, flushed, circle soaring, hunting, gliding, and other. Any comments or unusual observations were noted, and weather information was recorded for each survey point including temperature, wind speed, wind direction and cloud cover.

Flight paths and perch locations for eagles and other species of interest (raptors, waterbirds, sensitive species) were mapped on recent satellite imagery or USGS topographic base maps. The map indicated whether the bird was within or outside the survey radius based on reference points at known distances from the plot center. Flight paths and perches were digitized using Geographic Information System software so that bird movement patterns could be evaluated relative to topography, vegetation, and other features of the Project.

Small Bird Use Surveys

Small bird use surveys document species observed in the Project, their abundance, and provide data to estimate temporal and spatial use of the Project. The small-bird use surveys consisted of small bird counts at the same 16 observation points used for eagle and other large bird surveys. Passerines (songbirds excluding large corvids), kingfishers, swifts and hummingbirds, woodpeckers, and most cuckoos were considered small birds.

Small-bird use surveys were 10 min in duration and were conducted immediately upon arrival at the survey point location. From September through January, small bird surveys were concurrent during the first 10 min of the large bird survey. Starting in February due to the revisions to the Eagle Permit Rule that went into effect on January 17, 2017, the small bird surveys preceded the 60-min eagle and large bird use observation period. The survey radius of the circular plots was 100 m for small birds. Observations of small birds beyond the specified radius may have been recorded and these observations are included in Appendix A, but they were not included in the analysis. The estimated distance to each bird observed was recorded to the nearest five m. The date, start, and end time of the observation period, species or best possible identification, number of individuals, sex and age class, distance from plot center when first observed, closest distance, flight height above ground, activity, and habitat were recorded. Additionally, bird behavior and habitat will be recorded for each observation.

Incidental Observations

Incidental wildlife observations provide records of wildlife seen outside of the standardized surveys. Sensitive species and unusual or unique birds, mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys; sensitive species include federal listed and state listed (endangered, threatened or special concern) species or those protected by the Bald and Golden Eagle Protection Act. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species) and habitat were recorded. The location of sensitive species was recorded by Universal Transverse Mercator coordinates using a hand-held Global Positioning System unit.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots once within the study area. Visits were assigned according to the following criteria: 1) a single visit had to be completed in a single season; and 2) a visit could be spread across multiple dates, but a single date could not contain surveys from multiple visits.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data was identified using a series of database queries. Irregular codes or questionable data were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

Data Compilation and Storage

A database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent QA/QC and data analysis. All data forms, field notebooks (if provided), and electronic data files were retained for reference.

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species lists (with the number of observations and groups) were generated by season and they included all observations of birds detected, regardless of their distance from the observer. In some cases, the tally may have represented repeated sightings of the same individual. For example, a sum of 50 observations of northern harrier (*Circus cyaneus*) may be 50 different birds, or it may be one bird observed on 50 separate visits, or something in between. Species richness by season was calculated by averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season. Species diversity and richness were compared among seasons for fixed-point bird use surveys. Species diversity and richness were calculated separately for large birds and small birds.

Bird Use, Percent of Use, and Frequency of Occurrence

For generating standardized fixed-point bird use estimates, large birds detected within the 800-m radius plot during the 60-min survey were used in the analysis; small birds recorded within a 100-m radius during the 10-min surveys were included. The metric used to measure mean bird use was the number of birds per plot per survey. These standardized estimates of mean bird use were used to compare differences among bird types, seasons, survey points, and other studies where similar methods were used. Mean use by season was calculated by summing the

total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. Estimates were calculated separately for large and small birds.

Exposure to risk at a wind facility is influenced by the extent to which a species uses the area (percent of use) and how often use occurs (frequency of occurrence). Percent of use and frequency of occurrence provide relative measures of species exposure to the proposed facility.

For the Project, percent of use was calculated as the proportion of large or small bird mean use that was attributable to a particular bird type or species. Frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. For example, flocks of waterfowl, waterbirds, and shorebirds can comprise several dozen, hundred, or thousands of individual birds, which would result in a very high percentage of use. However, examining the percent of use alone would not account for the concentrated exposure to the facility associated with a small number of very large flocks (low frequency of occurrence). A high percent of use may indicate that a species has higher exposure relative to other species, but when the exposure is concentrated in a small number of large flocks, the species may be less likely to be affected. Conversely, a species that has a low percentage of use and a high frequency of occurrence would have long-term exposure to the facility, increasing the likelihood that this species may be affected by the facility. Therefore, exposure to facility infrastructure is more accurately assessed by evaluating both percent of use and frequency of occurrence.

Bird Flight Height and Behavior

Bird flight heights are important metrics to assess relative exposure. Flight height information was used to calculate the percentage of birds observed flying within the rotor-swept height (RSH) for turbines likely to be used at the expansion area. An RSH for potential collision with a turbine blade of 25 – 150 m (82 – 492 ft) above ground level (AGL) was used for the purposes of the analysis. The flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height. The percentage of birds flying within the RSH at any time was calculated using the lowest and highest flight heights recorded.

Bird Exposure Index

The bird exposure index is used as a relative measure of species-specific risk of turbine collision and the species most likely to occur as fatalities at the wind energy facility. A relative index of bird exposure (R) was calculated for bird species observed during the surveys using the following formula:

$$R = A*P_f*P_t$$

Where A equals mean relative use for species *i* (large bird observations within 800 m of the observer or small bird observations within 100 m of the observer) averaged across all surveys, P_f equals the proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate percentage of time species *i* spends flying during the daylight period),

and P_t equals the proportion of all initial flight height observations of species *i* within the likely RSH. The exposure index does not account for other possible collision risk factors, such as foraging or courtship behavior.

Spatial Use

Large bird flight paths were qualitatively compared to study area characteristics (e.g., topographic features). The objective of mapping observed large bird locations and flight paths was to identify areas of concentrated use by diurnal raptors and other large birds and/or consistent flight patterns within the study area. This information can be useful in turbine layout design or micro-siting individual turbines to reduce risk to birds.

RESULTS

Fixed-Point Bird Use Surveys

A total of 192 fixed-point bird use surveys were conducted from September 2, 2016 – August 23, 2017 (Tables 2a and 2b) An 800-m viewshed was used to calculate species richness, use, percent composition, percent frequency, and exposure index for large birds during 60-min surveys. For small birds, the viewshed was 100 m and the survey period was 10 min, which was used for calculation of species richness, use, percent composition, and percent frequency. Seasons were categorized as spring (1 March - 29 May), summer (30 May – 31 August), fall (1 September – Nov 29), and winter (30 Nov – 27 February).

Bird Diversity and Species Richness

Thirty-two large bird species and 43 small bird species were identified over the course of all fixed-point bird use surveys (Tables 2a and 2b; Appendix A). A mean of 1.65 large bird species/800-m plot/60-min surveys, and a mean of 1.40 small bird species/100-m plot/10-min survey were recorded. Bird diversity (the number of species identified) for large birds was greatest during spring (24 species), followed by fall (17), summer (15), and winter (11; Table 2a). Small bird diversity was greatest in summer (35), followed by spring (24), fall (12), and winter (four; Table 2b). Large bird species richness (mean number of species per 800-m plot per 60-min survey) was greatest in spring (2.79 species/plot/survey), followed by fall (1.73), summer (1.25), and winter (0.85; Table 2a). Small bird species richness (mean number of species per 100-m plot per 10-min survey) was highest during summer (3.27 species/plot/survey) compared to spring (1.33), fall (0.88), and winter (0.06; Table 2b).

Table 2a. Summary of large bird species richness (species/plot[a]/60-minute survey), and sample size by season and overall during the fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness Large Birds
Fall	3	48	17	1.73
Winter	3	48	11	0.85
Spring	3	48	24	2.79
Summer	3	48	16	1.25
Overall	**12**	**192**	**32**	**1.65**

[a] 800-meter radius for large birds

Table 2b. Summary of small bird species richness (species/plot[a]/10-minute survey), and sample size by season and overall during the fixed-point bird use surveys at Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness Small Birds
Fall	3	48	12	0.88
Winter	3	48	4	0.06
Spring	3	48	24	1.33
Summer	3	48	35	3.27
Overall	**12**	**192**	**43**	**1.40**

[a] 100-meter radius for small birds

During large bird surveys, 3,957 large bird observations were recorded within 485 separate groups (defined as one or more individual) during the fixed-point bird use surveys (Appendix A1). Three species (9.4% of all species) comprised 73.6% of all observations: Canada goose (*Branta canadensis*; 1,356 observations), greater white-fronted goose (*Anser albifrons*; 984), and snow goose (*Anser caerulescens*; 574; Appendix A1). Each of all other large bird species accounted for less than 5% of observations. A total of 98 diurnal raptor observations were recorded within the Project, representing eight species (Appendix A1).

Small bird surveys resulted in a total of 4,276 observations in 591 groups (Appendix A2). Four species (9.3% of all small bird species) comprised 72.3% of all observations: mixed flocks of unidentified blackbirds (2,343 observations), horned lark (*Eremophila alpestris*; 275), red-winged blackbird (*Agelaius phoeniceus*; 260), and European starling (*Sturnus vulgaris*; 215; Appendix A2). Each of all other small bird species accounted for less than 4% of observations.

Bird Use, Percent of Use, and Frequency of Occurrence

Mean bird use, percent of use, and frequency of occurrence was calculated by season for all bird types (Tables 3a and 3b) and species (Appendix B). The highest overall large bird use occurred during winter (43.90 birds/800-m plot/60-min survey), followed by fall (17.90), spring (16.56), and summer (4.00; Table 3a). Large bird use in all seasons was mostly due to waterfowl, specifically Canada goose, snow goose, and greater white-fronted goose (Appendix B).

Small bird use was greatest during summer (8.27 birds/100-m plot/10-min survey); use in fall, spring, and winter was fairly similar (5.96, 5.71, and 5.23, respectively; Table 3b). Passerines dominated small bird use. Blackbirds/orioles, particularly mixed flocks of unidentified blackbirds and red-winged blackbird, represented most of the small bird use during fall, spring, and summer; sparrows(Appendix A2, Table 3b). Snow bunting (*Plectrophenax nivalis*), represented most of the small bird use in winter (Appendix A2, Table 3b).

Waterbirds

Waterbird use was recorded during spring and summer; no waterbirds were observed in fall or winter (Table 3a). Waterbird use was low in spring (0.29 birds/800-m plot/60-min survey) and even lower in summer (0.02, Table 3a). Most waterbird use was due to American white pelican (*Pelecanus erythrorhynchos*; Appendix B). Waterbirds only made up 1.8% of all large bird observations in spring and 0.5% of summer observations (Table 3a). Waterbirds were recorded during 8.3% of surveys in spring and 2.1% of surveys in summer (Table 3a).

Waterfowl

Waterfowl use was highest in winter (42.83 birds/800-m plot/60-min survey) and lowest in summer (1.96; Table 3a). Most waterfowl use was due to large flocks of Canada goose and greater white-fronted goose (Appendix A1). Waterfowl made up 49.0% - 97.6% of all large bird observations, and were recorded during 6.2% - 27.1% of surveys (Table 3a).

Shorebirds

Shorebirds were recorded during all four seasons but use was low (ranging from 0.04 bird/800-m plot/60-min survey in winter to 2.44 in spring; Table 3a). Most shorebird use was due to killdeer (*Charadrius vociferus*; Appendix B). Shorebirds comprised 14.7% of overall large bird observations in spring, 12.0% in summer, 7.0% in fall, and less than 0.1% in winter (Table 3a). Shorebirds were observed during 4.2% - 66.7% of survey observations among seasons (Table 3a). Four upland sandpiper (*Bartramia longicauda)* individuals were observed at the project during one survey at one location in July. No other grassland habitat-dependent shorebirds, such as marbled godwit (*Limosa fedoa*), were observed.

Gulls/Terns

Gulls/terns were recorded in fall and spring; use was low in both seasons (1.35 bird/800-m plot/60-min survey and 0.02, respectively; Table 3a). Franklin's gull (*Leucophaeus pipixcan*) was the most commonly observed gull/tern species in fall; spring observations consisted of one ring-billed gull (*Larus delawarensis;* Appendix A1). Gulls/terns comprised 7.6% of overall large bird observations in fall and 0.1% in spring (Table 3a). Gulls/terns were observed during 2.1% of surveys in spring and 6.2% of surveys in fall (Table 3a).

Rails/Coots

Rails/coots observations consisted of one sora (*Porzana carolina*) observed in spring (Appendix A1). Rails/coots use was low (0.02 birds/800-m plot/60-min survey in spring, zero in all other seasons; Table 3a).

Diurnal Raptors

Diurnal raptor use was highest during spring (0.75 birds/800-m plot/60-min survey), followed by fall (0.65), summer (0.56), and winter (0.08; Table 3a). Red-tailed hawk (*Buteo jamaicensis*) made up most diurnal raptor use during fall, spring, and summer; diurnal raptor use in the winter was comprised of single observations of bald eagle (*Haliaeetus leucocephalus*), American kestrel (*Falco sparverius*), merlin (*Falco columbarius*), and an unidentified raptor (Appendix B). Northern harriers, a grassland obligate raptor, were observed at half of the survey points, with sightings during spring, summer and fall. Diurnal raptors accounted for 14.1% of large bird use in summer, 4.5% in spring, 3.6% in fall, and 0.2% in winter (Table 3a). Diurnal raptors were observed during 41.7% of surveys during spring, 39.6% during fall, 35.4% of summer surveys, and 8.3% of winter surveys (Table 3a).

The total survey effort for eagles was 192 hours during which six bald eagles were observed at the Project: four during surveys and two incidentally (discussed further in Sensitive Species Observations). No golden eagles (*Aquila chrysaetos*) were observed at the Project.

Vultures

Turkey vulture (*Cathartes aura*) was the only vulture species observed (Appendices A1 and B), and use by turkey vulture was recorded during fall (0.50 bird/800-m plot/60-min survey), summer (0.15), and spring (0.08; Table 3a; Appendix B). Turkey vultures were not observed during the winter. Turkey vultures comprised 3.6% of overall large bird use during summer, 2.8% during fall, and 0.5% during spring (Table 3a). Turkey vultures were observed during 4.2% of surveys in spring, 10.4% in summer, and 16.7% in fall (Table 3a).

Upland Game Birds

The only upland game bird species observed was ring-necked pheasant (*Phasianus colchicus*) (Appendix A1 and B). Surveys documented use during spring (0.62 birds/800-m plot/60-min survey), summer (0.23), fall (0.12), and winter (0.12; Table 3a, Appendix B). Ring-necked pheasants comprised 5.7% of the overall large bird use during summer, 3.8% during spring, 0.7% during fall, and 0.3% during winter (Table 3a). Ring-necked pheasants were observed between 6.2% – 33.3% of surveys by season (Table 3a).

Doves/Pigeons

Doves/pigeons were recorded in all four seasons but had the greatest number of observations in fall (2.38 birds/800-m plot/60-min survey), followed by spring (1.17), summer (0.25), and winter (0.23). Three species, one native, and two introduced dove/pigeons, were observed during the year of avian surveys: Eurasian collared-dove (*Streptopelia decaocto;* introduced), mourning dove (*Zenaida macroura;* native), and rock pigeon (*Columba livia*; introduced; Appendix B). Doves/pigeons comprised 13.3% of overall large bird use in the fall and 0.5% of overall large bird use in the winter, with intermediate use in the spring (7.0%) and summer (6.2%, Table 3a). Throughout the year, doves/pigeons were observed between 6.2% – 18.8% of surveys by season (Table 3a).

Large Corvids

Large corvid observations consisted of one species, American crow (*Corvus brachyrhynchos*), which were observed in all four seasons (Appendix A1). Observations were most frequent in fall (1.50 birds/800-m plot/60-min survey) and least in summer (0.33). American crows comprised less than 10% of use in all four seasons (Table 3a). American crows were observed during 31.2% of surveys in the spring, 25.0% in the winter, and 12.5% in both fall and summer surveys (Table 3a).

Goatsuckers

Only one species of goatsucker was observed, the common nighthawk (*Chordeiles minor*), and it was only observed during summer. Use in summer was low (0.02 birds/800-m plot/60-min survey). Common nighthawks made up 0.5% of use in the summer and were observed during 2.1% of surveys.

Table 3a. Mean large bird use (number of birds/plot[a]/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type by season during the 60-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

	Mean Use				% of Use				% Frequency			
Type	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
Waterbirds	0	0	0.29	0.02	0	0	1.8	0.5	0	0	8.3	2.1
Waterfowl	10.15	42.83	10.21	1.96	56.7	97.6	61.6	49.0	16.7	16.7	27.1	6.2
Shorebirds	1.25	0.04	2.44	0.48	7.0	<0.1	14.7	12.0	39.6	4.2	66.7	16.7
Gulls/Terns	1.35	0	0.02	0	7.6	0	0.1	0	6.2	0	2.1	0
Rails/Coots	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
Diurnal Raptors	**0.65**	**0.08**	**0.75**	**0.56**	**3.6**	**0.2**	**4.5**	**14.1**	**39.6**	**8.3**	**41.7**	**35.4**
Accipiters	*0*	*0*	*0.02*	*0*	*0*	*0*	*0.1*	*0*	*0*	*0*	*2.1*	*0*
Buteos	*0.35*	*0*	*0.38*	*0.33*	*2.0*	*0*	*2.3*	*8.3*	*27.1*	*0*	*22.9*	*22.9*
Northern Harrier	*0.12*	*0*	*0.08*	*0.04*	*0.7*	*0*	*0.5*	*1.0*	*12.5*	*0*	*6.2*	*4.2*
Eagles	*0*	*0.02*	*0.04*	*0.02*	*0*	*<0.1*	*0.3*	*0.5*	*0*	*2.1*	*2.1*	*2.1*
Falcons	*0.04*	*0.04*	*0.12*	*0.15*	*0.2*	*<0.1*	*0.8*	*3.6*	*2.1*	*4.2*	*10.4*	*6.2*
Other Raptors	*0.12*	*0.02*	*0.10*	*0.02*	*0.7*	*<0.1*	*0.6*	*0.5*	*8.3*	*2.1*	*8.3*	*2.1*
Vultures	0.50	0	0.08	0.15	2.8	0	0.5	3.6	16.7	0	4.2	10.4
Upland Game Birds	0.12	0.12	0.62	0.23	0.7	0.3	3.8	5.7	12.5	6.2	33.3	18.8
Doves/Pigeons	2.38	0.23	1.17	0.25	13.3	0.5	7.0	6.2	10.4	6.2	18.8	12.5
Large Corvids	1.50	0.58	0.96	0.33	8.4	1.3	5.8	8.3	12.5	25.0	31.2	12.5
Goatsuckers	0	0	0	0.02	0	0	0	0.5	0	0	0	2.1
Large Bird Overall	**17.90**	**43.90**	**16.56**	**4.00**	**100**	**100**	**100**	**100**				

[a.] 800-meter radius plot for large birds

Table 3b. Mean small bird use (number of birds/plot[a]/10-minute survey), percent of total use (%), and frequency of occurrence (%) for each small bird type by season during the 10-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

	Mean Use				% of Use				% Frequency			
Type	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
Woodpeckers	**0.04**	**0**	**0.02**	**0.08**	**0.7**	**0**	**0.4**	**1.0**	**4.2**	**0**	**2.1**	**6.2**
Passerines	**5.92**	**5.23**	**5.67**	**8.15**	**99.3**	**100**	**99.3**	**98.5**	**56.2**	**6.2**	**62.5**	**83.3**
Blackbirds/Orioles	3.31	0	4.17	2.69	55.6	0	73.0	32.5	18.8	0	43.8	52.1
Finches/Crossbills	1.27	0	0.02	0.62	21.3	0	0.4	7.6	20.8	0	2.1	29.2
Flycatchers	0	0	0.02	0.48	0	0	0.4	5.8	0	0	2.1	25.0
Grassland/Sparrows	0.58	5.23	0.69	1.21	9.8	100	12.0	14.6	20.8	6.2	25.0	56.2
Mimids	0	0	0.04	0.02	0	0	0.7	0.3	0	0	2.1	2.1
Swallows	0.62	0	0.10	2.46	10.5	0	1.8	29.7	10.4	0	6.2	27.1
Thrushes	0.02	0	0.60	0.19	0.3	0	10.6	2.3	2.1	0	12.5	12.5
Warblers	0	0	0.02	0.12	0	0	0.4	1.5	0	0	2.1	12.5
Wrens	0	0	0	0.35	0	0	0	4.3	0	0	0	14.6
Corvids	0.10	0	0	0	1.7	0	0	0	6.2	0	0	0
Unidentified Birds	**0**	**0**	**0.02**	**0.04**	**0**	**0**	**0.4**	**0.5**	**0**	**0**	**2.1**	**4.2**
Small Bird Overall	**5.96**	**5.23**	**5.71**	**8.27**	**100**	**100**	**100**	**100**				

100-meter for small birds

Small Birds

Small birds were documented within a 100-m viewshed during a 10-min observation period; therefore, descriptive statistics for small bird types are not directly comparable to large bird types. Passerines and woodpeckers represented most of the small bird use, with passerine use greatest during summer (8.15 birds/100-m plot/10-min survey), and similar among the other three seasons: fall (5.92), spring (5.67), and winter (5.23; Table 3b).

Blackbirds/orioles were most abundant during spring (4.17 birds/100-m plot/10-min survey), fall (3.31), and summer (2.69); no blackbirds/oriole species were observed in winter (Table 3b). Grassland/sparrows (a group that consists primarily of sparrow species with additional grassland-associated species such as dickcissel, horned lark, and snow buntings) made up all of the use in winter (5.23 birds/100-m plot/10-min survey). Use by other bird types was low and inconsistent; grassland/sparrows and corvids/jays were the only types observed in all four seasons. Wrens were only observed in summer. Blackbirds/orioles made up 73.0% of use in spring, 55.6% in fall, and 32.5% in summer. Grassland/sparrows made up 100% of use in winter (Table 3b). Blackbirds/orioles were observed more frequently than any other bird type in spring (43.8%). Grassland/sparrows had the highest frequency of observation in summer (56.2%), fall (20.8%, tied with finches/crossbills), and winter (6.2%).

Woodpeckers and unidentified small birds had low use (less than 0.1 birds/100-m plot/10-min survey) in all seasons.

Grassland Species

Grassland species typical of grassland habitats in this part of Minnesota are dependent on grassland and prairie habitat, but can be found in adjacent agricultural areas. The most abundant species include the blackbirds/orioles and grassland/sparrows species groups, referenced above in the small birds discussion, in addition to several large birds species (raptors [northern harrier] and shorebirds [upland sandpiper]). Eighty percent of the spring and summer small bird grassland species observations (indicating which species may be breeding in the Project) were comprised of six species: western meadowlark (*Sturnella neglecta*), common grackle (*Quiscalus quiscula*), red-winged blackbird (*Agelaius phoeniceus*), song sparrow (*Melospiza melodia*), brown-headed cowbird (*Molothrus ater*), and horned lark (*Eremophila alpestris*), which are more generalists and often associated with fragmented grassland habitats in an agricultural setting. The remaining 20% of observations across the survey area were comprised of 17 species, including some more typical grassland specialist species: dickcissel (*Spiza americana*), clay-colored sparrow (*Spizella pallida*), grasshopper sparrow (*Ammodramus savannarum*), Savannah sparrow (*Passerculus sandwichensis*), yellow-headed blackbird (*Xanthocephalus xanthocephalus*), and bobolink (*Dolichonyx oryzivorus*). Grassland small bird species were observed most abundantly at Point 7 and Point 12 (Figure 4e); Point 7 is located adjacent to crop fields and wet areas, and Point 12 is located adjacent to primarily pasture grassland areas. Upland sandpipers were observed once, and only at Point 1 (3% grassland/pasture within 800 m). Northern harriers were documented at half of the survey points throughout the Project.

Bird Flight Height and Behavior

Flight height characteristics, based on initial flight height observations and estimated use, were calculated for large bird types and species (Tables 4 and 5). During fixed-point large bird surveys, 315 groups of large birds were observed flying within the 800-m plot, totaling 3,678 observations. Overall, 29.2% of flying large birds were recorded within the RSH (i.e., 25 – 150 m AGL), 14.3% were below the RSH, and 56.4% were flying above the RSH. Most (58.6%) of flying diurnal raptors were observed below the RSH, while 24.1% were within the RSH and 17.2% were above the RSH. The most commonly observed bird types flying in the RSH were waterfowl (30.4%, 945 individuals), large corvids (48.2%, 55 individuals), vultures (51.5%, 17 individuals), eagles (75.0%, 3 individuals), and goatsuckers (100%, 1 individual; Table 4). Twenty-five percent of flying shorebird observations were documented flying in the RSH (24 individuals, Table 4). Diurnal raptors had the sixth highest percentage of birds within the RSH due to eagles and buteos recorded at this height (Table 4). All other large bird types were observed flying in the RSH less than 15% of the time (Table 4). No upland gamebirds, rails/coots, or accipiters were observed in the RSH (Table 4).

Seven species were observed flying within the estimated RSH during more than half of initial observations: common nighthawk, great egret (*Ardea alba*), unidentified goose, wood duck (*Aix sponsa*), unidentified duck, bald eagle, and turkey vulture, though percentages for all but turkey vulture and unidentified duck were based on four or fewer observations (Table 5).

Table 4. Flight height characteristics by bird type[a] and raptor subtype during 60-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0 - 25 m	25 - 150 m[b]	> 150 m
Waterbirds	6	15	91.67	100	13.3	13.3	73.3
Waterfowl	76	3,109	123.59	99.4	5.6	30.4	63.9
Shorebirds	52	96	26.88	47.5	71.9	25.0	3.1
Gulls/Terns	4	65	167.50	98.5	30.8	3.1	66.2
Rails/Coots	0	0	0	0	0	0	0
Diurnal Raptors	**81**	**87**	**63.35**	**88.8**	**58.6**	**24.1**	**17.2**
Accipiters	*1*	*1*	*20.00*	*100*	*100*	*0*	*0*
Buteos	*43*	*46*	*83.86*	*90.2*	*43.5*	*30.4*	*26.1*
Northern Harrier	*11*	*12*	*8.64*	*100*	*91.7*	*8.3*	*0*
Eagles	*4*	*4*	*122.50*	*100*	*0*	*75.0*	*25.0*
Falcons	*12*	*14*	*12.58*	*82.4*	*92.9*	*7.1*	*0*
Other Raptors	*10*	*10*	*76.90*	*76.9*	*60.0*	*20.0*	*20.0*
Vultures	28	33	73.18	94.3	39.4	51.5	9.1
Upland Game Birds	4	10	1.25	18.9	100	0	0
Doves/Pigeons	33	148	13.91	76.7	95.3	4.7	0
Large Corvids	30	114	33.10	70.4	40.4	48.2	11.4
Goatsuckers	1	1	40.00	100	0	100	0
Large Birds Overall	**315**	**3,678**	**65.68**	**93.0**	**14.3**	**29.2**	**56.4**

[a.] 800-meter (m) radius plot for large birds
[b] The likely "rotor-swept height" for potential collision with a turbine blade, or 25 – 150 m (82 – 492 ft) above ground level
Obs = observations

Bird Exposure Index

A relative exposure index based on initial flight height observations and the use estimate was calculated for each bird species. Species that had exposure to the RSH are listed in Table 5. Due to relatively high use and number of observations within the RSH, Canada goose had the highest exposure index (3.15), followed by snow goose (0.83), and greater white-fronted goose (0.52), as a consequence of high use (Table 5). The other large bird species with exposure indices greater than zero had lower mean use than the previously mentioned species (Table 5).

Table 5. Relative exposure index and flight characteristics for large bird species during 60-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH[b] based on Initial obs	Exposure Index	% Within RSH at Anytime
Canada goose	31	7.05	99.4	45.0	3.15	45.0
snow goose	8	2.98	100	27.9	0.83	36.6
greater white-fronted goose	11	5.07	99.0	10.3	0.52	10.3
American crow	30	0.84	70.4	48.2	0.28	48.2
unidentified goose	2	0.26	100	100	0.26	100
unidentified duck	6	0.14	100	77.8	0.11	77.8
killdeer	37	0.58	48.7	34.5	0.10	34.5
turkey vulture	28	0.18	94.3	51.5	0.09	75.8
red-tailed hawk	29	0.18	85.3	31.0	0.05	34.5
rock pigeon	20	0.56	63.3	10.1	0.04	53.6
Swainson's hawk	12	0.08	100	33.3	0.03	60.0
wood duck	2	0.03	100	83.3	0.03	83.3
Wilson's snipe	7	0.11	90.5	26.3	0.03	26.3
mallard	12	0.17	100	12.1	0.02	18.2
bald eagle	4	0.02	100	75.0	0.02	75.0
unidentified raptor	10	0.07	76.9	20.0	0.01	20.0
Franklin's gull	2	0.22	100	4.8	0.01	100
common nighthawk	1	<0.01	100	100	<0.01	100
American kestrel	11	0.08	81.2	7.7	<0.01	7.7
great blue heron	3	0.02	100	33.3	<0.01	66.7
northern harrier	11	0.06	100	8.3	<0.01	16.7
great egret	1	<0.01	100	100	<0.01	100

[a] Only includes species with actual exposure index values

[b] The likely "rotor-swept height" (RSH) for potential collision with a turbine blade, or 25 – 150 m (82 – 492 ft) above ground level

[c.] 800-m radius plot for large birds

Obs = observations

Spatial Use

For all large bird species combined, use was highest at Point 1 (92% row crops within 800 m) and Point 3 (48% row crops within 800 m)(72.0 and 88.4 birds/60-min survey, respectively) while other points ranged from 1.33 to 29.2 birds/60-min survey (Figure 4a). The high mean use estimate for Point 5 was due to high waterfowl use at this point (Figure 4b). Point 5 had no open water within 800 m and was primarily (61%) row crops within 800 m; this high waterfowl use was associated with large flocks passing through in the winter. Diurnal raptor use was relatively consistent at most points, ranging from 0.08 bird/60-min survey at Point 1 (93% row crops within 800 m) and Point 8 (82% row crops within 800 m) to 1.00 at Point 12 (81% grassland/pasture within 800 m) and Point 13 (54% grassland/pasture within 800 m) (Figure 4c). Small bird use, focused within 100 m, was greatest at Points 7 (40% grassland within 100 m) and 14 (50% grassland within 100 m) (20.67 and 19.2 small birds/10-min survey, respectively), while other points ranged from 0.33 – 12.2 birds/10-min survey (Figure 4d).

Flight paths of waterfowl, and diurnal raptors, including eagles, were digitized and mapped (Figures 5a and 5b). Waterfowl flight paths were mapped throughout most of the Project with mean use of zero at Points 12 and 14, (points with relatively higher percentage of grassland habitat in the 800 m viewshed), and the highest density at Point 1 and Point 3, (points with relatively high percentages of row crops in the viewshed, but no open water); the majority of these flight paths were Canada goose and greater white-fronted goose migrating in a north/south direction. Eagle flight paths were concentrated in the southern portion of the Project, near Point 15 and Point 16; however, including incidental observations, only six eagles were observed throughout the year of surveys (Table 10). Other diurnal raptors were observed flying within the Project with no obvious movement corridors or areas of concentration. The available data (from observations, survey data, and habitats) do not indicate that any portion of the study area supports relatively high bird use; the majority of use documented in these surveys was by waterfowl observed moving through the Project during their spring and fall migration periods.

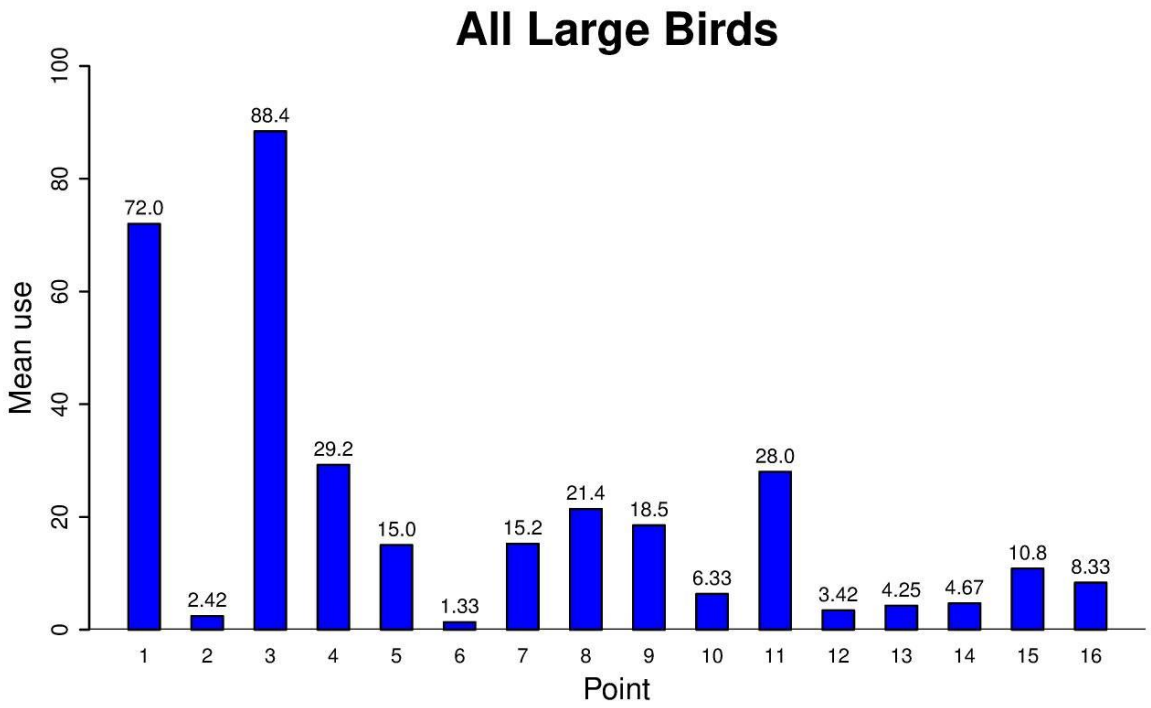


Figure 4a. Relative large bird use by observation point during 60-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

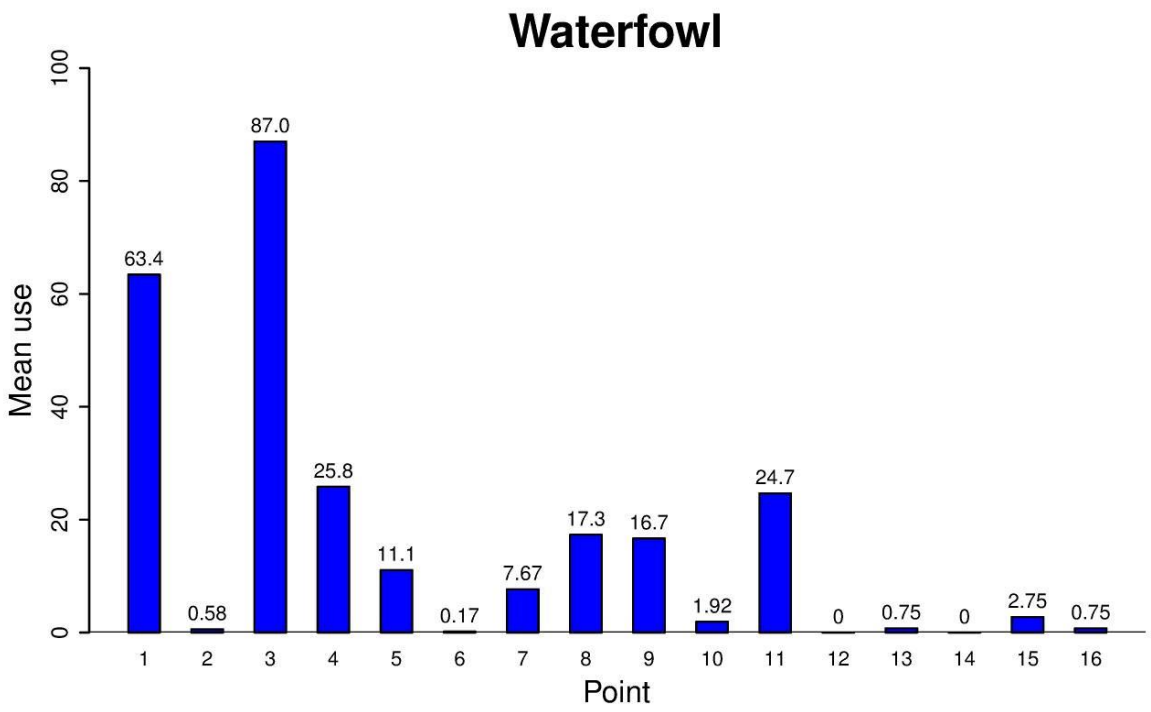


Figure 4b. Relative waterfowl use by observation point during 60-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

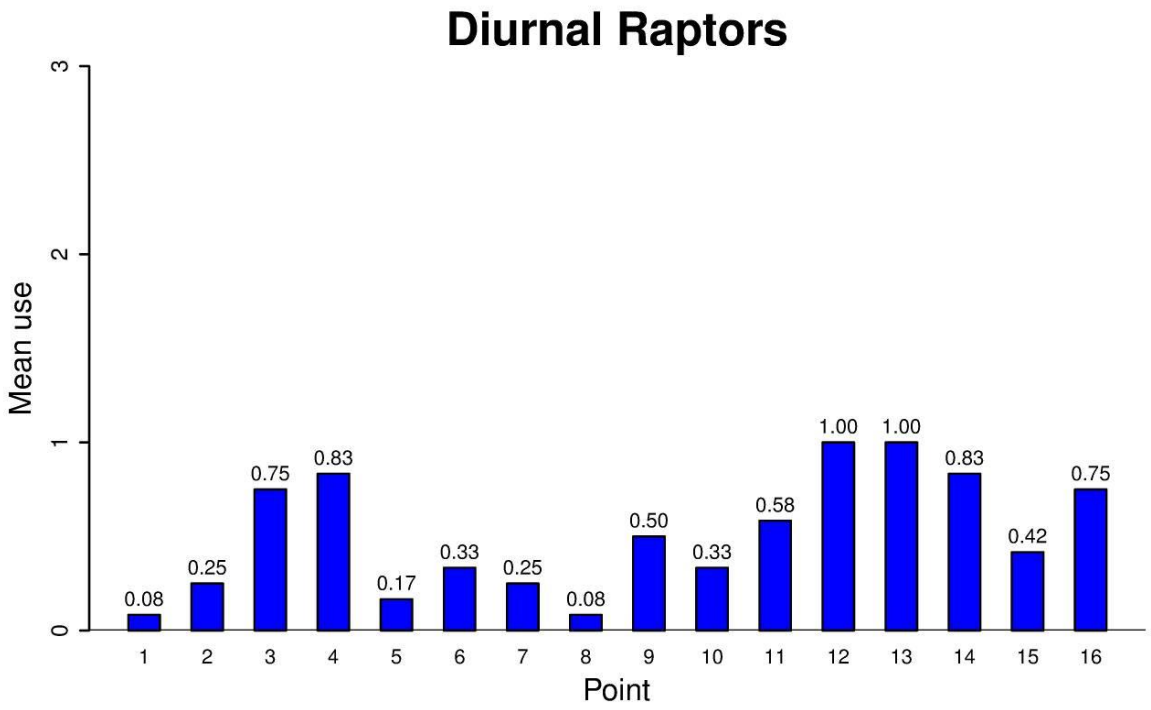


Figure 4c. Relative raptor use by observation point during 60-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

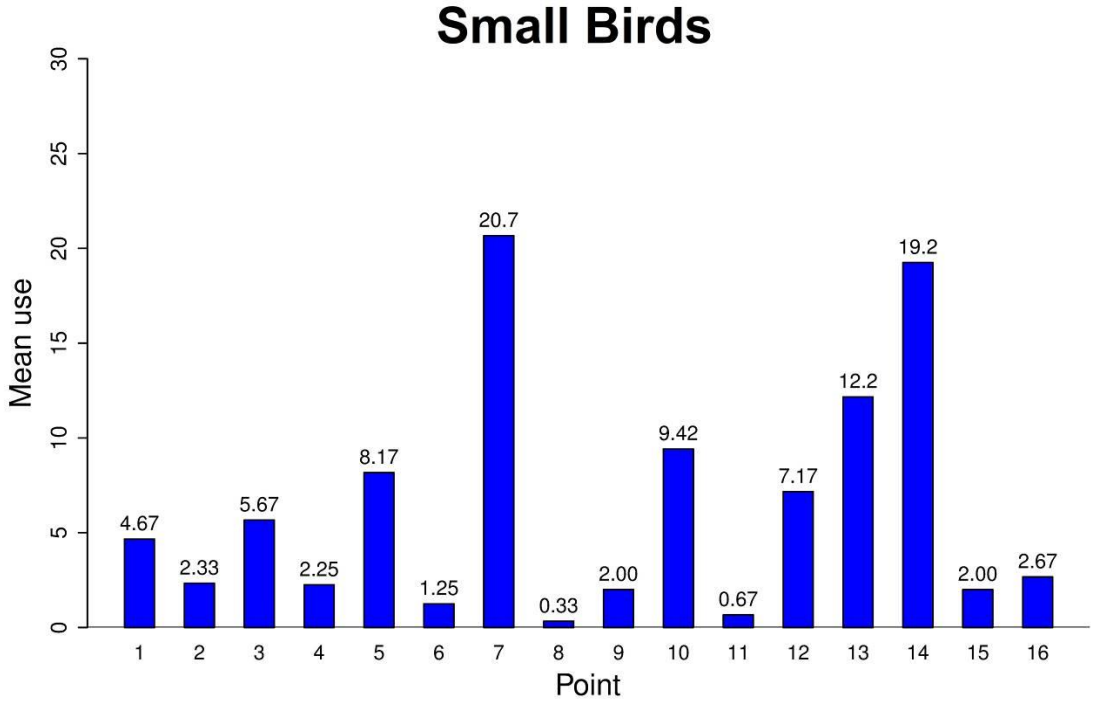


Figure 4d. Relative small bird use by observation point during 10-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

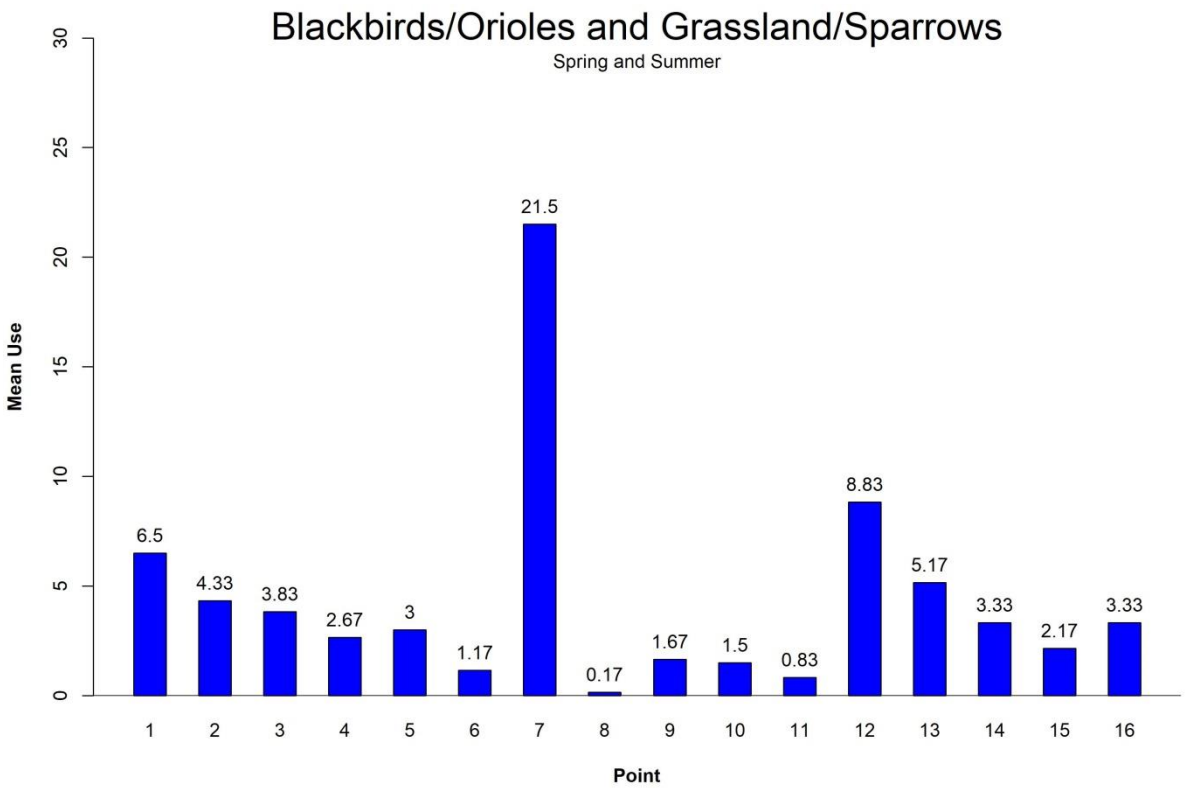


Figure 4e. Relative grassland species (blackbird/oriole and grassland/sparrow) use by observation point,10-minute fixed-point bird use surveys at the Lake Benton II Wind Energy Center during spring and summer seasons (March 1, 2017 – August 23, 2017).

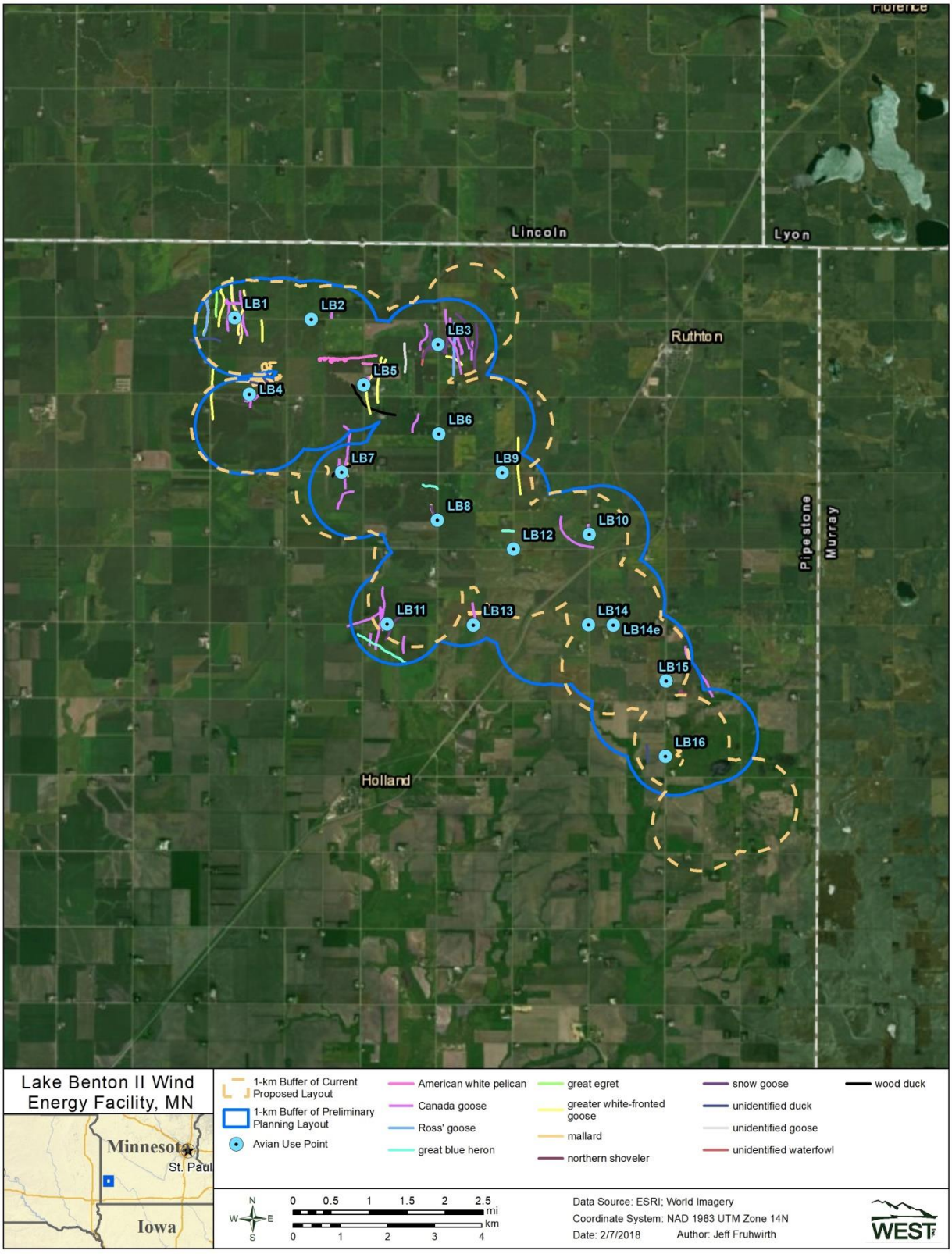


Figure 5a. Waterfowl flight paths recorded during 60-minute fixed-point bird use surveys at Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

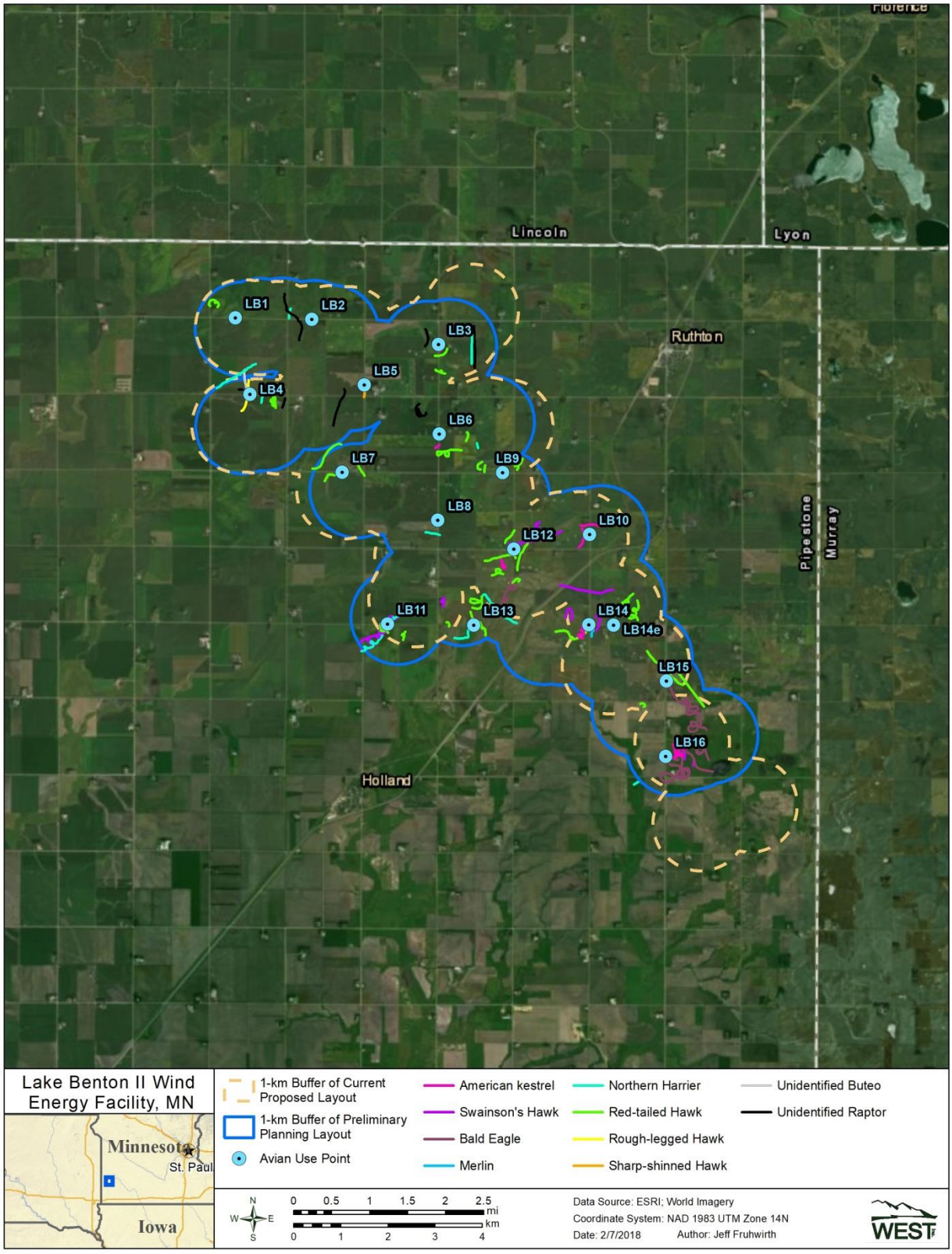


Figure 5b. Diurnal raptor flight paths recorded during 60-minute fixed-point bird-use surveys at Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Eagle Use

A total of 30 bald eagle flight minutes were documented during 192 large bird use survey observation hours, with the greatest number of minutes documented in spring 2017 (15 minutes; Table 6); no perched eagles were observed during the surveys. Of those eagle minutes, 8 minutes were within the zone of risk (defined for eagles as within 800 m of the observer and below 200 m in height), recorded during March 2017 (five eagle risk minutes) and June 2017 (three eagle risk minutes; Table 7). Although an eagle was observed in December for 7 minutes of flight, none of those minutes were observed within the zone of risk.

Eagle use was observed at Point 13 (1 eagle, 8 minutes with 3 minutes in the zone of risk), Point 15 (1 eagle, 7 minutes, 0 minutes in the zone of risk), and Point 16 (2 eagles, 15 minutes, 5 minutes in the zone of risk); (Table 8).

Table 6. Summary of eagle observations during the fixed-point large bird use surveys and risk minutes (within 800 meters below 200 meters) at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Season	Number of Surveys	Survey Hours	Eagle Observation	Minutes Recorded	Risk Minutes
fall	48	48	0	0	0
winter	48	48	1	7	0
spring	48	48	2	15	5
summer	48	48	1	8	3
Total	**192**	**192**	**4**	**30**	**8**

Table 7. Summary of eagle observations during the fixed-point large bird use surveys and risk minutes (within 800 meters below 200 meters) at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Month	Number of Surveys	Survey Hours	Eagle Observation	Minutes Recorded	Risk Minutes
January	16	16	0	0	0
February	16	16	0	0	0
March	16	16	2	15	5
April	16	16	0	0	0
May	16	16	0	0	0
June	16	16	1	8	3
July	16	16	0	0	0
August	16	16	0	0	0
September	16	16	0	0	0
October	16	16	0	0	0
November	16	16	0	0	0
December	16	16	1	7	0
Total	**192**	**192**	**4**	**30**	**8**

Table 8. Summary of eagle observations during the fixed-point large bird use surveys and risk minutes (within 800 meters below 200 meters) at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Survey Location	Number of Surveys	Survey Hours	Eagle Observation	Minutes Recorded	Risk Minutes
1	12	12	0	0	0
2	12	12	0	0	0
3	12	12	0	0	0
4	12	12	0	0	0
5	12	12	0	0	0
6	12	12	0	0	0
7	12	12	0	0	0
8	12	12	0	0	0
9	12	12	0	0	0
10	12	12	0	0	0
11	12	12	0	0	0
12	12	12	0	0	0
13	12	12	1	8	3
14	12	12	0	0	0
15	12	12	1	7	0
16	12	12	2	15	5
Total	**192**	**192**	**4**	**30**	**8**

Sensitive Species Observations

No federally listed or state-listed species were recorded during the fixed-point bird use surveys. Bald eagles were observed at the Project (see *Eagle Use* above), and eagles are federally protected under Bald and Golden Eagle Protection Act (1940). Two species designated by Minnesota Department of Natural Resources as Species of Special Concern were observed flying through the Project. These two Special Concern species were recorded during the bird use surveys: American white pelican (11 observations) and Franklin's gull (42; Table 9). No sensitive species were observed during small bird surveys.

Incidental Observations

Seventeen bird species were recorded as incidental observations outside of standard surveys (Table 10). All bird species observed incidentally were also recorded during standard surveys. Three mammal species, badger (*Taxidea taxus*), raccoon (*Procyon lotor*), and white-tailed deer (*Odocoileus virginianus*) were recorded as incidental observations (Table 10).

Table 9. Summary of sensitive species observed at the Lake Benton II Wind Energy Center during fixed-point large bird use surveys (FPLB), fixed-point small bird use surveys (FPSB), and as incidental wildlife observations (Inc.) from September 2, 2016 – August 23, 2017.

			FPLB		FPSB		Inc.		Total	
Species	**Scientific Name**	**Status**	**# of grps**	**# of obs**	**# of grps**	**# of obs**	**# of grps**	**# of obs**	**# of grps**	**# of obs**
American white pelican	*Pelecanus erythrorhynchos*	MN-SSC	2	11	0	0	0	0	2	11
bald eagle	*Haliaeetus leucocephalus*	FED-EA	4	4	0	0	2	2	6	6
Franklin's gull	*Leucophaeus pipixcan*	MN-SSC	2	42	0	0	0	0	2	42
Total	**3 species**		**8**	**57**	**0**	**0**	**2**	**2**	**10**	**59**

FED=Federal, MN=Minnesota, EA= Bald and Golden Eagle Act, SSC= Species of Special Concern

Grps = groups, obs = observations

Table 10. Incidental wildlife observed while conducting all surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

Species	Scientific Name	# grps	# obs
great blue heron	*Ardea herodias*	1	1
Canada goose	*Branta canadensis*	5	52
greater white-fronted goose	*Anser albifrons*	1	7
snow goose	*Anser caerulescens*	5	720
unidentified duck		1	50
unidentified waterfowl		1	200
Killdeer	*Charadrius vociferus*	3	4
unidentified shorebird		3	3
upland sandpiper	*Bartramia longicauda*	3	4
American kestrel	*Falco sparverius*	15	15
bald eagle	*Haliaeetus leucocephalus*	2	2
northern harrier	*Circus cyaneus*	8	8
red-tailed hawk	*Buteo jamaicensis*	24	25
Swainson's hawk	*Buteo swainsoni*	3	3
unidentified buteo	*Buteo* spp.	2	2
unidentified hawk		1	1
unidentified raptor		5	5
turkey vulture	*Cathartes aura*	7	7
ring-necked pheasant	*Phasianus colchicus*	2	8
mourning dove	*Zenaida macroura*	27	59
American goldfinch	*Spinus tristis*	3	4
brown-headed cowbird	*Molothrus ater*	1	1
unidentified blackbird		4	1,301
western meadowlark	*Sturnella neglecta*	1	1
unidentified bird (small)		2	61
unidentified large bird		2	51
Bird Subtotal		**132**	**2,595**
Badger	*Taxidea taxus*	1	1
Raccoon	*Procyon lotor*	1	1
white-tailed deer	*Odocoileus virginianus*	8	18
Mammal Subtotal		**10**	**20**

Grps = groups, obs = observations

DISCUSSION

These baseline (Tier 3) studies provided site-specific data that, when combined with available literature, allow for a better-informed assessment of the risk of significant adverse impacts to species of concern at this existing Project.

Passerines and waterfowl were the two most abundant bird types observed at the Project. The results of this study indicate that risk to passerines may be higher in the fall and spring, and that fatalities would likely include species common to agricultural landscapes. Passerines are expected to comprise a majority of bird fatalities at the Project site (Johnson et al. 2000; Erickson et al. 2014). However, current turbine-related fatalities constitute a very small percentage of even the most common passerine's total population size (Kingsley and Whittam 2007; Kuvlesky et al. 2007; Erickson et al. 2014). Given the relative high waterfowl use moving through the Project, waterfowl could be most susceptible group to fatality at the Project,

particularly if flocks of geese are passing through the Project in the winter and are flying in the RSH. However, large numbers of waterfowl fatalities have not been observed at this Project during post-construction monitoring or incidentally during operational surveys. Previous work at this site and in the greater Buffalo Ridge Wind Resource Area document the primary avian fatalities as associated with turbines were comprised of 76.4% passerines, 9.1% waterfowl, 5.5% waterbirds, 5.5% upland gamebirds, 1.8% raptors and 1.8% shorebirds (Johnson et al. 2000). Given the results of other publicly available post-construction mortality surveys at other wind projects in the US, including projects in the Prairie Pothole region, it is anticipated that passerine and waterfowl fatalities would likely consist of multiple species, but with relatively low numbers of fatalities per species that would not approach levels that could affect populations.

Raptor use at the Project was generally low and fairly even across seasons, but lowest in winter. The species with the most apparent risk is the red-tailed hawk. However, given the large and stable population of red-tailed hawks that occur throughout the region (Preston and Beane 2009; BirdLife International 2016), the Project is not expected to result in significant impacts to local or regional populations.

Grassland species, while present within the Project, were observed at relatively low levels, and were primarily comprised of western meadowlarks and brown-headed cowbirds. The most abundant species of grassland birds observed include species typical of fragmented grassland habitats.

No federal or state-listed threatened or endangered species were observed during the surveys; two species listed as species special concern were documented. These species include one waterbird species and one gull species that would be expected to utilize bodies of water near the southeastern edge of the Project.

This study was designed to document use by eagles, following the ECPG survey recommendations. During the 192 hours of observation during the year of surveys, four bald eagles were observed flying for a total of 30 minutes, eight minutes of which were documented within 800 m of the observer and below 200 m in height. These eagles were observed during surveys in the southern portion of the Project at points 13, 15, and 16. Two bald eagles were also observed incidentally in the center of the Project, west of Point 11. These eagles were seen circling together at a height of approximately 200 m in December 2016. Bald eagles use varied slightly by season with observations during these seasons: winter (one eagle), spring (two eagles), and summer (one eagle). No bald eagles were seen in the fall. No golden eagles were documented during this survey. The results of this year of surveys indicate a relatively low use of the Project by eagles.

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Appendix A. All Bird Types and Species Observed at the Lake Benton II Wind Energy Center During Fixed-Point Bird Use Surveys from September 2, 2016 – August 23, 2017

Appendix A1. Summary of individuals and group observations by bird type and species for 60-minute fixed-point large bird use surveys at the Lake Benton II Wind Energy Center[a] from September 2, 2016 – August 23, 2017.

		Fall		Winter		Spring		Summer		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Waterbirds		**0**	**0**	**0**	**0**	**5**	**14**	**1**	**1**	**6**	**15**
American white pelican	*Pelecanus erythrorhynchos*	0	0	0	0	2	11	0	0	2	11
great blue heron	*Ardea herodias*	0	0	0	0	2	2	1	1	3	3
great egret	*Ardea alba*	0	0	0	0	1	1	0	0	1	1
Waterfowl		**9**	**487**	**37**	**2,056**	**29**	**490**	**6**	**94**	**81**	**3,127**
Canada goose	*Branta canadensis*	3	104	20	1,140	7	19	5	93	35	1,356
greater white-fronted goose	*Anser albifrons*	4	298	6	286	2	400	0	0	12	984
mallard	*Anas platyrhynchos*	0	0	0	0	12	33	0	0	12	33
northern shoveler	*Anas clypeata*	0	0	0	0	1	3	0	0	1	3
Ross' goose	*Anser rossii*	0	0	2	14	0	0	0	0	2	14
snow goose	*Anser caerulescens*	0	0	7	566	1	8	0	0	8	574
unidentified duck	NA	0	0	0	0	6	27	0	0	6	27
unidentified goose	NA	0	0	2	50	0	0	0	0	2	50
unidentified waterfowl	NA	1	80	0	0	0	0	0	0	1	80
wood duck	*Aix sponsa*	1	5	0	0	0	0	1	1	2	6
Shorebirds		**21**	**60**	**2**	**2**	**74**	**117**	**19**	**23**	**116**	**202**
killdeer	*Charadrius vociferus*	6	7	0	0	64	89	14	17	84	113
lesser yellowlegs	*Tringa flavipes*	0	0	0	0	1	1	0	0	1	1
unidentified shorebird	*NA*	14	52	2	2	2	8	0	0	18	62
unidentified yellowlegs	*Tringa* spp.	0	0	0	0	1	1	0	0	1	1
upland sandpiper	*Bartramia longicauda*	0	0	0	0	0	0	3	4	3	4
Wilson's snipe	*Gallinago delicata*	1	1	0	0	6	18	2	2	9	21
Gulls/Terns		**4**	**65**	**0**	**0**	**1**	**1**	**0**	**0**	**5**	**66**
Franklin's gull	*Leucophaeus pipixcan*	2	42	0	0	0	0	0	0	2	42
ring-billed gull	*Larus delawarensis*	1	3	0	0	1	1	0	0	2	4
unidentified gull	NA	1	20	0	0	0	0	0	0	1	20
Rails/Coots		**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**
sora	*Porzana carolina*	0	0	0	0	1	1	0	0	1	1
Diurnal Raptors		**31**	**31**	**4**	**4**	**34**	**36**	**23**	**27**	**92**	**98**
Accipiters		*0*	*0*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*1*
sharp-shinned hawk	*Accipiter striatus*	0	0	0	0	1	1	0	0	1	1
Buteos		*17*	*17*	*0*	*0*	*17*	*18*	*14*	*16*	*48*	*51*
red-tailed hawk	*Buteo jamaicensis*	12	12	0	0	13	13	9	9	34	34
rough-legged hawk	*Buteo lagopus*	0	0	0	0	1	1	0	0	1	1
Swainson's hawk	*Buteo swainsoni*	5	5	0	0	2	3	5	7	12	15

Appendix A1. Summary of individuals and group observations by bird type and species for 60-minute fixed-point large bird use surveys at the Lake Benton II Wind Energy Center[a] from September 2, 2016 – August 23, 2017.

		Fall		Winter		Spring		Summer		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
unidentified buteo	*Buteo* spp.	0	0	0	0	1	1	0	0	1	1
Northern Harrier		*6*	*6*	*0*	*0*	*3*	*4*	*2*	*2*	*11*	*12*
northern harrier	*Circus cyaneus*	6	6	0	0	3	4	2	2	11	12
Eagles		*0*	*0*	*1*	*1*	*2*	*2*	*1*	*1*	*4*	*4*
bald eagle	*Haliaeetus leucocephalus*	0	0	1	1	2	2	1	1	4	4
Falcons		*2*	*2*	*2*	*2*	*6*	*6*	*5*	*7*	*15*	*17*
American kestrel	*Falco sparverius*	2	2	1	1	6	6	5	7	14	16
merlin	*Falco columbarius*	0	0	1	1	0	0	0	0	1	1
Other Raptors		*6*	*6*	*1*	*1*	*5*	*5*	*1*	*1*	*13*	*13*
unidentified raptor	NA	6	6	1	1	5	5	1	1	13	13
Vultures		**23**	**28**	**0**	**0**	**4**	**4**	**6**	**7**	**33**	**39**
turkey vulture	*Cathartes aura*	23	28	0	0	4	4	6	7	33	39
Upland Game Birds		**6**	**6**	**3**	**6**	**26**	**30**	**11**	**11**	**46**	**53**
ring-necked pheasant	*Phasianus colchicus*	6	6	3	6	26	30	11	11	46	53
Doves/Pigeons		**10**	**114**	**4**	**11**	**15**	**56**	**10**	**12**	**39**	**193**
Eurasian collared-dove	*Streptopelia decaocto*	1	1	0	0	0	0	0	0	1	1
mourning dove	*Zenaida macroura*	7	71	0	0	0	0	10	12	17	83
rock pigeon	*Columba livia*	2	42	4	11	15	56	0	0	21	109
Large Corvids		**10**	**72**	**17**	**28**	**26**	**46**	**12**	**16**	**65**	**162**
American crow	*Corvus brachyrhynchos*	10	72	17	28	26	46	12	16	65	162
Goatsuckers		**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**
common nighthawk	*Chordeiles minor*	0	0	0	0	0	0	1	1	1	1
Large Bird Overall		**114**	**863**	**67**	**2,107**	**215**	**795**	**89**	**192**	**485**	**3,957**

[a] Regardless of distance from observer

Obs = observations, grps = groups

Appendix A2. Summary of individuals and group observations by bird type and species for 10-minute fixed-point small bird use surveys at the Lake Benton II Wind Energy Center[a] from September 2, 2016 – August 23, 2017.

		Fall		Winter		Spring		Summer		Total	
Type/Species	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Woodpeckers		**3**	**3**	**0**	**0**	**5**	**5**	**4**	**4**	**12**	**12**
downy woodpecker	*Picoides pubescens*	3	3	0	0	0	0	0	0	3	3
northern flicker	*Colaptes auratus*	0	0	0	0	5	5	2	2	7	7
red-headed woodpecker	*Melanerpes erythrocephalus*	0	0	0	0	0	0	2	2	2	2
Passerines		**88**	**2,355**	**12**	**264**	**219**	**1,089**	**247**	**507**	**566**	**4,215**
Corvids		*6*	*8*	*2*	*2*	*2*	*12*	*1*	*2*	*11*	*24*
blue jay	*Cyanocitta cristata*	6	8	2	2	2	12	1	2	11	24
Blackbirds/Orioles		*36*	*2,111*	*1*	*3*	*118*	*846*	*101*	*195*	*256*	*3,155*
Baltimore oriole	*Icterus galbula*	0	0	0	0	0	0	3	3	3	3
orchard oriole	*Icterus spurius*	0	0	0	0	0	0	2	2	2	2
bobolink	*Dolichonyx oryzivorus*	0	0	0	0	0	0	2	2	2	2
Brewer's blackbird	*Euphagus cyanocephalus*	0	0	0	0	0	0	1	1	1	1
brown-headed cowbird	*Molothrus ater*	0	0	0	0	7	9	14	58	21	67
common grackle	*Quiscalus quiscula*	2	10	0	0	26	101	30	53	58	164
European starling	*Sturnus vulgaris*	6	197	1	3	3	12	2	3	12	215
red-winged blackbird	*Agelaius phoeniceus*	4	35	0	0	23	180	28	45	55	260
western meadowlark	*Sturnella neglecta*	1	1	0	0	49	84	9	11	59	96
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	0	0	0	0	1	1	1	1	2	2
unidentified blackbird	NA	23	1,868	0	0	9	459	9	16	41	2,343
Finches/Crossbills		*18*	*73*	*0*	*0*	*4*	*4*	*21*	*35*	*43*	*112*
American goldfinch	*Spinus tristis*	18	73	0	0	4	4	21	35	43	112
Flycatchers		*0*	*0*	*0*	*0*	*1*	*1*	*17*	*23*	*18*	*24*
alder flycatcher	*Empidonax alnorum*	0	0	0	0	0	0	1	1	1	1
least flycatcher	*Empidonax minimus*	0	0	0	0	1	1	0	0	1	1
eastern kingbird	*Tyrannus tyrannus*	0	0	0	0	0	0	14	20	14	20
western kingbird	*Tyrannus verticalis*	0	0	0	0	0	0	2	2	2	2
Grassland/Sparrows		*16*	*118*	*9*	*259*	*48*	*126*	*58*	*74*	*131*	*577*
American tree sparrow	*Spizella arborea*	0	0	0	0	1	1	0	0	1	1
chipping sparrow	*Spizella passerina*	0	0	0	0	2	3	2	2	4	5
clay-colored sparrow	*Spizella pallida*	0	0	0	0	1	1	8	8	9	9
dickcissel	*Spiza americana*	0	0	0	0	0	0	16	19	16	19
eastern towhee	*Pipilo erythrophthalmus*	0	0	0	0	0	0	1	1	1	1
grasshopper sparrow	*Ammodramus savannarum*	0	0	0	0	2	2	2	2	4	4
horned lark	*Eremophila alpestris*	6	85	6	108	16	77	3	5	31	275
Savannah sparrow	*Passerculus sandwichensis*	0	0	0	0	3	4	0	0	3	4

Appendix A2. Summary of individuals and group observations by bird type and species for 10-minute fixed-point small bird use surveys at the Lake Benton II Wind Energy Center[a] from September 2, 2016 – August 23, 2017.

		Fall		Winter		Spring		Summer		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
snow bunting	*Plectrophenax nivalis*	0	0	3	151	0	0	0	0	3	151
song sparrow	*Melospiza melodia*	0	0	0	0	17	24	13	16	30	40
vesper sparrow	*Pooecetes gramineus*	0	0	0	0	0	0	6	6	6	6
house sparrow	*Passer domesticus*	2	8	0	0	2	8	1	8	5	24
unidentified sparrow	NA	8	25	0	0	4	6	6	7	18	38
Mimids		*0*	*0*	*0*	*0*	*2*	*3*	*2*	*2*	*4*	*5*
brown thrasher	*Toxostoma rufum*	0	0	0	0	2	3	2	2	4	5
Swallows		*10*	*42*	*0*	*0*	*11*	*22*	*19*	*138*	*40*	*202*
barn swallow	*Hirundo rustica*	10	42	0	0	8	19	11	17	29	78
cliff swallow	*Petrochelidon pyrrhonota*	0	0	0	0	0	0	4	113	4	113
tree swallow	*Tachycineta bicolor*	0	0	0	0	3	3	2	3	5	6
unidentified swallow	NA	0	0	0	0	0	0	2	5	2	5
Thrushes		*1*	*1*	*0*	*0*	*30*	*72*	*12*	*13*	*43*	*86*
American robin	*Turdus migratorius*	0	0	0	0	30	72	12	13	42	85
eastern bluebird	*Sialia sialis*	1	1	0	0	0	0	0	0	1	1
Titmice/Chickadees		*1*	*2*	*0*	*0*	*0*	*0*	*0*	*0*	*1*	*2*
black-capped chickadee	*Poecile atricapilla*	1	2	0	0	0	0	0	0	1	2
Warblers		*0*	*0*	*0*	*0*	*3*	*3*	*8*	*8*	*11*	*11*
chestnut-sided warbler	*Setophaga pensylvanica*	0	0	0	0	2	2	0	0	2	2
common yellowthroat	*Geothlypis trichas*	0	0	0	0	1	1	8	8	9	9
Wrens		*0*	*0*	*0*	*0*	*0*	*0*	*8*	*17*	*8*	*17*
house wren	*Troglodytes aedon*	0	0	0	0	0	0	2	3	2	3
marsh wren	*Cistothorus palustris*	0	0	0	0	0	0	2	5	2	5
sedge wren	*Cistothorus platensis*	0	0	0	0	0	0	4	9	4	9
Unidentified Birds		**2**	**26**	**3**	**3**	**4**	**16**	**4**	**4**	**13**	**49**
unidentified bird (small)	NA	2	26	3	3	4	16	4	4	13	49
Small Bird Overall		**93**	**2,384**	**15**	**267**	**228**	**1,110**	**255**	**515**	**591**	**4,276**

[a] Regardless of distance from observer

Grps = groups, obs = observations

Appendix B. Mean Use, Percent of Use, and Frequency of Occurrence for Large Birds Observed During Fixed-Point Bird Use Surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017

Appendix B. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

	Mean Use				% of Use				% Frequency			
Type/Species	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
Waterbirds	**0**	**0**	**0.29**	**0.02**	**0**	**0**	**1.8**	**0.5**	**0**	**0**	**8.3**	**2.1**
American white pelican	0	0	0.23	0	0	0	1.4	0	0	0	2.1	0
great blue heron	0	0	0.04	0.02	0	0	0.3	0.5	0	0	4.2	2.1
great egret	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
Waterfowl	**10.15**	**42.83**	**10.21**	**1.96**	**56.7**	**97.6**	**61.6**	**49.0**	**16.7**	**16.7**	**27.1**	**6.2**
Canada goose	2.17	23.75	0.40	1.94	12.1	54.1	2.4	48.4	6.2	16.7	12.5	4.2
greater white-fronted goose	6.21	5.96	8.33	0	34.7	13.6	50.3	0	6.2	4.2	4.2	0
mallard	0	0	0.69	0	0	0	4.2	0	0	0	10.4	0
northern shoveler	0	0	0.06	0	0	0	0.4	0	0	0	2.1	0
Ross' goose	0	0.29	0	0	0	0.7	0	0	0	4.2	0	0
snow goose	0	11.79	0.17	0	0	26.9	1.0	0	0	6.2	2.1	0
unidentified duck	0	0	0.56	0	0	0	3.4	0	0	0	8.3	0
unidentified goose	0	1.04	0	0	0	2.4	0	0	0	4.2	0	0
unidentified waterfowl	1.67	0	0	0	9.3	0	0	0	2.1	0	0	0
wood duck	0.10	0	0	0.02	0.6	0	0	0.5	2.1	0	0	2.1
Shorebirds	**1.25**	**0.04**	**2.44**	**0.48**	**7.0**	**<0.1**	**14.7**	**12.0**	**39.6**	**4.2**	**66.7**	**16.7**
killdeer	0.15	0	1.85	0.35	0.8	0	11.2	8.9	12.5	0	66.7	16.7
lesser yellowlegs	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
unidentified shorebird	1.08	0.04	0.17	0	6.1	<0.1	1.0	0	27.1	4.2	4.2	0
unidentified yellowlegs	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
upland sandpiper	0	0	0	0.08	0	0	0	2.1	0	0	0	2.1
Wilson's snipe	0.02	0	0.38	0.04	0.1	0	2.3	1.0	2.1	0	8.3	2.1
Gulls/Terns	**1.35**	**0**	**0.02**	**0**	**7.6**	**0**	**0.1**	**0**	**6.2**	**0**	**2.1**	**0**
Franklin's gull	0.88	0	0	0	4.9	0	0	0	4.2	0	0	0
ring-billed gull	0.06	0	0.02	0	0.3	0	0.1	0	2.1	0	2.1	0
unidentified gull	0.42	0	0	0	2.3	0	0	0	2.1	0	0	0
Rails/Coots	**0**	**0**	**0.02**	**0**	**0**	**0**	**0.1**	**0**	**0**	**0**	**2.1**	**0**
sora	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
Diurnal Raptors	**0.65**	**0.08**	**0.75**	**0.56**	**3.6**	**0.2**	**4.5**	**14.1**	**39.6**	**8.3**	**41.7**	**35.4**
Accipiters	*0*	*0*	*0.02*	*0*	*0*	*0*	*0.1*	*0*	*0*	*0*	*2.1*	*0*
sharp-shinned hawk	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
Buteos	*0.35*	*0*	*0.38*	*0.33*	*2.0*	*0*	*2.3*	*8.3*	*27.1*	*0*	*22.9*	*22.9*
red-tailed hawk	0.25	0	0.27	0.19	1.4	0	1.6	4.7	22.9	0	18.8	16.7
rough-legged hawk	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
Swainson's hawk	0.10	0	0.06	0.15	0.6	0	0.4	3.6	4.2	0	4.2	8.3

Appendix B. Mean large bird use (number of large birds/800-meter plot/60-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

	Mean Use				% of Use				% Frequency			
Type/Species	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**	**Fall**	**Winter**	**Spring**	**Summer**
unidentified buteo	0	0	0.02	0	0	0	0.1	0	0	0	2.1	0
Northern Harrier	*0.12*	*0*	*0.08*	*0.04*	*0.7*	*0*	*0.5*	*1.0*	*12.5*	*0*	*6.2*	*4.2*
northern harrier	0.12	0	0.08	0.04	0.7	0	0.5	1.0	12.5	0	6.2	4.2
Eagles	*0*	*0.02*	*0.04*	*0.02*	*0*	*<0.1*	*0.3*	*0.5*	*0*	*2.1*	*2.1*	*2.1*
bald eagle	0	0.02	0.04	0.02	0	<0.1	0.3	0.5	0	2.1	2.1	2.1
Falcons	*0.04*	*0.04*	*0.12*	*0.15*	*0.2*	*<0.1*	*0.8*	*3.6*	*2.1*	*4.2*	*10.4*	*6.2*
American kestrel	0.04	0.02	0.12	0.15	0.2	<0.1	0.8	3.6	2.1	2.1	10.4	6.2
merlin	0	0.02	0	0	0	<0.1	0	0	0	2.1	0	0
Other Raptors	*0.12*	*0.02*	*0.10*	*0.02*	*0.7*	*<0.1*	*0.6*	*0.5*	*8.3*	*2.1*	*8.3*	*2.1*
unidentified raptor	0.12	0.02	0.10	0.02	0.7	<0.1	0.6	0.5	8.3	2.1	8.3	2.1
Vultures	**0.50**	**0**	**0.08**	**0.15**	**2.8**	**0**	**0.5**	**3.6**	**16.7**	**0**	**4.2**	**10.4**
turkey vulture	0.50	0	0.08	0.15	2.8	0	0.5	3.6	16.7	0	4.2	10.4
Upland Game Birds	**0.12**	**0.12**	**0.62**	**0.23**	**0.7**	**0.3**	**3.8**	**5.7**	**12.5**	**6.2**	**33.3**	**18.8**
ring-necked pheasant	0.12	0.12	0.62	0.23	0.7	0.3	3.8	5.7	12.5	6.2	33.3	18.8
Doves/Pigeons	**2.38**	**0.23**	**1.17**	**0.25**	**13.3**	**0.5**	**7.0**	**6.2**	**10.4**	**6.2**	**18.8**	**12.5**
Eurasian collared-dove	0.02	0	0	0	0.1	0	0	0	2.1	0	0	0
mourning dove	1.48	0	0	0.25	8.3	0	0	6.2	8.3	0	0	12.5
rock pigeon	0.88	0.23	1.17	0	4.9	0.5	7.0	0	4.2	6.2	18.8	0
Large Corvids	**1.50**	**0.58**	**0.96**	**0.33**	**8.4**	**1.3**	**5.8**	**8.3**	**12.5**	**25.0**	**31.2**	**12.5**
American crow	1.50	0.58	0.96	0.33	8.4	1.3	5.8	8.3	12.5	25.0	31.2	12.5
Goatsuckers	**0**	**0**	**0**	**0.02**	**0**	**0**	**0**	**0.5**	**0**	**0**	**0**	**2.1**
common nighthawk	0	0	0	0.02	0	0	0	0.5	0	0	0	2.1
Large Bird Overall	**17.90**	**43.9**	**16.56**	**4.00**	**100**	**100**	**100**	**100**				

APPENDIX Ia – Lake Benton II Raptor Nest Report

2017 Raptor Nest Survey – REPORT

Lake Benton II Wind Energy Center

Pipestone County, Minnesota



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REPORT REFERENCE

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INTRODUCTION

Lake Benton Power Partners II, LLC (Lake Benton II), an indirect wholly owned subsidiary of NextEra Energy Resources, LLC, is planning for the decommissioning of the existing Lake Benton II Wind Energy Center to facilitate the construction of a new 100 megawatt (MW) wind energy generation facility (Project) on the site. The existing wind energy center has been in operation since 1999 and is located in Pipestone County in southwestern Minnesota. The new facility would consist of up to 44 wind turbines and associated facilities with the Project boundary spanning 25,597 acres. To support development of the new project plan, Lake Benton Wind Power Partners II, LLC an indirect wholly owned subsidiary of NextEra Energy Resources, LLC, contracted Western EcoSystems Technology, Inc. (WEST) to conduct an aerial raptor nest survey to record bald eagle (*Haliaeetus leucocephalus*) and other raptor nests in and near the Project area. This survey will aid in assessing potential effects of the Project on eagles and other raptors. The aerial survey was conducted in accordance with the guidance provided in the US Fish and Wildlife Service (USFWS) *Eagle Conservation Plan Guidance* (ECPG; US Fish and Wildlife Service (USFWS) 2013) and the USFWS *Interim Golden Eagle Technical Guidance* (Pagel et al. 2010).

SURVEY AREA

The survey area for all raptor stick-nests consisted of a 1-mile (mi; 1.6-kilometer [km]) buffer of potential turbine siting areas within the Project boundary, and the survey area for bald eagle nests consisted of a 10-mi (16.1-km) buffer of potential turbine siting areas (Figure 1). This area falls within the Northern Glaciated Plains (46) Level III Ecoregion and the Big Sioux Basin Level IV Ecoregion (46m) (USEPA 2013). The Big Sioux Basin is comprised of loess till plateaus converted to row crops, and pasture lands. Unlike the surrounding level IV Ecoregions within the Northern Glaciated Plains, the Big Sioux Basin supports no lakes. in contrast to surrounding Level IV Ecoregions with abundant lakes and riparian areas. The closest waterbody, Lake Benton, is greater than 5 miles to the north-northwest of the Lake Benton Wind Energy project area, within the Prairie Coteau (46k) Level IV Ecoregion.

METHODS

Aerial Raptor Nest Survey

Aerial surveys were conducted from a helicopter on March 29-30, April 2, and April 4, 2017, a period before leaf out when raptors would be actively tending to a nest or incubating eggs. Aerial surveys were conducted in accordance with the guidance provided in the ECPG (USFWS 2013) and the USFWS *Interim Golden Eagle Technical Guidance* (Pagel et al. 2010). An experienced raptor ecologist and a skilled helicopter pilot conducted the surveys. Raptors were defined for this survey as kites, accipiters, buteos, harriers, eagles, falcons, and owls (Buehler 2000). However, the main focus of the survey was to identify bald eagle nests. Surveyors focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate

(trees, transmission lines, cliff faces, etc.) within and around the proposed Project. Pre-flight planning included the creation of field maps and mobile Geographic Information System (GIS) files and review of relevant background information, such as previously recorded nest locations, topographic maps, and aerial photographs.

Surveys within the Project boundary and 1-mi (1.6-km) buffer documented all potential raptor nests, including bald eagles, while the surveys out to the 10-mi (16.1-km) buffer focused only on identifying potential bald eagle nests. Efforts were made to minimize disturbance to breeding raptors; the greatest possible distance at which the species could be identified was maintained, with distances varying, depending upon nest location and wind conditions.

In general, all potential raptor nest habitat was surveyed by flying meandering transects between 0.25 – 1.0 mi (0.8 – 1.6 km) apart, flying at speeds of approximately 46 miles per hour (mph; 74 km per hour) when actively scanning for nests. Surveys were typically conducted between 07:00 hours and 18:00 hours.

The survey track was recorded using a handheld Global Positioning System (GPS) unit to ensure that all areas were adequately covered. The helicopter was positioned to allow thorough visual inspection of the habitat, and in particular, to provide a view of the tops of the tallest dominant trees where bald eagles generally prefer to nest (Buehler 2000). The locations of all potential raptor nests were recorded using a handheld GPS. This included all confirmed and potential nests regardless of their activity status.

To determine the status of a nest the biologist evaluated behavior of adults on or near the nest, and presence of eggs, young, whitewash, or fresh building materials (Pagel et al. 2010). Attempts were made to identify the species of raptor associated with each active nest. Raptor species, nest type, nest status, nest condition, and nest substrate were recorded at each nest location to the extent possible.

Terminology

Included below are descriptions of terms used during the documentation of nests (see Results section).

Nest ID – WEST assigned a unique nest identification number for each nest documented.

Species – A species was assigned to each nest when possible; otherwise, it was classified as an unknown raptor nest. Nests documented as unknown raptor species are defined as any stick nest that did not have an occupant associated with it at the time of the survey. Many times nests will become abandoned or no longer used, and over time, may become a historic nest site. Unknown raptor nests, including old nests or nests that could become suitable for raptors, were documented in order to populate a nest database to ensure that future surveys include all potentially suitable nest sites.

Nest Condition – Nest condition was categorized as either good or in disrepair. Although the determination of nest condition can be subjective and may vary between observers, it gives a general sense of when a nest or nest site may have last been used. Nests in disrepair were sloughing or sagging heavily, and they would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good condition were those that appear to have been well-maintained, have a well-defined bowl shape, were not sagging or sloughing, and appeared to be suitable for nesting.

Substrate – The substrate in which a nest was observed was recorded to provide observers a visual reference. Substrates ranged from man-made structures (such as power lines, nest platforms, and dock hoists) to biological and physical structures (conifer and deciduous tree species or cliff faces).

Nest Status – WEST categorized basic nest use as consistent with definitions from the ECPG. Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position; (2) eggs; (3) nestlings or fledglings; (4) occurrence of a pair of adults (or, sometimes sub-adults); (5) a newly-constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season; or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active (if there was an adult on the nest in incubating position, an egg or eggs had been laid or nestlings were observed), or inactive (if no eggs or chicks were present). A nest that does not meet the above criteria for “occupied” was classified as “unoccupied.”

RESULTS

A total of 24 raptor nests representing three raptor species were detected during the aerial survey conducted March 29-30, April 2, and April 4, 2017 (Table 1). Two occupied and active bald eagle nests were documented. Additional raptor nests documented during the survey included two occupied and active great horned owl (*Bubo virginianus*) nests, five occupied and active red-tailed hawk (*Buteo jamaicensis*) nests, one occupied ad active nest of Canadian goose (*Branta canadensis*) two occupied and active nests of unknown species, one occupied and inactive nest of unknown species and 11 unoccupied and inactive nests of unknown species.

Two of the documented stick nests were consistent in size, structure and placement with a bald eagle nest, but occupied by a different species (nests 1013 and 1330 on Table 1); both of these nests are more than 8.5 miles outside of the Project boundary. Nest 1013 was in good condition in the 2017 surveys, and was generally consistent in size, structure and placement in the tree with bald eagle nests. However, great-horned owls were documented on the nest in 2017, so the nest is documented as an occupied and active great-horned owl nest.

Canada goose was present on the nest and in incubating position during the April surveys. Nest 1330 was in disrepair in the 2017 surveys, and was generally consistent in size, structure and

placement in the tree with bald eagle nests. An adult Canada goose was present on the nest and in incubating position during the April surveys. The nest was likely built in previous years by an unknown raptor species and used by Canada geese in the 2017 breeding season. The nest is therefore considered occupied and active by Canada geese in 2017, but is not occupied by a raptor species in the 2017 breeding season

The following section provides additional details on each eagle nest documented during the aerial survey:

Nest 1329 – this nest was located approximately 7.7 mi (12.4 km) north of the Project boundary and 8.2 mi (13.2 km) north of the 1-km buffer of the turbine siting area. The nest was in good condition. An adult eagle was present on the nest and in incubating position, and the nest had been recently repaired with fresh sticks or fresh boughs on top. The nest is therefore considered occupied and active in 2017 (Figure 1, Appendix A).

Nest 1334 – this nest was located approximately 7.6 mi (12.2 km) northeast of the Project boundary and 8.6 mi (13.8 km) northeast of the 1-km buffer of the turbine siting area. The nest was in good condition. An adult eagle was present on the nest and in incubating position, and the nest had been recently repaired with fresh sticks or fresh boughs on top. The nest is therefore considered occupied and active in 2017 (Figure 1, Appendix A).

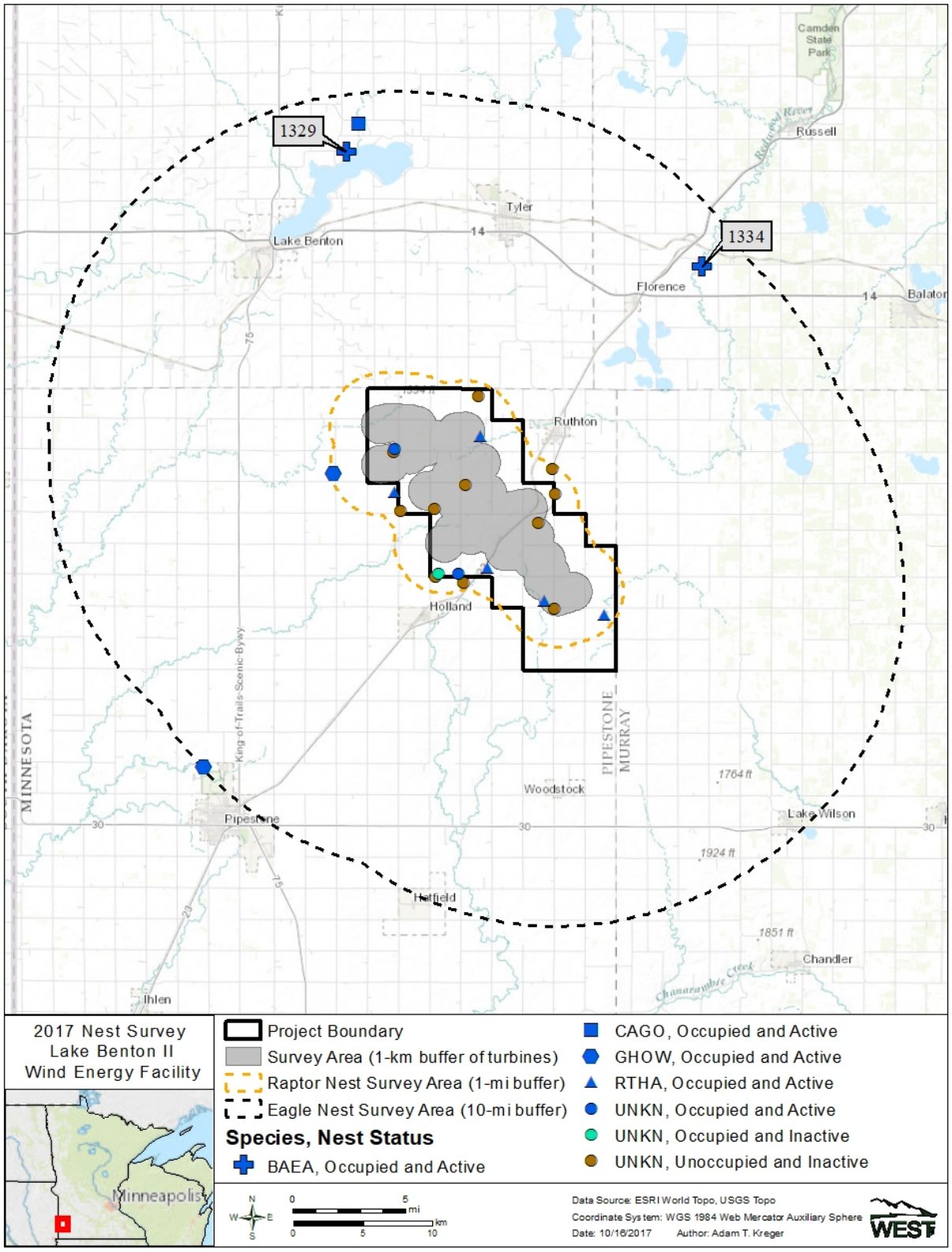


Figure 1. Locations of raptor nests observed near the Lake Benton II Wind Energy Center, Pipestone County, Minnesota.

BAEA = bald eagle, RTHA = red-tailed hawk, GHOW = great-horned owl, UNKN = unknown species

Table 1. Raptor nest ID, location, species, status, substrate, and condition of nests during the March 29-30, April 2, and April 4, 2017 survey for the Lake Benton II Wind Energy Center, Pipestone County, Minnesota.

Nest ID	Latitude	Longitude	Species[1, 2]	Status at time of survey	Nest Substrate	Condition
1329	44.3068	-96.2386	BAEA	Occupied and Active	Tree	Good
1334	44.2536	-96.0088	BAEA	Occupied and Active	Tree	Good
1013	44.0217	-96.3305	GHOW*	Occupied and Active	Tree	Good
1042	44.1578	-96.2471	GHOW	Occupied and Active	Tree	Good
0973	44.0923	-96.0718	RTHA	Occupied and Active	Tree	Good
0983	44.0986	-96.1105	RTHA	Occupied and Active	Tree	Good
0990	44.1141	-96.1475	RTHA	Occupied and Active	Tree	Good
1284	44.1750	-96.1519	RTHA	Occupied and Active	Tree	Good
1291	44.1492	-96.2075	RTHA	Occupied and Active	Tree	Good
0998	44.1110	-96.166	UNKN	Occupied and Active	Tree	Good
1330	44.3197	-96.2305	CAGO*	Occupied and Active	Tree	Disrepair
1290	44.1691	-96.2075	UNKN	Occupied and Active	Tree	Good
1000	44.1112	-96.179	UNKN	Occupied and Inactive	Tree	Good
1281	44.1481	-96.1035	UNKN	Unoccupied and Inactive	Tree	Good
1282	44.1347	-96.1147	UNKN	Unoccupied and Inactive	Tree	Good
0982	44.0950	-96.1045	UNKN	Unoccupied and Inactive	Tree	Good
0997	44.1071	-96.1631	UNKN	Unoccupied and Inactive	Tree	Good
0999	44.1096	-96.1807	UNKN	Unoccupied and Inactive	Tree	Disrepair
1280	44.1597	-96.1054	UNKN	Unoccupied and Inactive	Tree	Disrepair
1285	44.1525	-96.1617	UNKN	Unoccupied and Inactive	Tree	Good
1286	44.1936	-96.1532	UNKN	Unoccupied and Inactive	Tree	Good
1288	44.1413	-96.1818	UNKN	Unoccupied and Inactive	Tree	Good
1289	44.1674	-96.2083	UNKN	Unoccupied and Inactive	Tree	Disrepair
1292	44.1403	-96.2034	UNKN	Unoccupied and Inactive	Tree	Disrepair

1. BAEA = bald eagle, RTHA = red-tailed hawk, GHOW = great-horned owl, CAGO = Canada goose, UNKN = unknown species.
2. Nests that were consistent in size and structure with bald eagle nests were labeled as the species currently occupying the nest and marked with an asterisk (i.e., GHOW* or CAGO*).

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Appendix A. Images of Active and Occupied Eagle Nests Found March 29-30, April 2, and April 4, 2017, within the 10-mile Buffer of the Lake Benton II Wind Energy Center, Pipestone County, Minnesota



Appendix A1. Nest 1329 was located approximately 8.2 miles (13.2 kilometers) north of the Lake Benton Wind II Energy Center turbine siting area. The nest was in good condition. An adult eagle was present on the nest and in incubating position, and the nest had been recently repaired with fresh sticks or fresh boughs on top.



Appendix A2. Nest 1334 was located approximately 8.6 miles (13.8 kilometers) northeast of the Lake Benton II Wind Energy Center turbine siting area. The nest was in good condition. An adult eagle was present on the nest and in incubating position, and the nest had been recently repaired with fresh sticks or fresh boughs on top.

APPENDIX Ib – BBS Route Species List and USFWS BCC List

BBS Route Species List and USFWS Birds of Conservation Concern for Lake Benton II Wind

Species list of BBS routes in close proximity to the Project: Chandler (50005), Ash Creek (50006), & Tyler (50062)

Canada Goose	Turkey Vulture	Eastern Bluebird
Wood Duck	Bald Eagle	American Robin
Gadwall	Northern Harrier	Gray Catbird
Mallard	Cooper's Hawk	Brown Thrasher
Blue-winged Teal	Swainson's Hawk	European Starling
Northern Shoveler	Red-tailed Hawk	Cedar Waxwing
Northern Pintail	Great Horned Owl	House Sparrow
Redhead	Short-eared Owl	House Finch
Hooded Merganser	Belted Kingfisher	Purple Finch
Northern Bobwhite	Red-headed Woodpecker	American Goldfinch
Gray Partridge	Red-bellied Woodpecker	Ovenbird
Ring-necked Pheasant	Yellow-bellied Sapsucker	Common Yellowthroat
Wild Turkey	Downy Woodpecker	American Redstart
Pied-billed Grebe	Hairy Woodpecker	Yellow Warbler
Rock Pigeon	Northern Flicker	Eastern Towhee
Eurasian Collared-Dove	American Kestrel	Chipping Sparrow
Mourning Dove	Eastern Wood-Pewee	Clay-colored Sparrow
Yellow-billed Cuckoo	Willow Flycatcher	Field Sparrow
Black-billed Cuckoo	Least Flycatcher	Vesper Sparrow
Common Nighthawk	Eastern Phoebe	Lark Sparrow
Chimney Swift	Great Crested Flycatcher	Lark Bunting
Sora	Western Kingbird	Savannah Sparrow
American Coot	Eastern Kingbird	Grasshopper Sparrow
Killdeer	Loggerhead Shrike	Henslow's Sparrow
Upland Sandpiper	Yellow-throated Vireo	Song Sparrow
Wilson's Snipe	Warbling Vireo	Swamp Sparrow
American Woodcock	Red-eyed Vireo	Northern Cardinal
Spotted Sandpiper	Blue Jay	Rose-breasted Grosbeak
Wilson's Phalarope	American Crow	Blue Grosbeak
Franklin's Gull	Horned Lark	Indigo Bunting
Herring Gull	Purple Martin	Dickcissel
Black Tern	Tree Swallow	Bobolink
Forster's Tern	N. Rough-winged Swallow	Red-winged Blackbird
Double-crested Cormorant	Bank Swallow	Eastern Meadowlark
American White Pelican	Cliff Swallow	Western Meadowlark
American Bittern	Barn Swallow	Yellow-headed Blackbird
Least Bittern	Black-capped Chickadee	Brewer's Blackbird
Great Blue Heron	White-breasted Nuthatch	Common Grackle
Great Egret	House Wren	Brown-headed Cowbird
Green Heron	Sedge Wren	Orchard Oriole
Black-crowned Night-Heron	Marsh Wren	Baltimore Oriole

USFWS Birds of Conservation Concern (2008) as indicated in Project specific IPAC

American Bittern
Bald Eagle
Black Tern
Black-billed Cuckoo
Dickcissel
Hudsonian Godwit
Least Bittern
Loggerhead Shrike
Marbled Godwit
Peregrine Falcon
Pied-billed Grebe
Red-headed Woodpecker
Short-eared Owl
Swainson's Hawk
Upland Sandpiper
Western Grebe
Willow Flycatcher

APPENDIX J – Lake Benton Wildlife Conservation Study

Wildlife Conservation Strategy

Lake Benton II Wind Energy Center

Pipestone County, Minnesota



Prepared by:

Lake Benton Power Partners II, LLC

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and

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February 2018

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1. INTRODUCTION

Lake Benton Power Partners II, LLC (Lake Benton II), an indirect wholly owned subsidiary of NextEra Energy Resources, LLC, is planning for the decommissioning of the existing Lake Benton II Wind Energy Center to facilitate the construction of a new 100 megawatt (MW) wind energy generation facility (Project) on the site (Figure 1). The existing wind energy center has been in operation since 1999 and is located in Pipestone County in southwestern Minnesota. The new facility would consist of up to 44 wind turbines and associated facilities with the Project spanning 25,597 acres. Lake Benton II contracted Western EcoSystems Technology (WEST) to prepare a Wildlife Conservation Strategy (WCS), which will serve as an Avian and Bat Protection Plan (ABPP), to describe Lake Benton II's approach to avoid and/or minimize potential impacts to birds, bats, and species of concern that may result from construction and operation of the Project, outline a post-construction monitoring program, and address adaptive management measures that will be implemented, if appropriate, during operation.

The WCS has been prepared in accordance with the US Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines* (WEG; USFWS 2012) and the Minnesota Department of Natural Resources (MNDNR) and Minnesota Department of Commerce (MNDOC) *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (Mixon et al. 2014).

Specifically, this WCS document was developed to:

- Provide a framework for fulfilling the application requirements for a Large Wind Energy Conversion System (LWECS) Site Permit anticipated to be issued by the Minnesota Public Utilities Commission (PUC), in accordance with the Chapter 216F, Minnesota Statutes;
- Follow recommendations in the USFWS WEG for completion of an ABPP and a post-construction fatality monitoring protocol;
- Consolidate documentation of steps already taken and planned to be taken to avoid and minimize potential effects on birds and bats during the Project planning and development; and
- Identify and implement steps to further reduce the potential for avian and bat fatality or other potential adverse effects on birds and bats at the Project, including the plan for implementation of adaptive management measures, if they are determined to be appropriate.

In addition to birds and bats, Lake Benton II has also closely evaluated and implemented measures to avoid impacts to other sensitive biological and natural resources in coordination with the appropriate agencies, including identifying and avoiding impacts to native prairies, calcareous fens, and federally and state-listed species. This WCS will be updated as appropriate once additional information is available from studies that are currently underway or will otherwise occur before construction begins.

Preparation of this WCS draws on a Site Characterization Study (SCS) completed for Lake Benton II (Atwell 2017) in addition to Project-specific avian reports submitted to Lake Benton II by WEST general relevant scientific literature, and published reports from nearby projects.

1.1 Project Description

The proposed project plan for repowering of the existing Lake Benton II Project requires the decommissioning of the existing 137 Zond 0.75 MW turbines from the original Lake Benton II development (also referred to in reports as Buffalo Ridge Phase III) to facilitate the installation of a new 100.2 megawatt (MW) LWECS facility across 25,597 acres of Pipestone County, MN (Figure 2). The repowered project will include up to 44 turbines (GE 2.3 MW wind turbines with 116m rotor diameters on 90m towers and GE 2.1 MW wind turbines with 116m rotor diameters on 80m towers). A total of 48 turbine positions, including four alternate positions, are being considered, but not more than 44 will be constructed. The existing Project switchyards and overhead transmission line will be reused. Construction of the new facility will occur beginning in 2019 to support completion and commercial operations by the end of 2019.

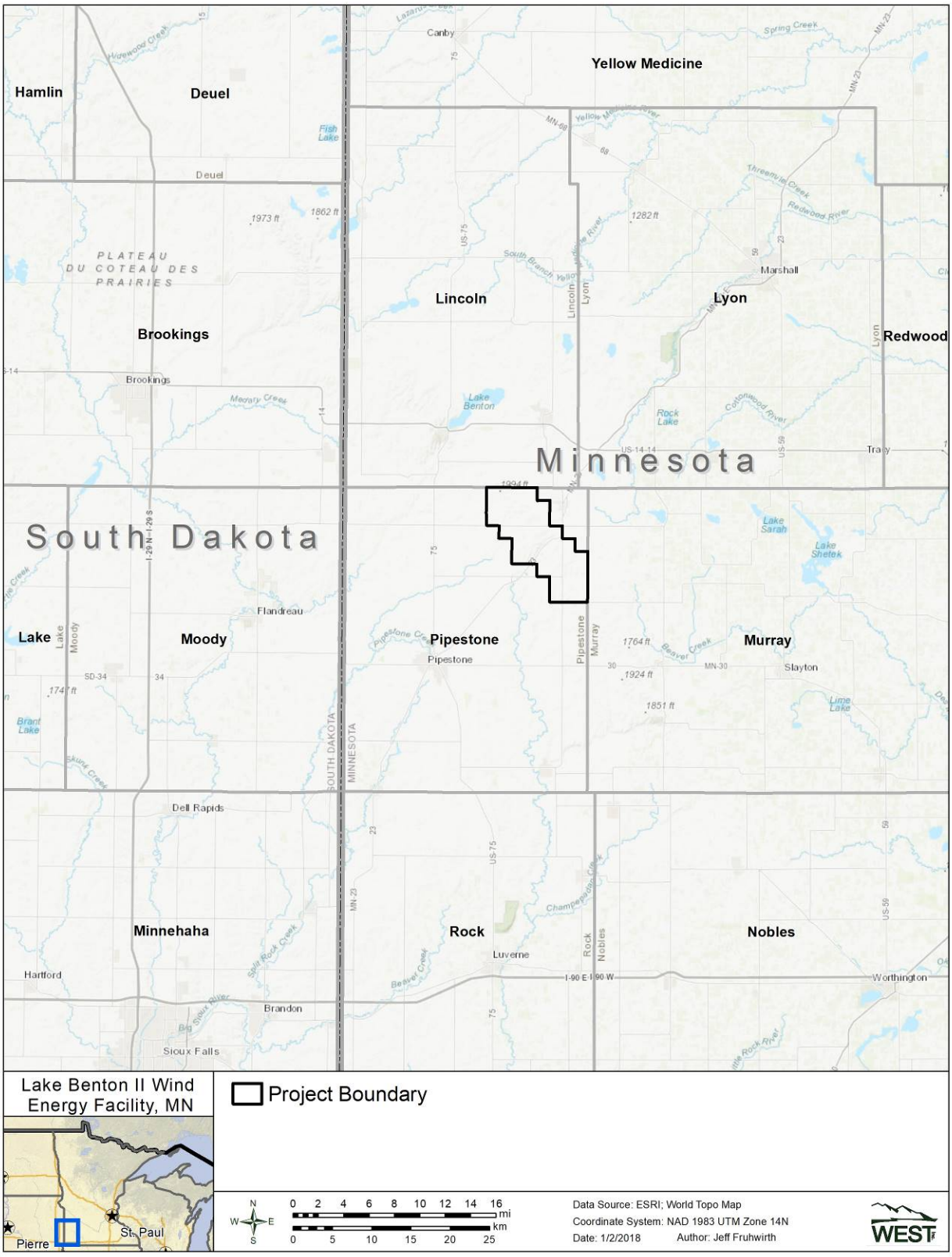


Figure 1. Location of the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

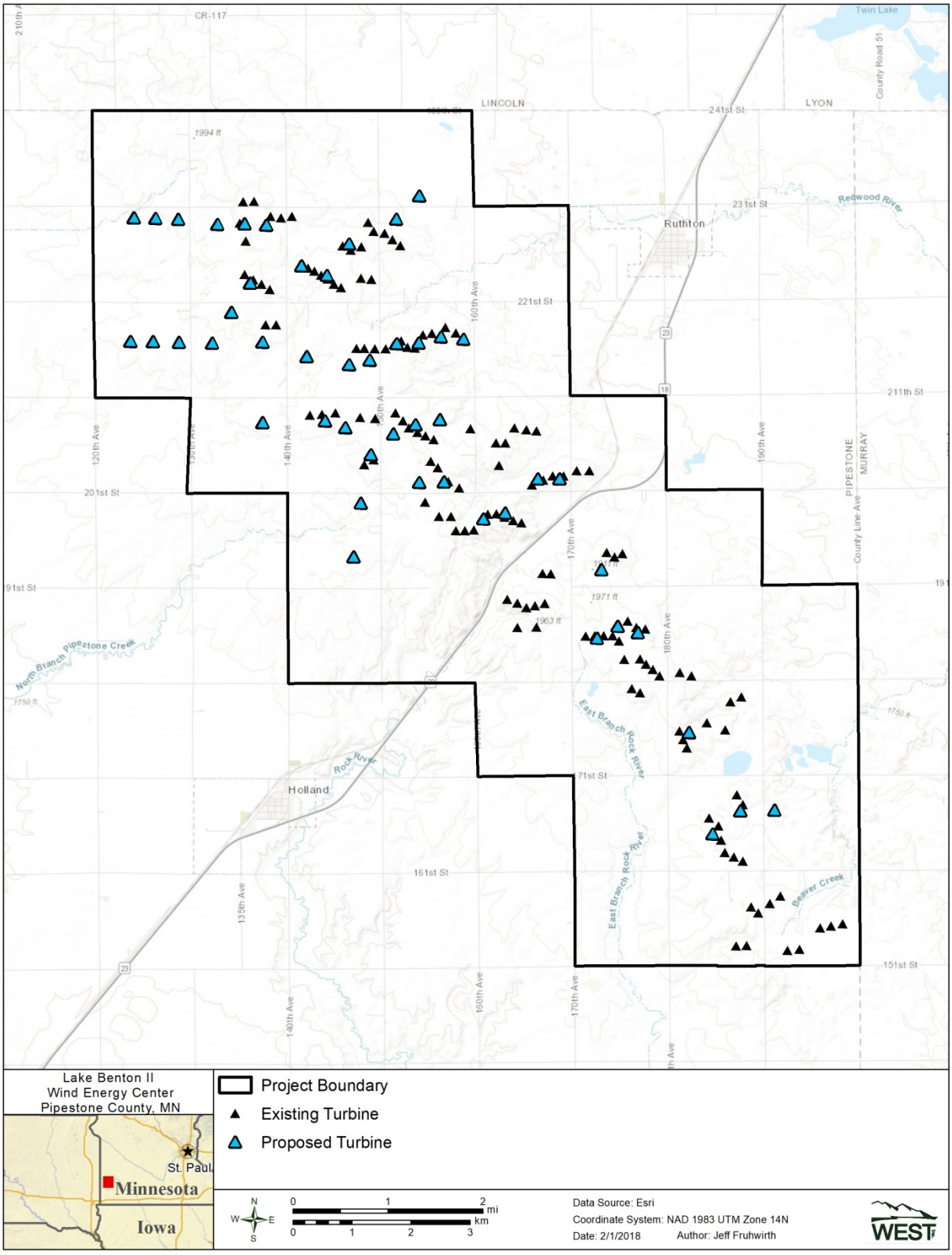


Figure 2. Current (1999) and Proposed (2017-11-16) Layout of the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

1.1.1 Land Cover, Use, and Topography

The Project (as shown as the area within the Project boundary on Figure 3) falls within the Northern Glaciated Plains (46) Level III Ecoregion and the Big Sioux Basin Level IV Ecoregion (46m) (USEPA 2013). The Big Sioux Basin is comprised of loess till plateaus converted to row crops, and pasture lands. Unlike the surrounding Level IV Ecoregions within the Northern Glaciated Plains, the Big Sioux Basin supports no lakes in contrast to surrounding Level IV Ecoregions with abundant lakes and riparian areas. The closest large waterbody, Lake Benton, is greater than 5 miles to the north-northwest of the Project, within the Prairie Coteau (46k) Level IV Ecoregion.

Land cover within the Project is primarily cropland (62.7%), followed by herbaceous lands or grasslands (28%). Developed land constitutes approximately 4.8 percent of the Project (Table 1, Figure 3). All other land cover types constitute less than five percent of the Project. The relatively few wooded areas within the Project are primarily limited to small woodlots and shelterbelts around farmsteads and along farm fields and drainage ways.

Table 1. Land cover types, coverage, and percent composition within the current Lake Benton II Wind Project, Pipestone County, Minnesota.

Land cover (habitat)	Acres (ac)	Hectares (ha)	% Composition
Cultivated Crops	16,057	6,498	62.73%
Herbaceous	7,167	2,900	28.00%
Developed, Open Space	1,154	467	4.51%
Hay/Pasture	719	291	2.81%
Emergent Herbaceous Wetlands	317	128	1.24%
Open Water	72	29	0.28%
Deciduous Forest	49	20	0.19%
Developed, Low Intensity	46	19	0.18%
Developed, Medium Intensity	8	3	0.03%
Barren Land	3	1	0.01%
Shrub/Scrub	3	1	0.01%
Developed, High Intensity	0.2	0.1	0.00%
Total	**25,597**	**10,359**	**100**

Data from the National Landcover Database (USGS NLCD 2011).

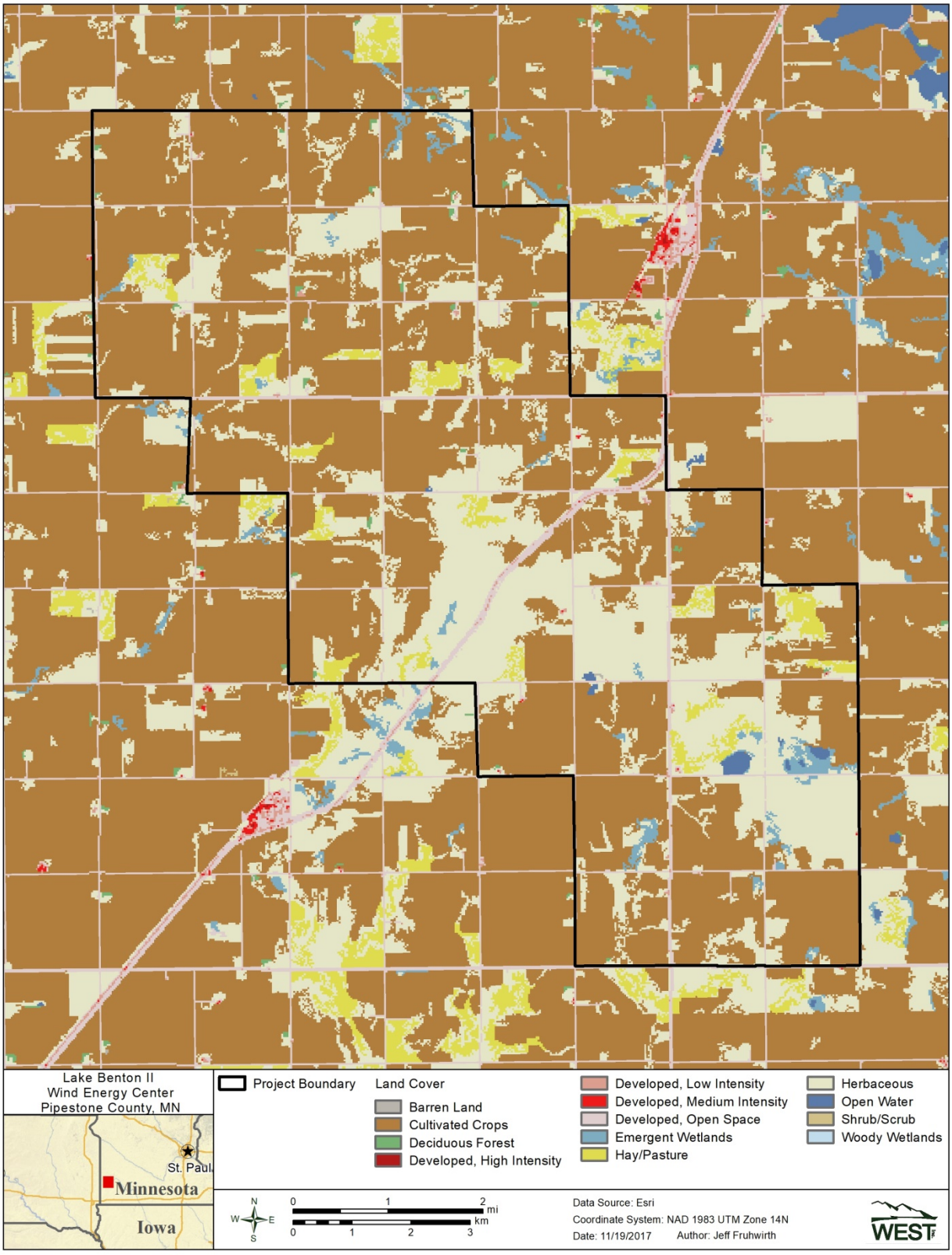


Figure 3. Land cover types in and near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

1.1.2 Wetlands and Waterbodies

According to the National Wetlands Inventory (NWI), there are 2,035 acres (823 HA) of wetlands within the Project. The majority of this area is classified as freshwater emergent wetland, most of which is located in the southwestern portion of the Project (6.8 percent; Table 2, Figure 4). Because of the nature of satellite wetland interpretation (NLCD, Table 1), it is expected that the NWI estimates of wetland coverage within the Project are more reliable, particularly for ephemeral wetlands.

Table 2. Wetland types present within the Lake Benton II Wind Energy Center in Pipestone County, Minnesota

	Wetland Area		Composition (%)	
Wetland Type	**Acres (ac)**	**Hectares (ha)**	**Wetland**	**Project**
Freshwater Emergent Wetland	1747.9	707.3	85.9	6.8
Riverine	171.8	69.5	3.7	0.7
Freshwater Pond	74.7	30.2	2.0	0.3
Freshwater Forested/Shrub Wetland	40.8	16.5	85.9	0.2
Total	**2035.2**	**823.6**	**100**	**7.9**

Data Source: USFWS NWI 2014

1.1.3 Federal, State, and Private Conservation Lands

No federally owned lands are present within the Project. Four state-owned wildlife management areas (WMAs) are located within the Project (Figure 5 *see* Atwell 2017). Minnesota DNR holdings within the Project include three WMAs (Buffalo Ridge, Gromer's Draw, and Woodstock), and one Scientific and Natural Area (SNA; Prairie Coteau). Several small, private conservation easements and Walk-In-Areas (WIA) are located in the northcentral and southeastern portion of the Project (Pipestone 225, Pipestone 226, Pipestone 358, Pipestone 399). Since these state-owned lands have existed within the currently operating Project for approximately 20 years, no new impacts to privately or publicly held and state-owned lands are expected. Nonparticipating landowners, including publicly held lands, are buffered from the Project by the standard 3 X 5 rotor diameter (RD) setbacks required under MN LWECS statutes.

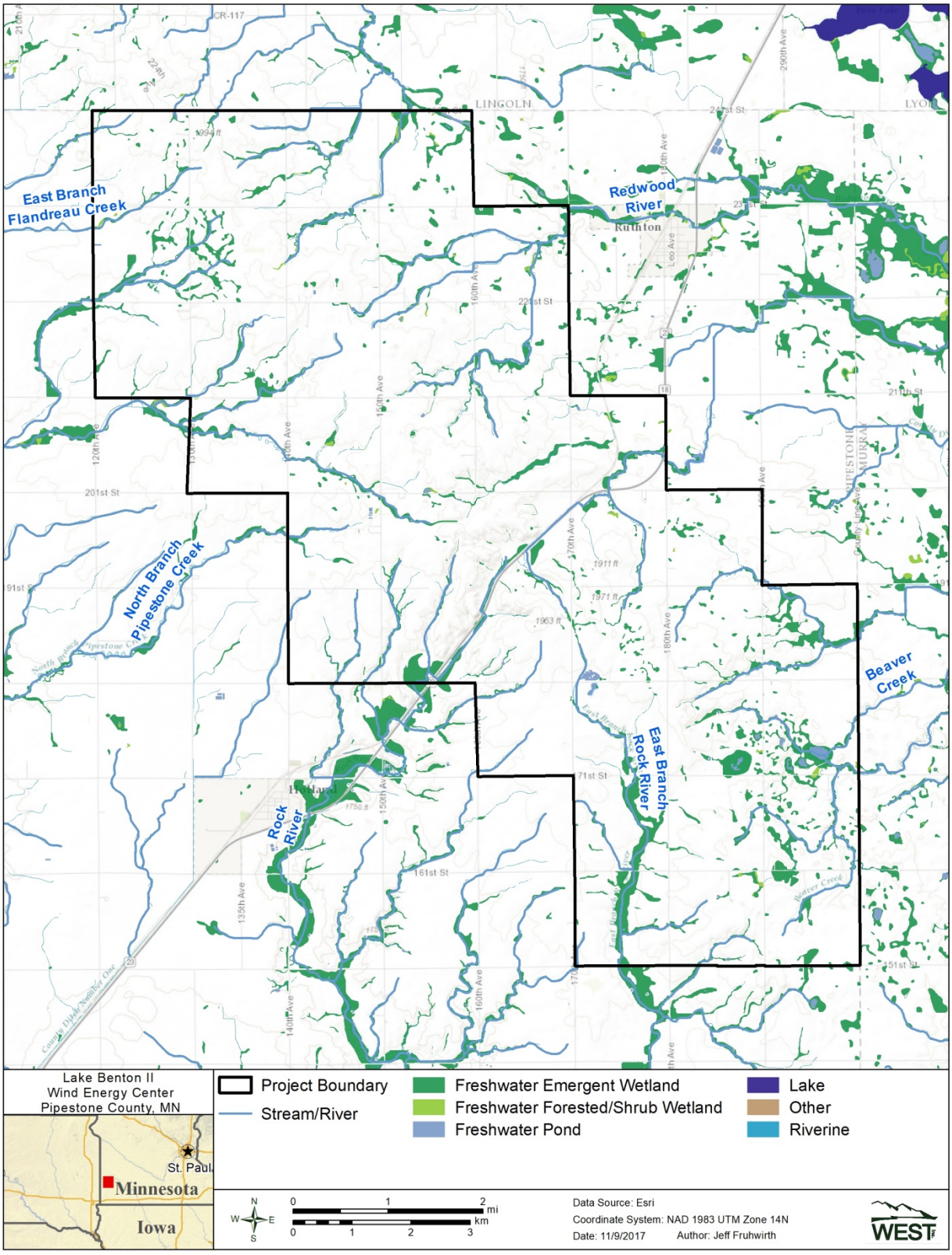


Figure 4. National Wetland Inventory wetland types located in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

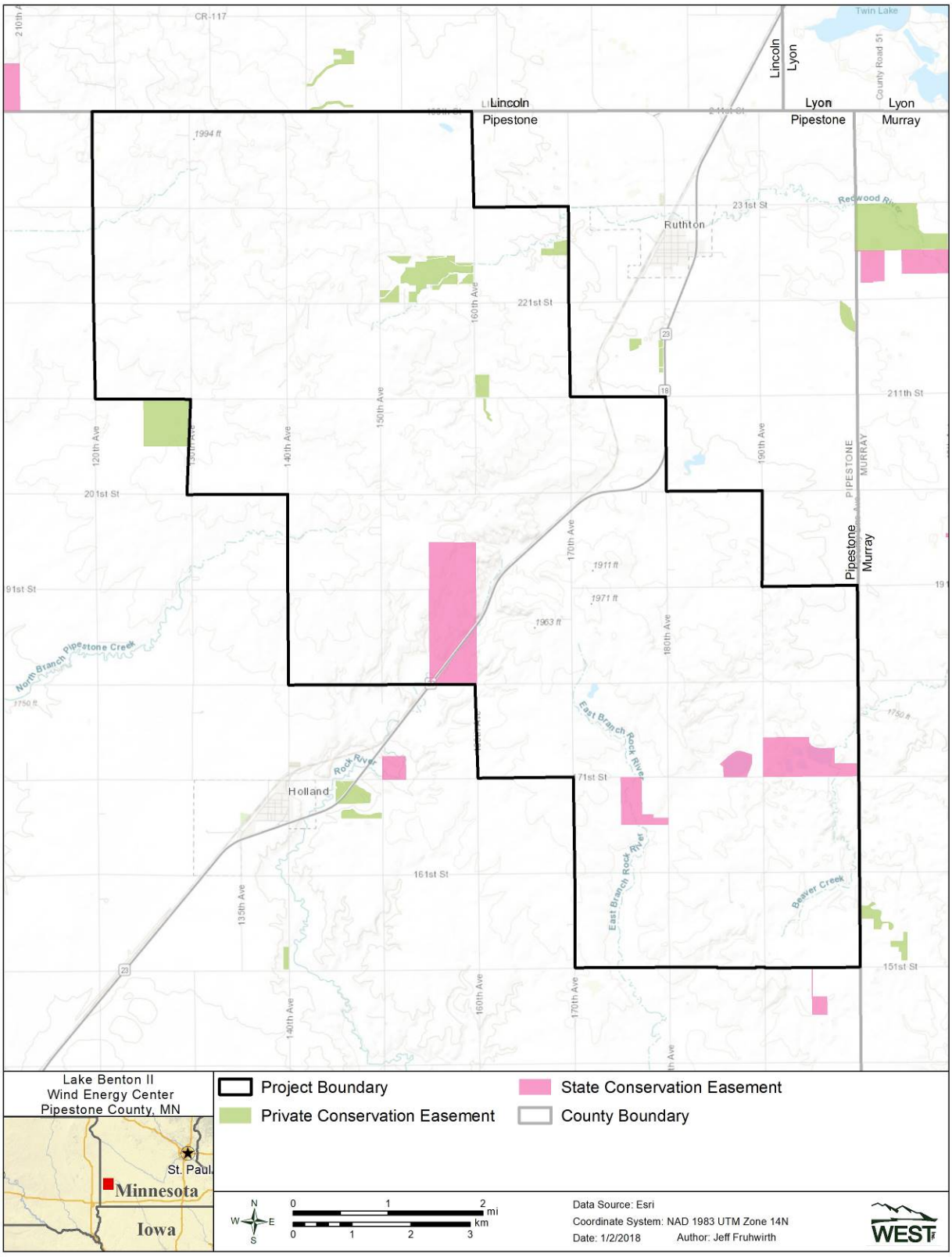


Figure 5. State and privately-owned conservation lands located in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

1.1.4 Federal Endangered Species Act

Certain species at risk of extinction, including many birds and bats, are protected under the federal Endangered Species Act of 1973 (ESA; 16 U.S.C. §§ 1531 *et seq.*, as amended). The ESA defines and lists species as "endangered" or "threatened" and provides regulatory protection for the listed species. The federal ESA provides a program for conservation and recovery of threatened and endangered species and ensures the conservation of designated critical habitat that the USFWS has determined is required for the survival and recovery of listed species. Section 9 of the federal ESA prohibits the "take" of species listed by USFWS as threatened or endangered. Take is defined as follows: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct." Section 10(a) of the federal ESA includes provisions for the authorization of take that is incidental to, but not the purpose of, otherwise lawful activities. Under Section 10(a)(1)(B), an Incidental Take Permit may be issued if take is incidental and does not jeopardize the survival and recovery of the species.

Lake Benton II commits to undertake actions to avoid impacts to the five federal ESA-listed species that have the potential to be impacted by the Project through this WRS, including those determined to be endangered (Poweshiek skipperling [*Oarisma poweshiek*]; Topeka shiner [*Notropis topeka*]), or threatened (northern long-eared bat [*Myotis septentrionalis*]; Western prairie fringed orchid [*Platanthera praeclara*]; Dakota skipper [*Hesperia dacotae]*). Project impacts to these species are considered unlikely, and conservation measures for northern long-eared bats, which are described in this WCS, will further reduce this likelihood. This WCS also provides measures for protection of unlisted avian and bat species. Further, this WCS contains adaptive management provisions that include additional minimization and avoidance measures if best available data indicate that risk to ESA-listed or unlisted bird or bat species is higher than currently anticipated.

1.2 Avian and Bat Regulations and Wind Energy Guidelines

1.2.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA; 6 U.S.C. §§ 703-711) prohibits the taking of migratory birds, their eggs, parts, and nests, except when specifically permitted by regulations. The word "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" 50 Code of Federal Regulations (CFR) § 10.12. The USFWS maintains a list of all species protected by the MBTA at 50 CFR § 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

While Lake Benton II does not expect to intentionally take any migratory birds in the Project, Lake Benton II commits to undertake actions to avoid and minimize unintentional impacts to the MBTA-listed species through this WCS. Lake Benton II has developed this WCS to be consistent with the guidance provided in the WEG (USFWS 2012). These guidelines contain materials to assist developers in siting potential wind energy facilities, assessing wind turbine

design and location, and evaluating results from pre- and post- construction studies. This information is then used to identify and/or assess potential impacts to avian species.

Lake Benton II applied the principles of these guidance documents in its planning of the re-powering of the Project, which influenced its decisions regarding siting of wind facility components. Additionally, while some of the avoidance and minimization measures are specifically intended to benefit MBTA- listed species, some of the avoidance and minimization measures being incorporated to protect bats or other species or for other reasons may provide conservation benefits to birds. Further, this WCS contains adaptive management provisions that would allow for the consideration and implementation of additional conservation measures to offset impacts to migratory birds as specified adaptive management thresholds are triggered.

1.2.2 Bald and Golden Eagle Protection Act

The purpose of the Bald and Golden Eagle Protection Act (BGEPA; 16 US Code 668–668c, as amended), administered by the USFWS, is to protect bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), including their nests, eggs, and parts (BGEPA 1940). The BGEPA states that "no person shall knowingly, or with wanton disregard for the consequences of his act take, possess, sell, purchase, barter, offer for sale, purchase or barter, transport, export, or import, at any time or in any manner any bald eagle commonly known as the American eagle or any golden eagle, alive or dead, or any part, nest or egg thereof of the foregoing eagles…"

BGEPA defines the take of an eagle to include "…to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb." The term "disturb" is defined in regulations found at 50 CFR § 22.3 to include to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

BGEPA authorizes the Secretary of the Interior to permit the take of bald or golden eagles for several defined purposes, including when "necessary to permit the taking of such eagles for the protection of wildlife or of agricultural or other interests in any particular locality." Based on this authority, the USFWS published a final rule (Eagle Permit Rule) on September 11, 2009 (see 50 CFR Parts 13 and 22) the USFWS set in place rules establishing two new permit types: 1) individual permits that can be authorized in limited instances of disturbance and in certain situations where other forms of take may occur, such as human or eagle health and safety; and 2) programmatic permits that may authorize incidental take that occurs over a longer period of time or across a larger area (USFWS 2009). On December 16, 2016, the USFWS issued a revised Eagle Permit Rule that includes changes to the regulations for eagle incidental take permits and eagle nest take permits. The revisions to the Eagle Permit Rule went into effect on January 17, 2017, and include changes to permit issuance criteria, duration (including a maximum permit term of 30 years), compensatory mitigation standards, and permit application

requirements. Since the permit program was authorized in 2009, only two permits have been issued for golden eagles and no permits have been issued for bald eagles.

1.2.3 Minnesota Threatened and Endangered Species Laws

The 2010 Minnesota Statutes, specifically the Protection of Threatened and Endangered Species (Minnesota Statutes § 84.0895), includes the language "Notwithstanding any other law, a person may not take, import, transport, or sell any portion of an endangered species of wild animal or plant, or sell or possess with intent to sell an article made with any part of the skin, hide, or parts of an endangered species of wild animal or plant, except as provided in subdivisions 2 and 7." The statute directs the Commissioner of the MNDNR to develop lists of endangered species, threatened species, and species of concern (Minnesota Rules, Chapter 6134). Minnesota Rules, Part 6212.1800 does allow for issuance of regulated taking for threatened and endangered species in situations when the social and economic benefits outweigh the harm caused by it, (84.0895 § Subdiv 7 (4)). While the Minnesota DNR regularly issues threatened and endangered species permits for construction impacts related to development, no permits have been requested by, or issued to, a wind energy development for construction or operation. Although listed as species of concern, the status of "species of special concern" confers no protection under Minnesota's Endangered Species Statute or the associated Rules.

1.2.4 State and Federal Wind Energy Guidelines

Until recently, the USFWS had been recommending, and many wind energy companies had been developing, ABPPs for wind projects. In Minnesota, it is a standard requirement of the LWECS Site Permit to develop an ABPP for the operation of the Project that complies with the MNDNR and MNDOC wind energy guidelines. With publication of the final WEG, the USFWS began recommending development of a BBCS instead of an ABPP (USFWS 2012). While the components may be generally the same, the BBCS is a mechanism by which wind energy companies document studies, analyses, agency input, and decisions in navigating through the WEG to help avoid and minimize impacts to environmental resources. This WCS aligns with recommendations included in both the state wind energy guidelines (Mixon et al. 2014) as well as the federal wind energy guidelines, including the WEG guidelines (USFWS 2012) and the USFWS's *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013a) and is inclusive of species that are not birds or bats, hence the WCS nomenclature.

2. Baseline Conditions (Tiers 1 through 3)

The WEG outlines a tiered approach for assessing suitability and risks to wildlife at a potential wind resource area. The "tiered" approach ensures that sufficient data are collected to enable project proponents to make informed decisions about continued development of a proposed project (USFWS 2012). At each tier, potential issues associated with the development or operations of the project are identified and questions are formulated to guide the decision process. This process starts with a broad scope and provides more site-specific detail at each tier as more data are gathered and the potential for avian and bat issues are better understood. The following sections describe the efforts completed as part of Tiers 1 through 3 and the

agency input during these tiers. Section 4.0 provides a proposed approach for Tier 4 during post-construction activities.

2.1 Desktop Review (Tier 1 and 2 Evaluations)

As described in the WEG, Tiers 1 and 2 evaluate potential issues that may need to be addressed before further actions can be taken with the development or operations of the Project. The objective of the Tier 1 study is to assist the developer in further identifying a potential wind site. Tier 1 studies provide a preliminary evaluation or screening of public data from federal, state, and tribal entities and offer early guidance about the sensitivity of the site, in regards to wildlife. The objective of Tier 2 studies is to determine the effects of the proposed Project on any Federal and State sensitive species. Although the existing Lake Benton II Wind Energy Center was developed prior to the issuance of the WEG, the wildlife studies that were completed were initiated at project completion but do align with the goals and purpose of the tiered approach. Many of these Tier 1 and Tier 2 efforts were also accomplished in the Site Characterization Study for Lake Benton Wind Partner (Atwell 2017), and readers seeking a comprehensive review of Tier 1 information should refer to that report.

Consistent with Tier 1, as described in the WEGs, these analyses (Atwell 2017) included a review of desktop data for environmental constraints within the vicinity of the Project based on publicly available data:

- topographic and aerial maps,
- state and nation-wide land use data,
- watershed information,
- geologic features, soils, field guides,
- National Wetland Inventory (NWI) mapping,
- Minnesota Natural Heritage Information System (NHIS),
- Federal Emergency Management Agency (FEMA) flood maps,
- information published by the MNDNR and USFWS, and
- communications with the agencies (included here as Appendix A)

2.1.1 Federal and State Listed Species

Potential species of concern in Pipestone County were mostly associated with prairies, wetlands, and riparian habitats including 21 Federal and State listed threatened and endangered species (See Table 2). Listed species with moderate likelihood to occur within the Project include: federally-listed Topeka shiner, and state listed burrowing owl (*Athene cunicularia*), Henslow's sparrow (*Ammodramus henslowii*), loggerhead shrike (*Lanius ludovicianus*), Blanding's turtle (*Emydoidea blandingii*), plains topminnow (*Fundulus sciadicus*), short-beaked arrowhead (*Sagittaria brevirostra*) and hair-like beak rush (*Rhynchospora capillacea*). Given the presence of designated critical habiat and other potential suitable habitat there is moderate potential for the Poweshiek skipperling, Ottoe skipper (*Hesperia ottoe*) and Dakota skipper to be found in the Project, although these species may be locally extirpated as described further in Section 2.1.4. Other species listed in Table 2 have low liklihood to occur

within the Project, including northern long-eared bat, blanchard's cricket frog (*Acris blanchardi*) and Western prairie fringed orchird and other state-listed plants.

Table 2. Federal and state listed species know to occur or have the potential to occur in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota

Species	Status	Habitat	Potential for Occurrence in the Project
Birds			
Burrowing owl *Athene cunicularia*	SE	Require areas inhabited by burrowing mammals (e.g., badgers and ground squirrels). These areas tend to be open grazed or native, mixed-grass prairies.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project.
Henslow's sparrow *Ammodramus henslowii*	SE	Prefers large (over 200 hectares [ha]) undisturbed grasslands and areas with plant stalks for perching. Litter depth, vegetation height, and standing plant stems/stalks are important habitat features for this species.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project.
Loggerhead shrike *Lanius ludovicianus*	SE	Inhabits grasslands (native and non-native) and sometimes agricultural areas, where short grass vegetation and perching sites such as hedgerows, shrubs, and small trees are found.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project.
Mammals			
Northern long-eared bat *Myotis septentrionalis*	FT, SSC	Hibernates in caves and underground mines in winter; mature upland forests and wooded riparian area used for roosting and foraging in summer	Low potential to occur within Project due to limited habitat within and surrounding the Project.
Reptiles			
Blanding's turtle *Emydoidea blandingii*	ST	In Minnesota, this species is adaptable and has been found in a wide variety of wetlands. In southwestern Minnesota areas of slow moving water and nearby upland agricultural lands (nesting females specifically) serve as important habitat.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project.
Amphibians			
Blanchard's cricket frog *Acris blanchardi*	SE	Occupy shallow small bodies of water and are often found along open, muddy water edges and shorelines with emergent vegetation.	Low potential to occur within the Project due to limited population numbers/distribution/ current range.
Fishes			

Table 2. Federal and state listed species know to occur or have the potential to occur in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota

Species	Status	Habitat	Potential for Occurrence in the Project
Plains topminnow *Fundulus sciadicus*	ST	Found in clear or slightly cloudy slow moving bodies of water with extensive aquatic plants and rocky or sandy bottoms.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project.
Topeka shiner *Notropis topeka*	FE,SSC	Inhabits slow-moving, small to mid-size prairie streams with sand, gravel, or rubble bottoms; prefer pool and oxbow areas that are outside main channel courses. These pools are in contact with groundwater and usually contain vegetation and areas of exposed gravel.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project. Creeks that drain to the Rock Creek Watershed. Including the East Branch Flandreau Creek, unnamed tributary to the Pipestone, Rock River and East Branch Rock River.
Insects			
Dakota skipper *Hesperia dacotae*	FT, SE	Native dry-mesic to dry prairie, dominated by mid-height grasses, such as little bluestem (*Schizachyrium scoparium*), prairie dropseed (*Sporobolus heterolepis*), and side-oats grama (*Bouteloua curtipendula*). Larval stages require clump grasses that are not annually maintained (*i.e.*, little bluestem) and adults prefer flowering plants in the coneflower genus (*Echinacea* spp.).	Moderate potential to occur within the Project in suitable habitat.
Ottoe skipper *Hesperia ottoe*	SE	Native dry-mesic to dry prairie, dominated by mid-height grasses, such as little bluestem (*Schizachyrium scoparium*), prairie dropseed (*Sporobolus heterolepis*), and side-oats grama (*Bouteloua curtipendula*). Adults forage flowing plants in adjacent moister prairie.	Moderate potential to occur within the Project in suitable habitat.
Poweshiek skipperling *Oarisma poweshiek*	FE, SE	Occurs in wet to dry native prairie, but not in sand prairie. Larval stages require clump grasses that are not annually maintained (*i.e.*, little bluestem, sideoats grama) and adults prefer flowering plants in the coneflower genus (*Echinacea* spp.).	Moderate potential to occur within the Project in suitable habitat.
Plants			

Table 2. Federal and state listed species know to occur or have the potential to occur in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota

Species	Status	Habitat	Potential for Occurrence in the Project
Hair-like beak rush *Rhynchospora capillacea*	ST	In Minnesota, this species is found in the margins of calcareous fens within the prairie regions. This species was recently discovered in an additional habitat, which consists of spring fens in large forested regions but these are not found within or surrounding the Project.	Moderate potential to occur within Project due to suitable habitat within and surrounding the Project.
Hairy waterclover *Marsilea vestita*	SE	In Minnesota, this species is only found in pools within rock out crops or shallow pools in prairies. Sparse vegetation and seasonal fluctuations in water level are an important feature of the preferred habitat.	Low potential to occur within Project due to limited habitat within and surrounding the Project.
Mud plantain *Heteranthera limosa*	ST	In Minnesota, all but one of this species known populations are found in aquatic areas associated with Sioux quartzite of the prairie regions specifically.	Low potential to occur within Project due to limited habitat within and surrounding the Project.
Prairie quillwort *Isoetes melanopoda*	SE	In Minnesota, this species is only found in aquatic areas associated with Sioux quartzite of the prairie regions.	Low potential to occur within Project due to limited habitat within and surrounding the Project.
Short-beaked arrowhead *Sagittaria brevirostra*	SE	Emergent wetlands and wetlands associated with rivers and streams.	Moderate potential to occur in wetlands/streams in Project.
Short-pointed umbrella sedge *Cyperus acuminatus*	ST	Found at the margins of shallow pools, ponds, and lakes.	Low potential to occur within the Project due to limited population numbers/distribution/ current range.
Waterhyssop *Bacopa rotundifolia*	ST	In western Minnesota, this species is found in small bedrock pools and on the margins of shallow prairie ponds.	Low potential to occur within Project due to limited habitat within and surrounding the Project.
Western prairie fringed orchid *Platanthera praeclara*	FT, SE	Wet prairies and sedge meadows	Low potential to occur within the Project due to limited population numbers/distribution/ current range.

Table 2. Federal and state listed species know to occur or have the potential to occur in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota

Species	Status	Habitat	Potential for Occurrence in the Project
Wolf's spikerush *Eleocharis wolfii*	SE	Habitat in Minnesota is poorly known. Historical records show this species only in moist habitats such as mud flats near streams and in Pipestone county specifically populations were found in rock outcroppings.	Low potential to occur within Project due to limited habitat within and surrounding the Project.

SE = State Endangered; ST = State Threatened; FE = Federally Endangered; FT = Federally Threatened.
Source: MNDNR 2008 and USFWS ECOS 2017

2.1.2 Native Prairie, Potentially Undisturbed Lands

Several of the listed species with potential to occur within the Project are associated with undisturbed native prairie and natural areas. While the Project and newly sited turbines for the re-powering effort strive to avoid and minimize impacts to native prairie, the associated figures show where these areas are located and how the repowering development plans continue to avoid these areas. Most, but not all Native Prairie are also Potentially Undisturbed Lands. The Site Characterization Study provides an extensive description of native prairies at the site (Atwell 2017).

Within the Project, the greatest concentration of DNR designated native prairie is located in the central southwestern portion with a few scattered patches in the south eastern and central portions (Figure 6). These prairie remnants are important to the state of Minnesota as they are some of the last and best remaining prairie. Most of these prairies are coincident with Potentially Undisturbed Lands (Figure 7), Areas of Biological Significance (see section 2.1.3; Figure 8) and habitats identified as important for Dakota skipper and Poweshiek skipperling. The Lake Benton II re-powering effort has turbines sited with consideration of these areas (compare Figures 2 and 7). Areas that have been designated as undisturbed overlap the native prairie areas mentioned above but also include other areas within and surrounding the site (Figure 8). All proposed infrastructure locations for the repower, including turbines, roads, and collection, will be compared with these resource areas to avoid and minimize potential impacts as much as feasible.

2.1.3 Areas of Biodiversity Significance

The Project contains 25 areas of biodiversity significance (Figure 10; Atwell 2017). The Site Characterization Study provides an extensive description of these areas of Biodiversity Significance (Atwell 2017).

The largest area is in the central western portion of the Project. One site is classified as having “outstanding” significance; six sites are classified as having “high” significance; nine sites are classified as having “moderate” significance; and the remainder has “below” biodiversity significance. The current turbine layout avoids these areas and impacts to areas of biodiversity

significance are expected to be minimal (Figures 2 and 3). All proposed infrastructure locations for the repower, including turbines, roads, and collection, will be compared with these resource areas to avoid and minimize potential impacts as much as feasible.

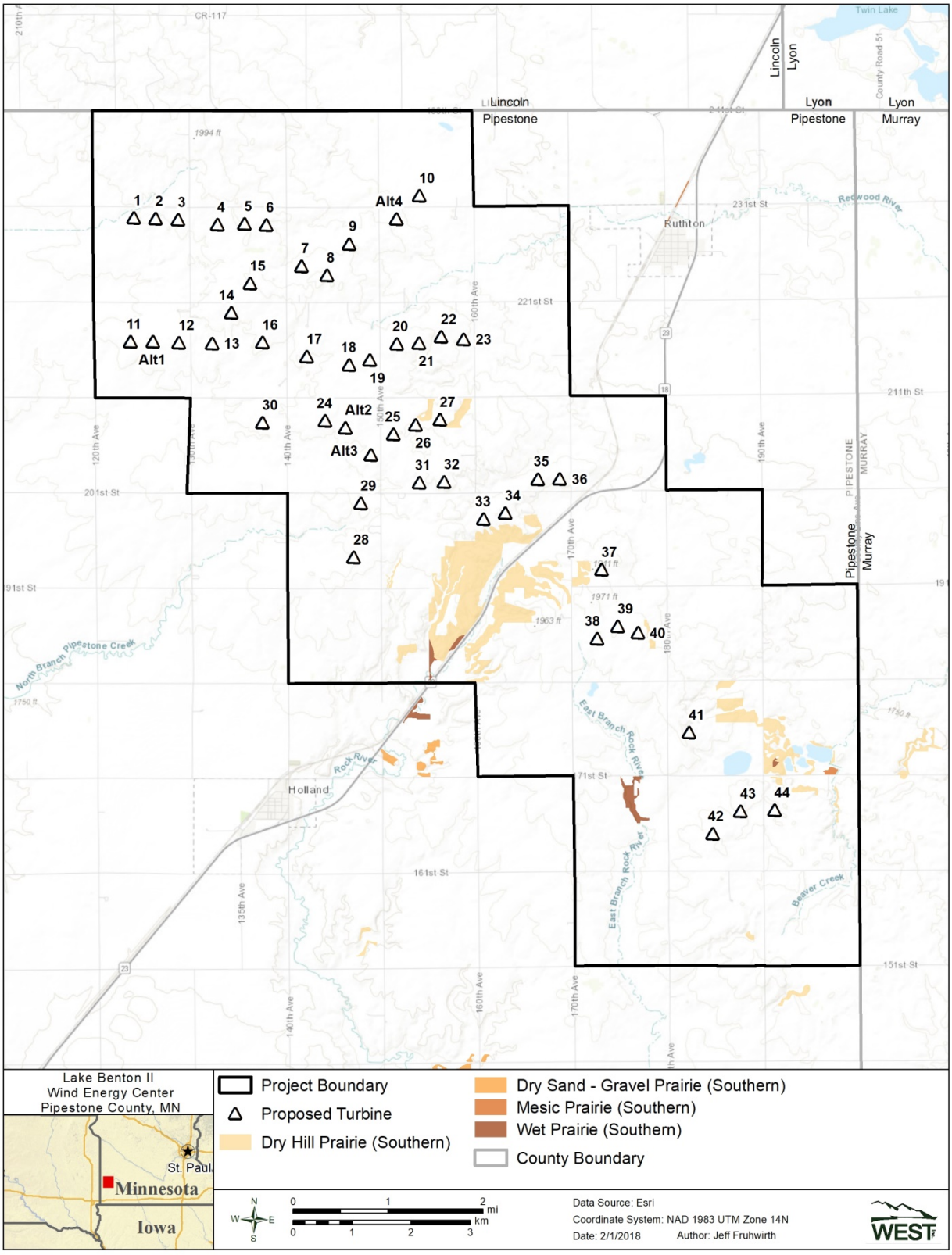


Figure 6. Native prairie located in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

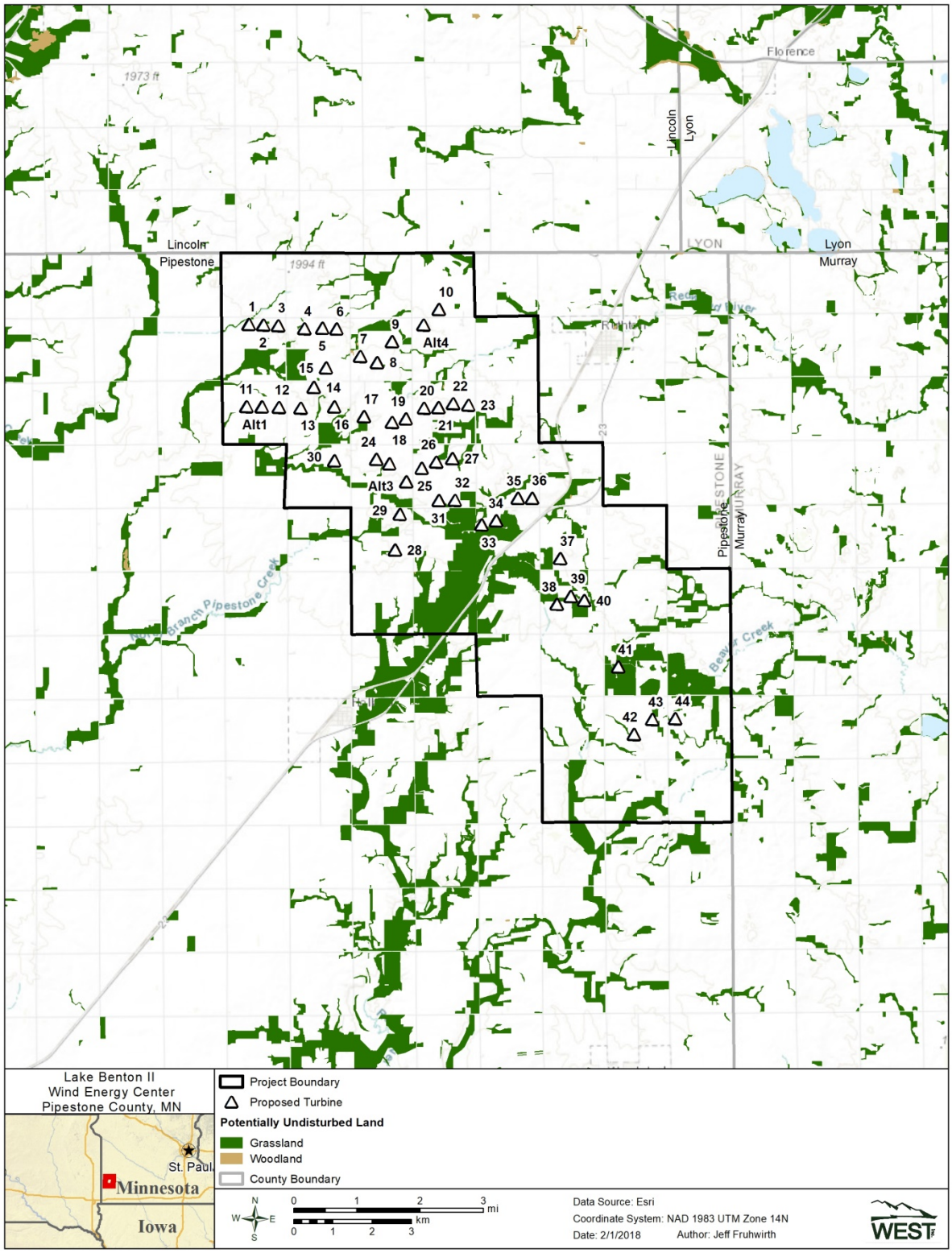


Figure 7. Potentially undisturbed land located in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

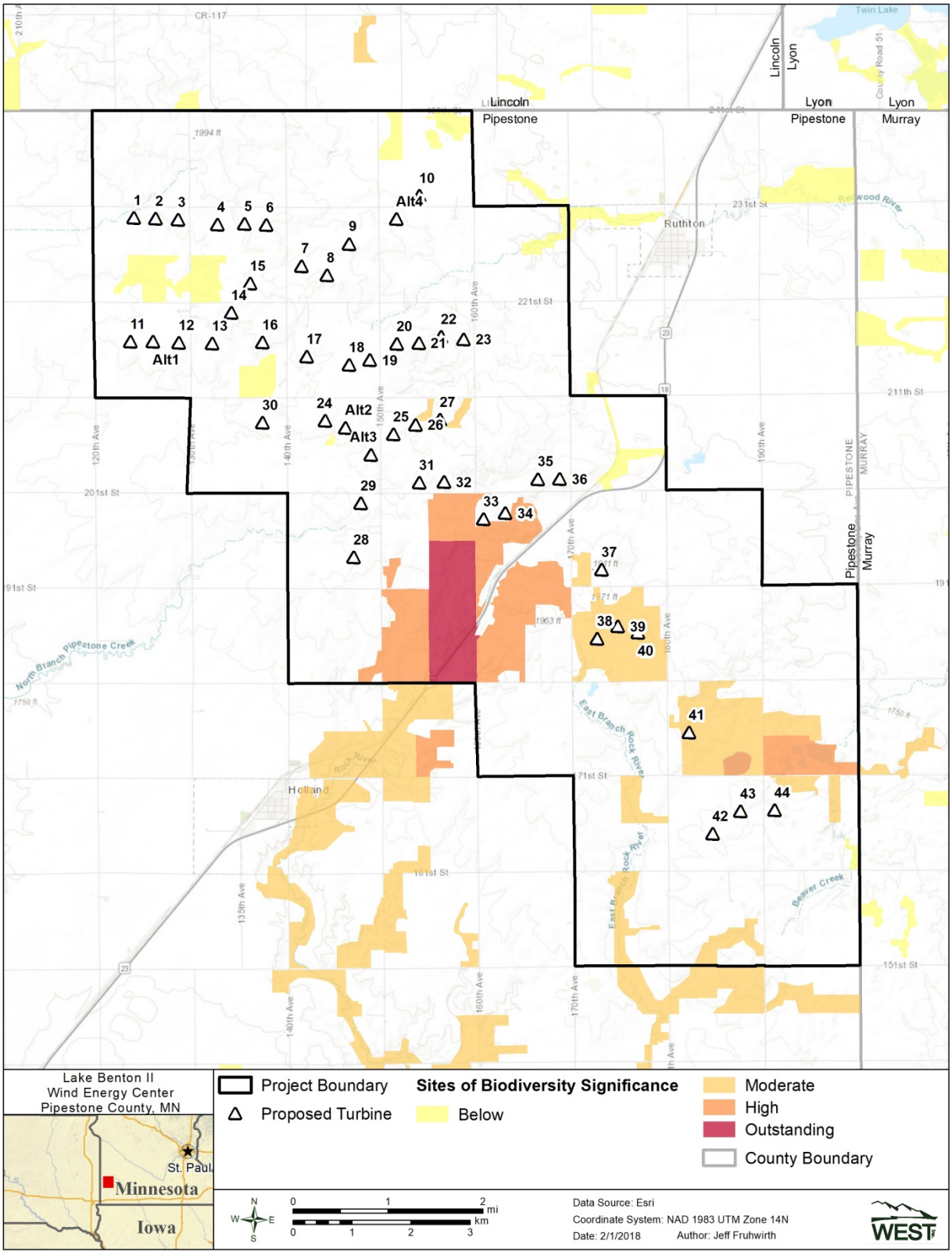


Figure 8. Areas of biodiversity significance located in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

2.1.4 Critical Habitat for Federally Listed Species

The Project contains critical habitat for three federally listed species: Dakota skipper, Poweshiek skipperling, and Topeka shiner. Two locations within the Project are designated as critical habitat for Dakota skipper; one of these locations is also critical habitat for Poweshiek skipperling (Figure 9). Project design avoids these critical habitat locations; it should also be noted that recent surveys in areas in southwestern Minnesota where previous records have shown documented listed skippers indicate that these species may be extirpated from the state; no Dakota skippers, for instance, have been documented in southwestern Minnesota since 2008 even in previously occupied habitat patches. As part of a reintroduction effort, The Nature Conservancy and Minnesota Zoo recently reintroduced the Dakota skipper to the Hole-in-the-Mountain Prairie Preserve in June 2017, which is approximately 4 miles away from the Project (Minnesota Zoo 2017).

A desktop analysis aimed at identifying potential suitable habitat for the Dakota skipper and Poweshiek skipperling in the Project was conducted in June 2017 (SWCA Environmental Consultants 2017). The desktop analysis, based off aerial imagery, identified a patchwork of potentially suitable habitat (remnant native prairie and wetlands) for both the Dakota skipper and Poweshiek skipperling scattered throughout the Project. In addition, the MNDNR's NHIS data review for the Project indicated that the majority of identified rare and unique natural features within the Project are of grassland-associated invertebrates (butterflies) and vascular plants concentrated in the central third of the Project in association with existing state owned SNA and WMA properties and grassland dominated areas. MNDNR suggested avoidance of native grassland habitat and public lands within the Project to the greatest extent practicable.

Following this desktop analysis, potentially suitable habitat was reviewed in the field in locations where Project infrastructure was proposed. Areas where suitable habitat appeared present in the field were avoided by Project design. As Project design continues, additional field verification and avoidance of potentially suitable habitat is planned so as to limit impacts to native grassland and wetland areas that provide potential habitat for these rare and unique natural features (e.g., Dakota skipper, Poweshiek skipperling, and any other listed plants and animals).

The entire area within the Project is located in federally designated critical habitat for the Topeka shiner; however suitable habitat is constrained to streams and rivers, particularly the Big Sioux River and Rock River Watersheds (Atwell 2017). If in-stream work, particularly soil disturbance is required within, or immediately adjoining streams and rivers, Lake Benton II will implement BMPs provided by MNDNR to avoid and minimize potential impacts during spawning. Consistent with MNDNR's recommendation, Lake Benton II will not conduct in-stream work before 15 August to protect Topeka shiners. Standard pollution and erosion control measures identified in the best management practice (Section 3) will aid in minimizing the effects of siltation in streams.

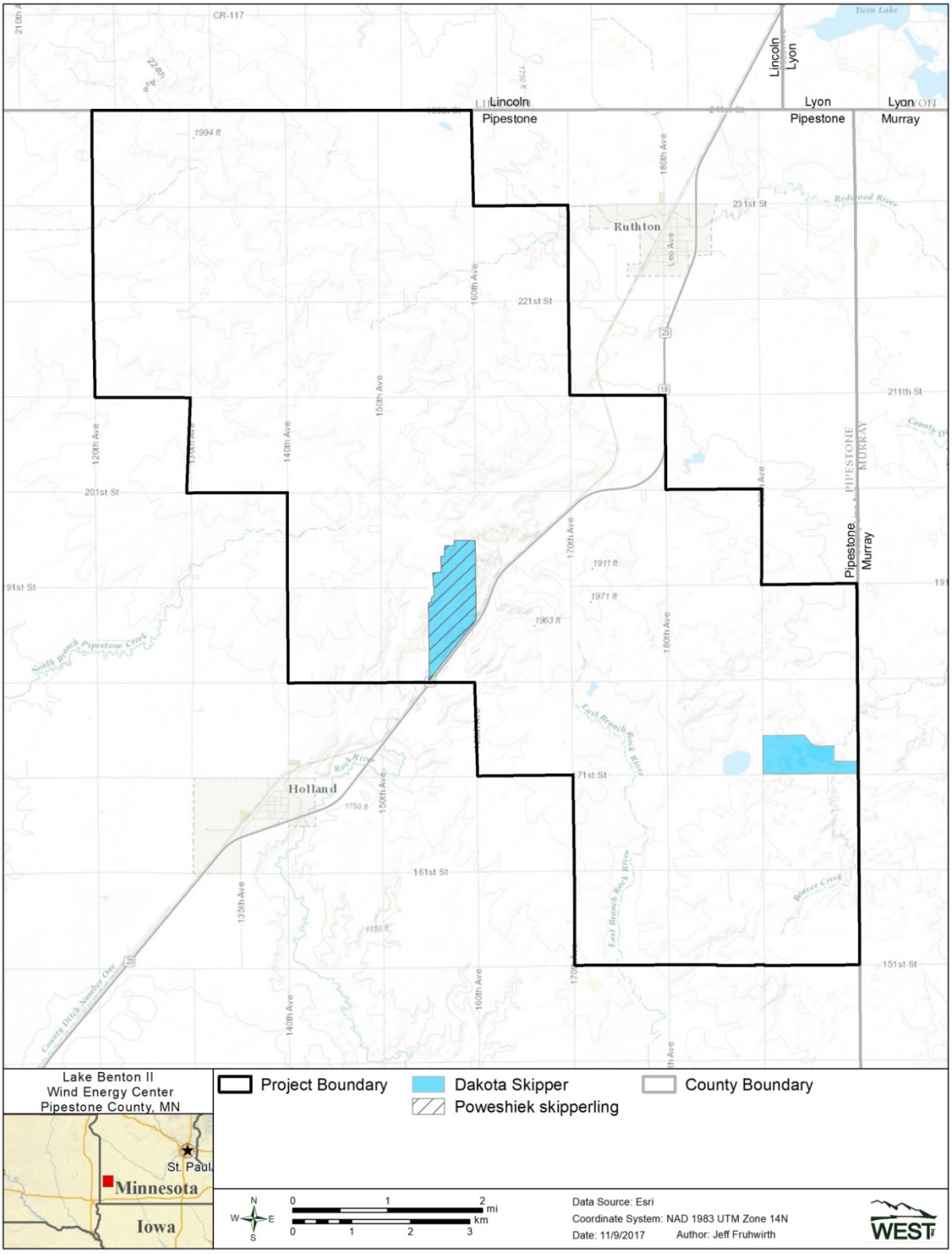


Figure 9. Critical habitat for federally listed species, Dakota skipper and Poweshiek skipperling in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

2.1.5 Northern Long-eared Bat Habitat Assessment

WEST conducted a Northern Long-Eared Bat (NLEB, *Myotis septentrionalis*) desktop assessment to evaluate potential for species presence following the NLEB January 2016 Conferencing and Planning Guidance (USFWS 2014). This assessment quantified habitat patches that could serve as NLEB habitat meeting established minimum size requirements including: 1) commuting/travel habitat (i.e., 0 – 14 acres [ac] in size), 2) small roost/foraging habitat (i.e., 15 – 49 ac in size), and 3) medium/large roosting/foraging habitat (i.e., 50+ ac in size). The mapping effort indicates that there is potential for one area of habitat in an area of planted woodland which could serve as a corridor habitat within the northwestern portion of the Project (Figure 10). As there are no significant waterbodies in the area that this wooded corridor connects, NLEB use is expected to be low. No NLEB fatalities were observed within the Buffalo Ridge area during previous work by WEST (Johnson et al. 2000).

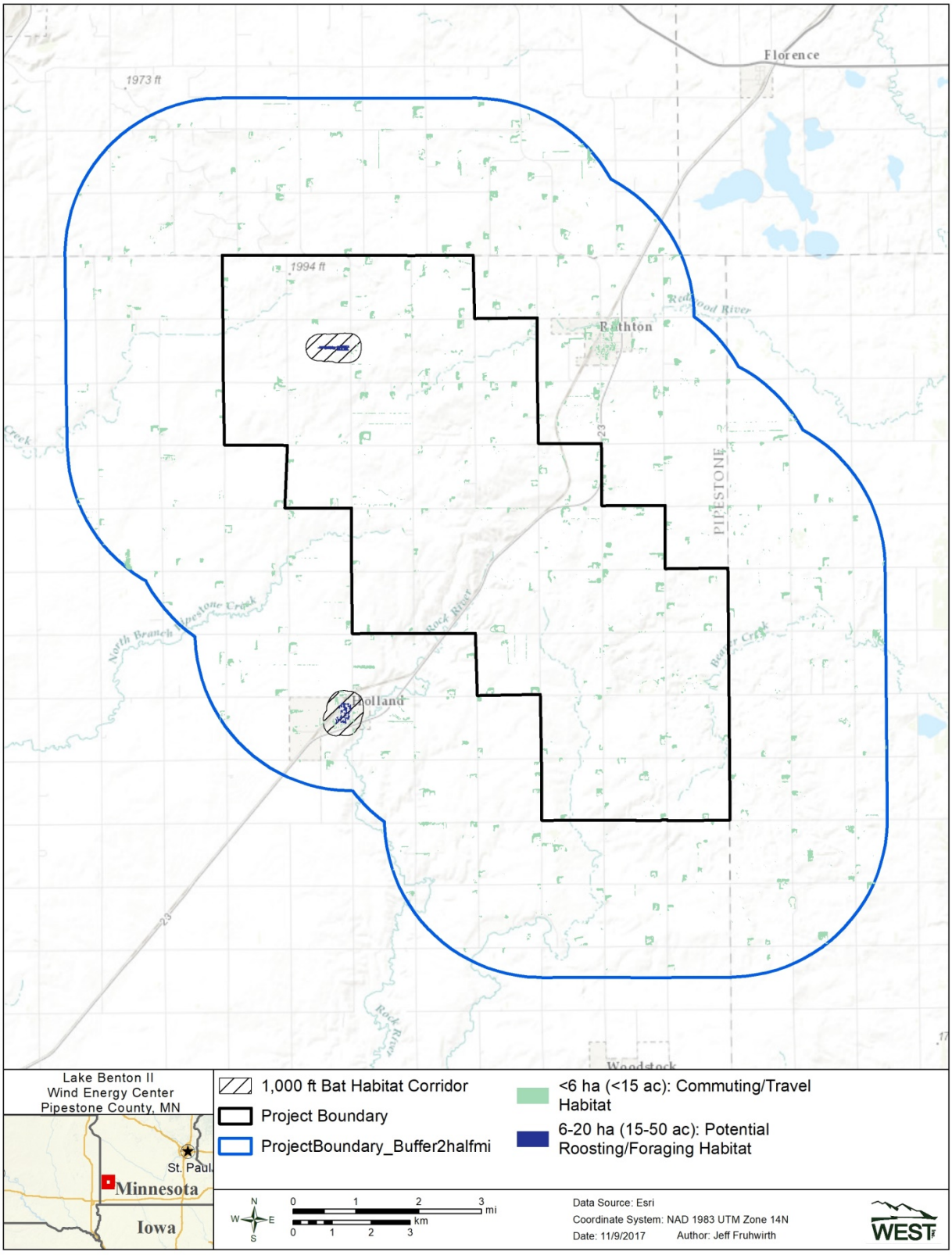


Figure 10. Potential northern long-eared bat habitat located in or near the Lake Benton II Wind Energy Center in Pipestone County, Minnesota.

2.2 Field Review (Tier 3 Avian and Bat Surveys)

The original Lake Benton II development (also referred to as Buffalo Ridge Phase III) was permitted and developed and operational as of 1999 prior to release of the WEG, and as such, not all baseline assessments described in the WEG were completed. As described further in Section 2.2.3, avian use surveys were conducted from 1996 - 1999 in the Buffalo Ridge wind resource area, which included areas within the current Project. With repowering planning underway, wildlife surveys were initiated in 2016 and planned to run through October 2018, to evaluate potential direct and indirect impacts to wildlife during repowering and operation of this facility. These surveys are being conducted while the current Lake Benton II project is in operation. Therefore, while not "baseline" as defined in the WEG, they are the current baseline for the site and the results are expected to inform development and operations of the Project. Surveys to date include raptor nest surveys (WEST 2017a), one year of avian use surveys (WEST 2017b) and a NLEB habitat assessment (results in section 2.1.3). Acoustic bat surveys are planned for three, ground-based locations (beginning April 2018), and an additional raptor nest survey will occur in spring 2018. Tier 3 studies were designed using methods consistent with the WEG recommendations, and the results of the Tier 3 studies indicate wildlife use similar to many other wind energy sites in the region. Relevant post-construction studies of the original Lake Benton II (previously referred to as Buffalo Ridge Phase III) have also been incorporated in the Tier 3 analysis to evaluate potential direct and indirect impacts, particularly for bats species (*see* section 2.2.3).

2.2.1 Raptor Nest Survey

WEST conducted an eagle and raptor nest survey to record bald eagle and other raptor nests in and near the Project (WEST 2017a). Surveys within the Project and 1-mile buffer documented all potential raptor nests, including bald eagles, while the surveys out to the 10-mile buffer focused only on identifying potential bald eagle nests. Aerial surveys were conducted from a helicopter on March 29-30, April 2, and April 4, 2017, prior to leaf out when raptors would be actively tending to a nest or incubating eggs. Aerial surveys were conducted in accordance with the guidance provided in the USFWS ECPG (USFWS 2013) and the USFWS *Interim Golden Eagle Technical Guidance* (Pagel et al. 2010).

An experienced raptor ecologist and a skilled helicopter pilot conducted the survey. Raptors were defined for this survey as accipiters, buteos, harriers, eagles, falcons, and owls. However, the main focus of the survey was to identify bald eagle nests. Surveyors focused on locating eyries (large, stick nest structures) in suitable eagle nesting substrate (trees, transmission lines, cliff faces, etc.) within the surveyed area.

A total of 24 raptor nests were detected during surveyed area (including the Project and 10-mile buffer). The locations of these nests are shown in Figure 11. Two occupied and active bald eagle nests (1329 and 1334) were documented during the survey, with none within the Project. The closest eagle nest (1334) is 7.6 miles northeast of the Project. Additional raptor nests documented during the survey included two occupied and active great horned owl nests (*Bubo virginianus*), five occupied and active red-tailed hawk nests (*Buteo jamaicensis*), one occupied

and active nest of Canada goose (*Branta canadensis*), two occupied and active nests of unknown species, one occupied and inactive nest of unknown species and 11 unoccupied and inactive nests of unknown species. None of the stick nests of unknown species were consistent with the size and structure of a bald eagle nest.

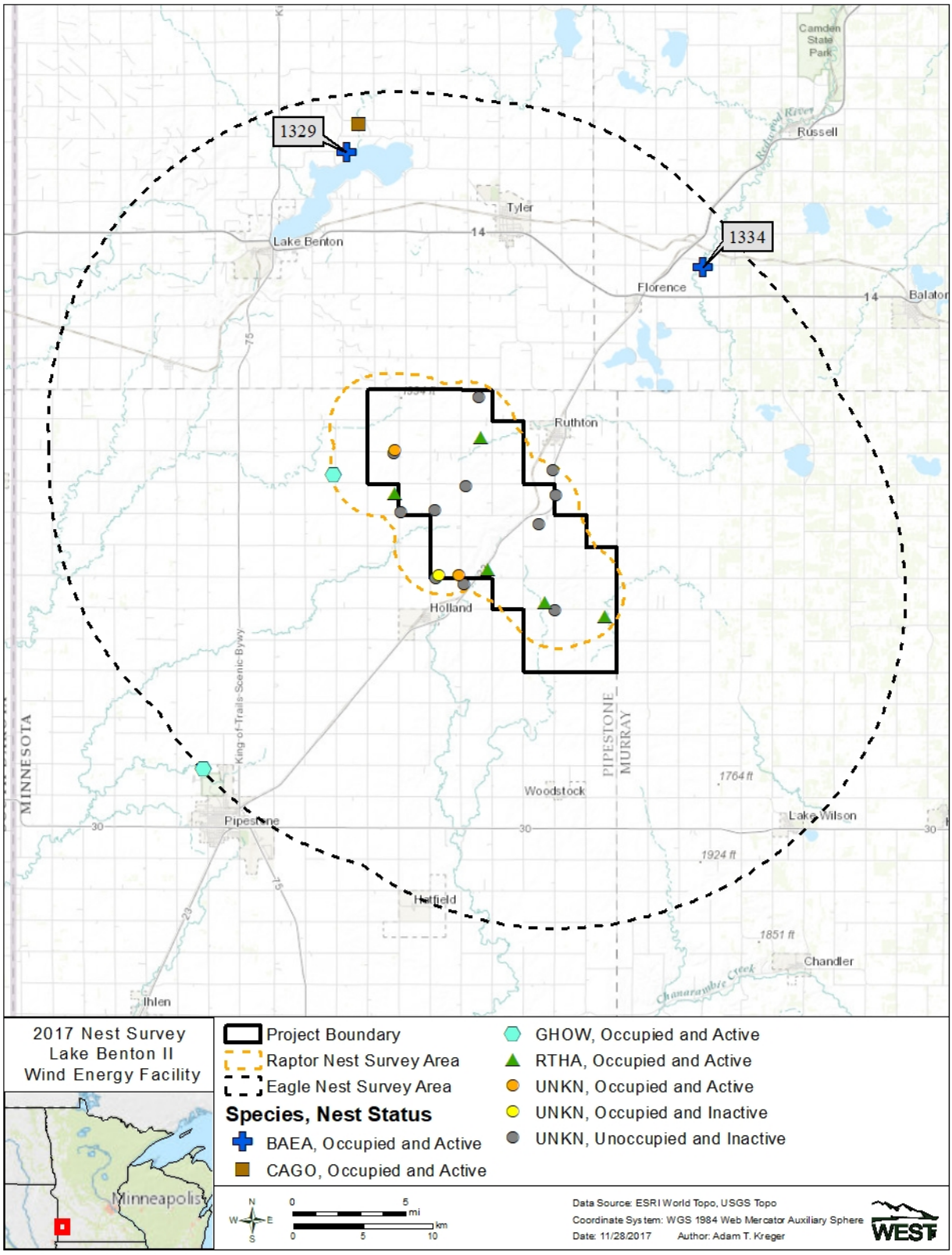


Figure 11. Locations of raptor nests observed near the Lake Benton II Wind Energy Center, Pipestone County, Minnesota.

2.2.2 Avian/Eagle Use Point Count Survey

WEST conducted avian use and eagle use surveys from September 2016 – August 2017 (WEST 2017b). The principal objective of the study was to provide site-specific bird resource and use data that would be useful for evaluating potential impacts during planning for the repowering of the Project.

Surveys consisted of counting eagles and other large birds within circular plots centered on an observation point. The maximum survey radius around each observation point was 800 meters (m; 2,625 feet [ft]). For eagle use surveys, the ECPG recommends that at least 30% of the area within one km of turbines be covered by bird observation plots. The 1-km buffer of the proposed June 2016 turbine layout was used as a proxy for the proposed repower Project footprint. This proxy area encompasses 104 square kilometers (km^2). Following the ECPG's recommendations, sixteen observation points were surveyed during each month. Surveys were conducted between sunrise and sunset. Each avian point count location was surveyed once per month by a qualified biologist. A survey consisted of a 10-minute small bird survey followed by a 60-minute large bird survey focusing on eagles. The observation radius was 100-m for small birds and 800-m for large birds; however any eagle observed during a survey was recorded regardless of distance from observer.

Over the year of avian surveys (192 surveys), 74 unique species were observed for a cumulative total of 10,822 bird observations. The most common species observed at the Project site included: mixed-species flocks of blackbirds, Canada goose, and greater white-fronted goose (*Anser albifrons*).

No federal or state threatened or endangered species were observed. No special status species were observed during fixed-point small bird surveys; three special status species were observed during fixed-point large bird surveys including eagles and two Minnesota species of special concern (SSC; Table 3). MN SSC hold no additional regulatory status in Minnesota. Two Minnesota SSC were observed flying through the Project included American white pelican (*Pelecanus erythrorhynchos*), and Franklin's gull (*Leucophaeus pipixcan*). A total of four bald eagles were observed during surveys and two additional bald eagles were observed incidentally. Thirty eagle minutes were recorded, eight of which were observed at observation points #13, #15, and #16 within 800 m and below 200 m in height (Figure 12).

Table 3. Summary of special status species observed at the Lake Benton II Wind Project during fixed-point large bird use surveys (FPLB) and as incidental wildlife observations (Inc.) from September 2, 2016 – August 23, 2017.

			FPLB		Incidental		Total	
Species	**Scientific Name**	**Status**	**# of grps**	**# of obs**	**# of grps**	**# of obs**	**# of grps**	**# of obs**
bald eagle	*Haliaeetus leucocephalus*	FED-EA	4	4	2	2	6	6
American white pelican	*Pelecanus erythrorhynchos*	MN-SSC	2	11	0	0	2	11
Franklin's gull	*Leucophaeus pipixcan*	MN-SSC	2	42	0	0	2	42
Total	**3 species**		**8**	**57**	**2**	**2**	**10**	**59**

EA= Bald and Golden Eagle Act , SSC= Species of Special Concern

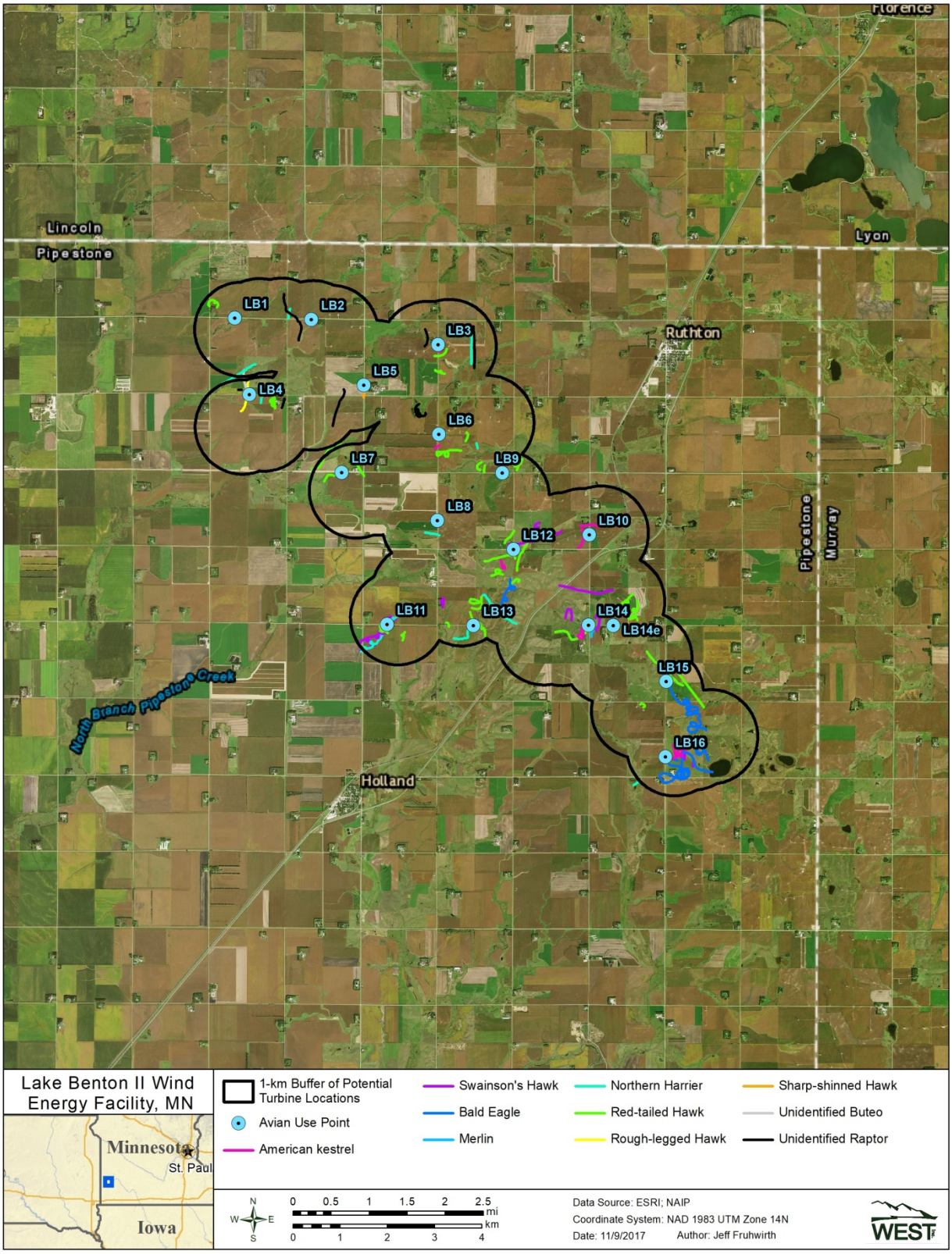


Figure 12. Diurnal raptor flight paths recorded during 60-minute fixed-point bird-use surveys at Lake Benton II Wind Energy Center from September 2, 2016 – August 23, 2017.

2.2.3 Post-construction Studies in the Original Project Area

The Buffalo Ridge wind resource area was constructed over the course of the mid- to late-1990s. This wind resource area consists of three wind energy plants (Phase I, Phase II, and Phase III) located on Buffalo Ridge, Minnesota with a combined total of 354 turbines. Phase III of this wind resource area was subsequently renamed the Lake Benton II Wind Energy Center Project (Figure 13).

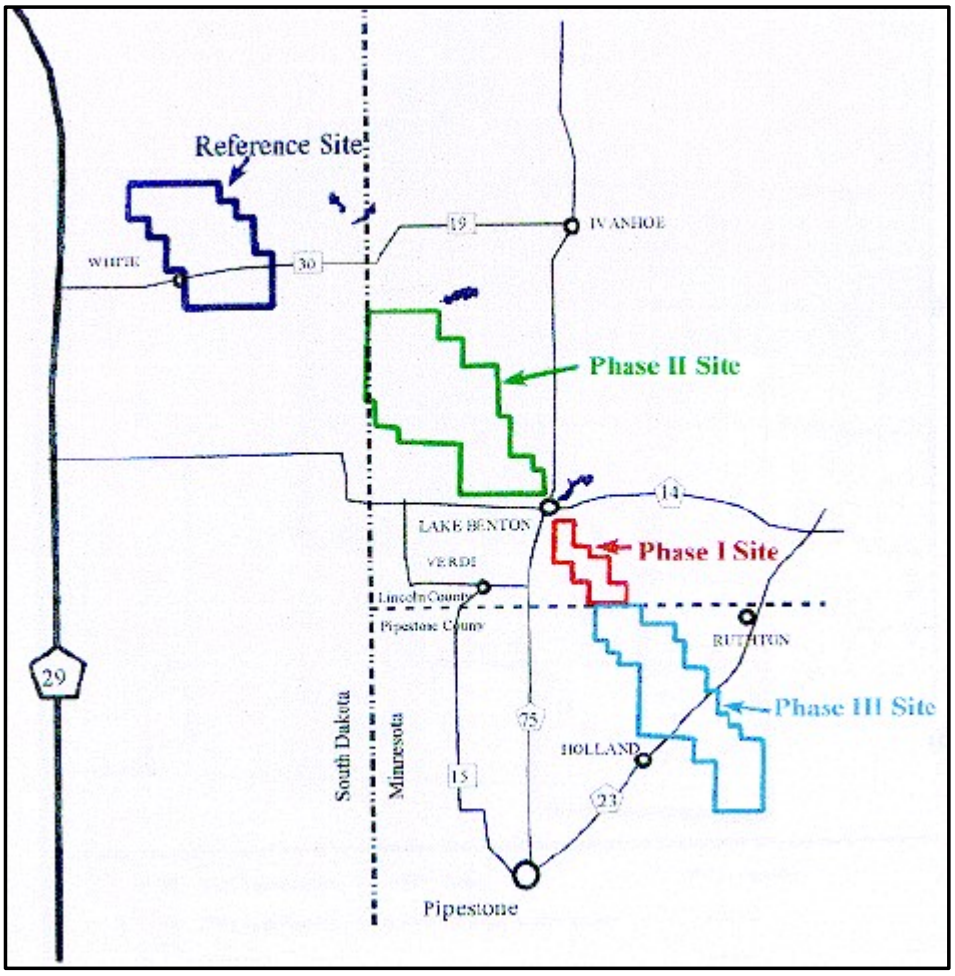


Figure 13. Locations of early wind energy development and assessment work within the Buffalo Ridge wind resource area, including the Phase III site, which was renamed the Lake Benton II Wind Energy Center, Pipestone County, Minnesota (excerpt from Johnson et al 2000).

Avian point count use surveys were conducted through the entire Buffalo Ridge wind resource area by WEST from 1996 - 1999, although particular phases (e.g., Phase III) were not specifically delineated in that avian portion of the assessment. During that multi-year period and across the Buffalo Ridge area, 218 species of birds were observed, including six state and/or federally threatened or endangered species: peregrine falcon (*Falco peregrinus*), bald eagle, Wilson's phalarope (*Phalaropus tricolor*), loggerhead shrike (*Lanius ludovicianus*), horned grebe (*Podiceps auritus*), and common tern (*Sterna hirundo*; Johnson et al. 2000). The majority of

these birds were most likely migrants, with the exception of the loggerhead shrikes which were documented breeding in the Buffalo Ridge area.

Thirty-one species of birds were detected in post-construction fatality surveys at operational turbines from 1996 - 1999 (Johnson et al. 2000). The majority of fatalities were passerine species. The total adjusted fatality rate for birds (based on scavenger removal and searcher efficiency) at Phase III was estimated to be 4.45 birds/turbine/year, or 5.93 birds/MW/year (Table 4). Raptors fatalities were not documented at Lake Benton II and raptor fatality estimates are minimal for the region (Table 5).

Table 4. Wind energy facilities in Minnesota with fatality data for all bird species.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Buffalo Ridge, MN (Phase III; 1999)	5.93	138*	103.5
Moraine II, MN	5.59	33	49.5
Buffalo Ridge, MN (Phase I; 1996)	4.14	73	25
Elm Creek II, MN	3.64	62	148.8
Buffalo Ridge, MN (Phase I; 1999)	1.43	73	25
Buffalo Ridge, MN (Phase II; 1999)	3.57	143	107.25
Buffalo Ridge, MN (Phase I; 1998)	3.14	73	25
Buffalo Ridge, MN (Phase I; 1997)	2.51	73	25
Buffalo Ridge, MN (Phase II; 1998)	2.47	143	107.25
Elm Creek, MN	1.55	67	100

A=number of bird fatalities/MW/year

*At the time of the post-construction fatality survey, 138 turbines were in place; one turbine was decommissioned in 2009.

Data from the following sources:

Facility	Fatality Estimate	Facility	Fatality Estimate
Buffalo Ridge, MN (Phase III; 99)	Johnson et al. 2000	Buffalo Ridge, MN (Phase I; 97)	Johnson et al. 2000
Moraine II, MN	Derby et al. 2010a	Buffalo Ridge, MN (Phase II; 98)	Johnson et al. 2000
Buffalo Ridge, MN (Phase I; 96)	Johnson et al. 2000	Elm Creek, MN	Derby et al. 2010b
Elm Creek II, MN	Derby et al. 2012	Buffalo Ridge, MN (Phase I; 99)	Johnson et al. 2000
Buffalo Ridge, MN (Phase II; 99)	Johnson et al. 2000		
Buffalo Ridge, MN (Phase I; 98)	Johnson et al. 2000		

Table 5. Wind energy facilities in Minnesota with fatality data for raptors.

Wind Energy Facility	Raptor Fatality Estimate[A]	No. of Turbines	Total MW
Buffalo Ridge, MN (Phase I; 1996)	0.47	73	25
Moraine II, MN	0.37	33	49.5
Buffalo Ridge, MN (Phase I; 1997)	0	73	25
Buffalo Ridge, MN (Phase I; 1998)	0	73	25
Buffalo Ridge, MN (Phase I; 1999)	0	73	25
Elm Creek, MN	0	67	100
Buffalo Ridge, MN (Phase III; 1999)	0	138	103.5
Buffalo Ridge, MN (Phase II; 1998)	0	143	107.25
Buffalo Ridge, MN (Phase II; 1999)	0	143	107.25
Elm Creek II, MN	0	62	148.8

A = number of fatalities/MW/year

Data from the following sources:

Facility	Fatality Estimate	Facility	Fatality Estimate
Buffalo Ridge, MN (Ph. I; 96)	Johnson et al. 2000	Elm Creek, MN	Derby et al. 2010a
Moraine II, MN	Derby et al. 2010b	Buffalo Ridge, MN (Ph. III; 99)	Johnson et al. 2000
Buffalo Ridge, MN (Ph. I; 97)	Johnson et al. 2000	Buffalo Ridge, MN (Ph. II; 98)	Johnson et al. 2000
Buffalo Ridge, MN (Ph. I; 98)	Johnson et al. 2000	Buffalo Ridge, MN (Ph. II; 99)	Johnson et al. 2000
Buffalo Ridge, MN (Ph. I; 99)	Johnson et al. 2000	Elm Creek II, MN	Derby et al. 2012
		Elm Creek II, MN	Derby et al. 2012

During the post-construction fatality surveys at Lake Benton II (Buffalo Ridge Phase III in Table 6), a total of 184 bat fatalities were detected in 1998 and 1999. The majority of fatalities were tree bats, most of which were hoary bats (*Lasiurus cinereus*). The total bat fatality at the Lake Benton II was estimated to be 2.04 bats/turbine/year (2.72 bats/MW/year) through 1999 (Johnson et al. 2000; Table 6). In subsequent years, the bat fatality rate was similar (3.71 bats/MW/year in 2001; 1.81 bats/MW/year in 2002), and consistent across the Buffalo Ridge wind resource area (Table 6). No northern long-eared bat fatalities were observed at this Lake Benton II phase or within any of the studied Buffalo Ridge facilities (Johnson et al. 2000).

Table 6. Wind energy facilities in Minnesota with fatality data for bats.

Wind Energy Facility	Fatality Estimate[A]	No. of Turbines	Total MW
Lakefield, MN (2012)	15.85	137	205.5
Big Blue, MN (2013)	6.33	18	36
Buffalo Ridge, MN (Phase II; 2001/Lake Benton I)	4.35	143	107.25
Buffalo Ridge, MN (Phase III; 2001/Lake Benton II)	3.71	138	103.5
Grand Meadows, MN (2013)	3.11	67	100.5
Oak Glen, MN (2013)	3.09	24	44
Elm Creek II, MN (2011-2012)	2.81	62	148.8
Buffalo Ridge, MN (Phase III; 1999)	2.72	138	103.5
Buffalo Ridge, MN (Phase II; 1999)	2.59	143	107.25
Moraine II, MN (2009)	2.42	33	49.5
Buffalo Ridge, MN (Phase II; 1998)	2.16	143	107.25
Buffalo Ridge, MN (Phase III; 2002/Lake Benton II)	1.81	138	103.5
Buffalo Ridge, MN (Phase II; 2002/Lake Benton I)	1.64	143	107.25
Elm Creek, MN (2009-2010)	1.49	67	100
Buffalo Ridge, MN (Phase I; 1999)	0.74	73	25

A = Number of fatalities per megawatt per year

Data from the following sources:

Facility	Fatality Estimate	Facility	Fatality Estimate
Buffalo Ridge, MN (Ph. II; 01/Lake Benton I)	Johnson et al. 2004	Buffalo Ridge, MN (Ph. II; 98)	Johnson et al. 2000
Buffalo Ridge, MN (Ph. III; 01/Lake Benton II)	Johnson et al. 2004	Buffalo Ridge, MN (Ph. III; 02/Lake Benton II)	Johnson et al. 2004
Elm Creek II, MN	Derby et al. 2012	Buffalo Ridge, MN (Ph. II; 02/Lake Benton I)	Johnson et al. 2004
Buffalo Ridge, MN (Ph. III; 99)	Johnson et al. 2000	Elm Creek, MN	Derby et al. 2010
Buffalo Ridge, MN (Ph. II; 99)	Johnson et al. 2000	Buffalo Ridge, MN (Ph. I; 99)	Johnson et al. 2000
Moraine II, MN	Derby et al. 2010b		

2.2.4 Acoustic Bat Survey - 2018

To assess current levels of bat activity, acoustic bat surveys consisting of three ground-based acoustic detectors are planned for survey deployment in April - October 2018. Once surveys are complete, results from the survey report will be used to update this document with new information.

2.2.5 Summary of Tier 3 Questions

1. Do field studies indicate that species of concern are present on or likely to use the proposed site?

No federal or state endangered or threatened species were detected during 2017 baseline studies. However, two Minnesota species of special concern (American white pelican and Franklin's gull) were detected migrating through the area during the 2016-2017 avian/eagle use point count surveys. Bald eagles, protected under BGEPA, were detected during both the 2016-2017 avian/eagle use point count surveys and the 2017 raptor nest surveys, but use appeared be low for this Project (four eagles seen in 192 hours of large bird surveys, with two seen incidentally over the year), and the closest bald eagle nests were located 7.6 miles outside of the Project.

During four years of avian monitoring in the late 1990s at the Buffalo Ridge wind resource area, which overlaps with some of the Project, six state threatened or endangered species were observed: peregrine falcon, bald eagle, Wilson's phalarope, loggerhead shrike, horned grebe, and common tern (Johnson et al. 2000). However, it should be noted that these surveys were conducted nearly twenty years ago throughout the Buffalo Ridge wind resource area, and the results of these surveys may not indicate species currently at risk. Many of these species, particularly loggerhead shrike, have experienced range wide declines since these surveys were conducted, and are no longer present in much of the state. None of these species were found within the Project in the 2016-2017 avian use surveys, and suitable habitat for most (e.g., common tern, horned grebe, Wilson's phalarope, peregrine falcon) are absent from the Project.

2. Do field studies indicate potential for significant adverse impacts on the affected populations of species of habitat fragmentation concern?

In the context of agricultural conversion history of this area, and construction of the Lake Benton II Wind Energy Center project in 1999, additional habitat fragmentation during the proposed repowering is not expected. With the exception of the habitat for Dakota Skipper and Poweshiek skipperling, species which may be extirpated from the area, there is no indication that habitat fragmentation is a concern for other species present. Given the already heavily modified cultivated landscape, and the proposed layout avoiding grassland habitats, effects are predicted to be minimal.

3. What is the distribution, relative abundance, behavior, and site use of species of concern identified in Tiers 1 or 2, and to what extent do these factors expose these species to risk from the proposed project?

The two species of Minnesota special concern (American white pelican and Franklin's gull) were detected migrating through the area and recorded in the Project and are likely to occur within or near the Project only during spring and fall migration. These species are not observed during the breeding and nesting season as habitat within the Project is limited. Species that occur within the Project during a particular season (e.g., migration or summer breeding) are exposed to relatively higher collision risk during this time, but lower risk in other seasons.

A total of four bald eagles were observed at the Project during 192 hours of the surveys that occurred over the year of avian/eagle use fixed point surveys; two were seen incidentally. Eagles were observed flying for a total of 30 minutes, eight of which were documented within 800 m of the observer and below 200 m in height. As of 2017, two bald eagle nests are located within ten miles of the Project. No golden eagles were documented during baseline studies. Tier 3 studies indicate low use by bald eagles at the Project, ranging from 0 bald eagles/800-m survey plot/60 minute survey in the fall to 0.04 bald eagles/800-m survey plot/60 minute survey in the spring.

Northern long-eared bat have the potential to occur in the Project, but are not expected to summer or winter in the vicinity of the due to the absence of wooded habitats and floodplain

forests. The closest known northern long-eared bat hibernaculum is located 105 miles to the east between Nicollet and Le Sueur counties (Atwell 2017).

Dakota skipper and Poweshiek skipperling have potential to occur in the Project, particularly within or near high quality ungrazed prairie, little of which occurs within the Project. Two critical habitat units occur within the Project (Figure 11), but these species have not been documented in skipper/skipperling flight surveys in the area (or in all of southwest Minnesota) in many years. The closest documented location with Dakota skippers is at the Nature Conservancy's Hole-in-the-Mountain Prairie Preserve 4.3 miles to the northwest of the Project, where the species was reintroduced in June 2017; the success of this reintroduction is yet to be determined. However, the USFWS has determined that the maximum dispersal distance for the Dakota skipper is 1 kilometer (0.6 mile) as indicated in the Dakota Skipper Guidance for Interagency Cooperation under Section 7(a)(2) of the Endangered Species Act for U.S. Fish and Wildlife Service, Regions 3 and 6 (2016). There are no grassland corridors that connect the reintroduction site to the Project, and given the distance and the intervening cultivated fields, it is not expected that the reintroduced population would disperse into the Project vicinity.

4. What are the potential risks of adverse impacts of the proposed project to individuals and local populations of species of concern and their habitats?

This Project is a repowering of an existing project and the current layout minimizes impacts to wildlife and habitats by concentrating activity in agricultural lands. By siting the repowering turbines in cultivated fields and designing the associated infrastructure to avoid or minimize impacts on the native plant communities, grasslands, wetlands, and streams, Lake Benton II has designed the Project facilities to avoid and minimize impacts on species of concern and other wildlife, including direct (mortality) and indirect (displacement, habitat loss and fragmentation) impacts. The repowering footprint as currently planned reduces the grassland fragmentation associated with turbines and wildlife displacement effects. Thus, adverse effects on species of concern and their habitats are not anticipated to occur as a result of construction and operation of the Project.

The site poses a low risk to bald eagles due to relatively low levels of observed eagle use, absence of eagle nests near the Project (nearest observed nest was 7.6 miles away) and general lack suitable nesting or foraging habitat in the Project. In addition, abundant prey for eagles is not expected to be present within the Project. Limited foraging opportunities may be present in the form of carrion, livestock carcasses, small game within grasslands/croplands, and waterfowl within the nearby WMAs.

5. How can developers mitigate identified significant adverse impacts?

Project design and construction best management practices are being developed based on the results from Tier 3 studies and information available in the WEG and from other studies at wind energy facilities. The steps to avoid and reduce impacts are described in Section 1.2 and Section 3.

6. Are there studies that should be initiated at this stage that would be continued in either Tier 4 or Tier 5?

Lake Benton II plans to conduct Tier 4 post-construction monitoring studies for the Project as detailed in Section 4.

2.3 Summary of Agency Coordination

The WEG highlight that coordination with state and federal wildlife agencies is paramount early in the development process as the developer gathers the information necessary for the tiered review process. Lake Benton II obtained input on the Project throughout the siting and development processes. Agency coordination is summarized in Appendix A.

As part of the LWECS Site Permit amendment process, Lake Benton II will further coordinate with the USFWS, MNDOC, and MNDNR on the proposed layout(s). As additional recommendations and comments are received from the agencies, this WCS will be updated accordingly.

3. SITING, DESIGN, CONSTRUCTION, AND OPERATIONAL MITIGATION MEASURES

3.1 Siting and Design Measures

Although this Project is a repowering of an existing Lake Benton II Project, the siting and development process for the Project included a tiered-study review process that follows the tiered approach detailed in the USFWS WEG (USFWS 2012). Information gathered during Tier 1, 2, and 3 studies was used for the turbine and infrastructure siting process to minimize potential impacts to birds and bats and their habitats. Prior to designing the facility layout, Lake Benton II incorporated setback and constraint information from literature reviews, Tiers 1, 2, and 3 studies, and agency recommendations. This information was used to adjust the Project boundary, establish setbacks, and inform site design.

3.1.1 Project Siting Measures Used to Reduce Impacts

- The Project was designed with fewer overall turbines (137 to 44), thereby reducing the overall impact of area affected by ground disturbance
- The Project was designed with standard setbacks for non-participating landowners, residences, state and federally owned lands (i.e., five rotor diameters [RD]/three RD), and for factors such as sound, shadow, etc.
- Turbines were primarily sited in agricultural fields to the greatest extent feasible thus avoiding impacts on the natural areas (e.g., native prairie, grasslands, calcareous fens, wetlands, etc.), thereby reducing potential impacts to birds, bats, and species of concern (Table 7.)

- Other Project infrastructure (e.g., collector lines, access roads) were laid out to avoid or minimize impacts on the natural areas to the extent practicable. When possible, access roads will be reused.

3.1.2 Avoidance/Minimization of Impacts to Native Plant Communities

Turbines were primarily sited in agricultural fields to the greatest extent feasible thus avoiding impacts on the natural areas (e.g., native prairie, grasslands, calcareous fens, wetlands, etc.), thereby reducing potential impacts to birds, bats, and species of concern (*see* Table 7). To the extent possible, the Project layout will be developed to use the existing public and private road network and to avoid clearing forests and natural habitats during Project construction. Impacts to these habitats have been minimized. Lake Benton II is coordinating with the MNDNR on the Native Prairie Protection Plan (NPPP), which will be finalized prior to construction. If design changes result in proposed impacts within potential areas of native prairie or wetland communities that may contain listed plant species, Lake Benton II will coordinate with the MNDOC, the USFWS and MNDNR to determine next steps.

Table 7. Land cover types[a], of the existing and proposed turbine field at Lake Benton II Wind Energy Center.

Land cover (habitat) [a]	Existing Turbines (%)	Proposed Turbines[b] (%)
Herbaceous	65%	0%
Hay and Pasture	25%	9%%
Row Crops	9%	91%
Deciduous Forest	1%	0%
Turbines	***137***	***44***

[a] Data from the National Landcover Database (USGS NLCD 2011).visually inspected and corrected.
b Four alternate turbine locations are in Row Crops(3) and herbaceous (1) land covers

3.1.3 Project Design Measures Used to Reduce Impacts

- Wind turbines designed with tubular towers and no external ladders or platforms on the towers or nacelles will be used so bird perching and nesting opportunities are minimized.
- The number of turbines with visibility lighting will be minimized, within Federal Aviation Administration (FAA) requirements.
- FAA-approved lighting uses the shortest allowable flash duration, the minimum allowed flashes per minute, and all lights flash at the same time so that nocturnal migrating birds are not disoriented by lights.
- Lighting at the operations and maintenance facility, Project substation, and other installations is minimized and designed so that light is directed downward (toward the access or work area) and is hooded to prevent light from shining into the sky and attracting or disorienting nocturnal migrants. Motion or heat-activated lighting is used where practicable.
- Because the wind resource is known in this area, no additional temporary or development meteorological (met) towers are expected to be installed at this Project. If additional operational or SCADA MET towers are needed, the Project will utilize free

standing towers where possible without guy wires and if guy wires are needed for stabilization during snowy weather, the guy wires will be marked with bird diverters.

- Electrical collection systems within the Project will be buried underground, and above ground electrical systems, including pad-mounted transformers, will follow applicable guidance by Avian Power Line Interaction Committee (APLIC) for minimizing the risks to birds.

3.2 Construction Measures

This WCS covers the repowering of the existing Lake Benton II Wind Center Project. Construction activities are planned start in 2019. Measures that will be taken to minimize wildlife impacts during construction are described below.

3.2.1 Construction Personnel Training

All construction personnel and contractors will be trained to identify sensitive resources and potential wildlife conflict situations and proper responses. Additionally, training will include education on the standard measures to be followed during construction to minimize wildlife impacts, including:

1. Industry-standard best management practices will be implemented to protect topsoil and adjacent resources and to minimize soil erosion.
2. All surface-disturbed areas will be restored to the approximate original contour and reclaimed in accordance with easement agreements.
3. Removal or disturbance of vegetation will be minimized through site management (e.g., by utilizing previously disturbed areas, designating limited equipment/materials storage yards and staging areas, scalping) and reclaiming all disturbed areas not required for operations.
4. Speed limits on Project access roads (25 mph) will be followed to minimize wildlife mortality due to vehicle collisions.
5. Travel will be restricted to designated roads; off-road travel will be minimized as feasible.
6. Construction activities will be performed using standard construction best management practices so as to minimize the potential for accidental spills of solid material, contaminants, debris, and other pollutants. Excavated material or other construction materials will not be stockpiled or deposited near or on stream banks.
7. No burning or burying of waste materials will occur at the Project site. All contaminated soil and construction debris will be removed and disposed of in approved landfills in accordance with appropriate environmental regulations.
8. All employees and contractors will follow federal and state measures for handling toxic substances to minimize contamination of water and wildlife resources.

3.3 Operational Measures

This section identifies impact avoidance and minimization measures that will be incorporated into operation of the Project. These measures were derived from the voluntary WEG and industry BMPs. All avoidance and minimization measures implemented during the operational

phase demonstrate practical means to reduce impacts to bird and bat species and their habitats.

- Avian and bat fatalities will be evaluated during standardized post-construction fatality monitoring (see Section 4).
- Lake Benton II will implement an Adaptive Management Program (Section 6) for avoidance, minimization, and mitigation of impacts to birds, bats, and other sensitive wildlife.
- A site-specific worker environmental training plan will be developed and implemented throughout the Project operating life to inform workers of the biological resources present on-site to minimize wildlife impacts. All employees and contractors working in the field will be required to attend the environmental training session prior to working on site. This training will include information regarding the sensitive biological resources, restrictions, protection measures, individual responsibilities associated with the Project, and the consequences of non-compliance. Written material will be provided to employees at orientation and participants will sign an attendance sheet to document their participation.
- "Good housekeeping" procedures will be developed to keep the site clean of debris, garbage, carrion, fugitive trash or waste, and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards. This will prevent trash from being exposed or blown around the Project, and will avoid attracting predators and potential food sources for eagles and other predators (i.e., rodents and other small mammals) to the Project.
- Vehicle speeds will be limited to 25 miles per hour on Project roads to minimize vehicle collisions with wildlife.
- Road-killed animals or other carcasses (excluding eagles and other migratory birds) detected by personnel on or near roads within the Project will be removed promptly to avoid attracting eagles or other raptors to the Project. Carcass removal will be conducted following an approved protocol.
- To avoid habitat destruction, BMPs for fire prevention during operation will be implemented to minimize wildfire potential.
- Lake Benton II workers and subcontractors will not be allowed to have firearms or pets at the Project and will be instructed to not disturb or harass wildlife.
- Lighting of the turbines will be pursuant to Federal Aviation Administration aviation hazard lighting standards. Lake Benton II may also install motion activated timed lighting on tower entrances and other facilities that require lighting at night to avoid the potential to attract insects that may draw birds and bats toward the facility.
- Lake Benton II has agreed to develop and implement this WCS in its continued efforts to demonstrate due diligence in avoiding and minimizing impacts to avian and bat species in association with development and operation of the Project.

In addition to the operational measures listed above, specific measures to minimize bat fatalities will be implemented, including:

- feathering turbine blades up to the manufacturer set cut-in speed from one-half hour before sunset to one-half hour after sunrise, from April 1 – October 31.

4. POST-CONSTRUCTION ACTIVITIES (Tier 4)

According to the WEG, "during post-construction tiers (including Tier 4), developers are assessing whether actions taken in earlier tiers to avoid and minimize impacts are successfully achieving the goals and, when necessary, taking additional steps to compensate for impacts" (USFWS 2012). The specific questions to be investigated in Tier 4 are:

1. What are the bird and bat fatality rates for the Project?
2. What are the fatality rates of species of concern?
3. How do the estimated fatality rates compare to the predicted fatality rates?
4. Do bird and bat fatalities vary within the project site in relation to site characteristics?
5. How do the fatality rates compare to the fatality rates from existing projects in similar landscapes with similar species composition and use?
6. What is the composition of fatalities in relation to migrating and resident birds and bats at the site?
7. Do fatality data suggest the need for measures to reduce impacts?

After post-construction field surveys and analysis are completed in accordance with the protocol described below, Lake Benton II will review the efforts and make a determination pursuant to the WEG "Decision Framework for Tier 4a Fatality Monitoring" (USFWS 2012) to determine the need for further monitoring or if any measures are needed to reduce impacts.

4.1 Formal Avian and Bat Fatality Monitoring

Fatality monitoring will provide information on the impact of the Project on birds and bats and give an indication if any specific turbines or Project facilities are responsible for a significant proportion of fatalities. Impacts to avian and bat species are anticipated to be within the overall range of other Minnesota and Midwestern facilities. The objective of the monitoring will be to determine if the avian and bat fatality rates are lower, similar to, or higher than other Minnesota, regional and national studies.

Fatality monitoring will begin after all the new turbines have been commissioned and are fully operational, and will be conducted by a third-party biologist. The duration and intensity of carcass searches, the number of selected turbines, and the levels of searcher efficiency and carcass removal trials will be consistent with general wind industry standard practices and the recommendations from the MNDOC, MNDNR, and USFWS, and will follow the protocols for low risk sites as described in the *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (Mixon et al. 2014). A discussion of each of the major fatality monitoring

components is in the following sections; as the layout is finalized the monitoring plan will be updated to include the final details of the proposed approach.

4.1.1 Survey Period

Formal carcass searches will be conducted for a minimum of one year. The search frequency will be one day per week for road and pad searches, and cleared plot search areas from March 15 through November 15, with a minimum of three days of separation between searches. The exact start and ending dates may be modified pending ground visibility and excess snowfall. The following dates will be used for defining seasons in the study during monitoring:

Season	Date Range
Spring	March 15 – May 14
Summer	May 15 – July 31
Fall	August 1 - November 15

4.1.2 Turbine Selection Method

The MNDNR's recommended post-construction protocol for low risk sites states that a minimum of 10 turbines be searched by transect. The avian and bat fatality monitoring will include a search of a subset of turbines selected to provide representative coverage throughout the Project. For the Lake Benton II Wind Energy Center, Lake Benton II will search 10 plots, which will be a minimum of 21 percent of the total turbines on the Project site. The turbines selected for cleared plots will be selected by the third-party biologist, and the proposed selection of cleared plots will be provided to the MNDNR and MNDOC no later than three months before the anticipated start of post-construction surveys or March of 2020. The cleared plot turbines will be selected to spatially represent the distribution of turbines within the Project and any unique habitat features such as riparian or grassland areas.

4.1.3 Search Methods

The objective of the standardized carcass searches is to systematically search plots centered on turbines for bat and bird casualties that are attributable to collision with Project facilities. The cleared search plots will consist of an area of 393 x 393 ft (120 x 120 m) centered on the turbine. A searcher will walk at a casual rate of approximately 148 to 197 ft (45 to 60 m) per minute through the search area. The searcher will scan the area on both sides of each search transect, which will be spaced 20 ft (6 m) apart.

At each search turbine, the following data will be recorded: date; start time; end time; observer; and the turbine number. When a bat or bird carcass is found during a search, the searcher will place a metal pin flag or similar marker at the carcass and finish searching the plot. After the plot has been completely searched, the searcher will return to each carcass and record information on a fatality data sheet, including date, species, sex and age (when possible), observer name, turbine number, distance from turbine (meters), azimuth from turbine, Universal Transverse Mercator [UTM] coordinates, habitat surrounding carcass, visibility class, condition of carcass (intact, partial, scavenged), and estimated time of death (e.g., <1 day, 2 days). Digital photographs will be taken of all carcasses, any injuries, and surrounding habitat.

4.1.4 Injured Wildlife Handling and Reporting Protocol

All injured raptors, waterfowl, waterbirds, federally or state-listed bird species, and federally-listed bats will be documented and handled according to the incidental reporting procedure outlined in Appendix C.

4.1.5 Incidental Finds Outside of Formal Searches

Casualties found outside the formal search area by carcass searchers will be documented in accordance with the standard survey protocol as closely as possible. Casualties found in non-search areas (e.g., near a turbine not included in the search area for that day) will be coded as incidental discoveries and will be documented in a similar manner as those found during standard searches, but not included in the analysis.

4.1.6 Weather Monitoring

Weather conditions will be documented during each survey period, including cloud cover, temperature, and wind direction and speed at the time of survey.

4.1.7 Carcass Information

The condition of each carcass found will be recorded using the following categories:

- Intact – a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger;
- Scavenged – an entire carcass, which shows signs of being fed upon by a predator or scavenger, or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, legs, pieces of skin, etc.); or
- Feather Spot - 10 or more feathers at one location indicating predation or scavenging.

In addition to carcasses, all injured birds or bats observed in search plots or elsewhere in the Project (e.g., near a turbine not included in the search area) will be recorded and treated as a fatality for analysis purposes (if found in search plots) or as an incidental find if found outside the search plot. The injured birds and bats will be handled in accordance with the procedures specified in Section 4.1.4.

4.1.8 Searcher Efficiency Trials

The objective of the searcher efficiency trials is to estimate the percentage of casualties which are found by searchers. Trials will be conducted during all seasons. Estimates of searcher efficiency will be used to adjust the total number of carcasses found for those missed by searchers and correcting for detection bias.

Searcher efficiency trials will begin when carcass search studies begin. Personnel conducting carcass searches will not know when trials are conducted or the location of the detection carcasses. A minimum of 75 carcasses per plot type, distributed approximately evenly among size classes, will be used for searcher efficiency trials. Searcher efficiency carcasses will

include: commercially available species, such as dark hopper-sized house mice (*Mus musculus*; approximately two to three week old weaned mice) as bat surrogates; house sparrows (*Passer domesticus*) and two week old northern bobwhite quail (*Colinus virginianus*) for small birds; and rock pigeons (*Columba livia*) and ring-necked pheasants (*Phasianus colchicus*) for large birds. As bat carcasses can be difficult to obtain, small bird searcher efficiency or mice may be used as surrogates. As the study progresses, if bat carcasses are found they will be incorporated into the searcher efficiency trials for later seasons.

All carcasses will be placed at random locations within areas being searched on the day of, or on the evening prior to the carcass search. Carcasses will be dropped from waist high or higher and allowed to land in a random posture. Each trial carcass will be discreetly marked prior to dropping so that it can be identified as a study carcass after it is found. The number and location of the detection carcasses found during the carcass search will be recorded. The number of carcasses available for detection during each trial will be determined immediately after the trial by the person responsible for distributing the carcasses.

4.1.9 Carcass Persistence Trials

The objective of carcass persistence trials is to estimate the likelihood that a carcass is removed by scavengers as a function of the time (measured in days) since the trial carcasses are placed in the field. Carcass removal includes removal by predation or scavenging, or removal by other means such as being plowed into a field. Carcass persistence studies will be conducted in the search plots during spring, summer, and fall seasons to adequately cover seasons and vegetation conditions. Estimates of carcass persistence will be used to adjust the total number of carcasses found for those removed from the study area, correcting for removal bias.

Carcass persistence trials will begin when carcass search studies begin. A minimum of 50 carcasses per plot type, distributed approximately evenly among size classes, will be used for carcass persistence trials.

All carcasses will be placed at random locations within the search area. Carcasses will be dropped from waist high or higher and allowed to land in a random posture. Each trial carcass will be discreetly marked prior to dropping so that it can be identified as a study carcass if it is found by other searchers or wind facility personnel.

Personnel conducting carcass searches will monitor the trial birds over a 30-day period according to the following schedule as closely as possible. Carcasses will be checked every day for the first four days, and then on day 7, day 10, day 14, day 20, and day 30. This schedule may vary depending on weather and coordination with the other survey work. Experimental carcasses will be left at the location until the end of the carcass persistence trial. At the end of the 30-day period any evidence of the carcasses that remain will be removed.

Scavenger removal rates will be regularly checked to confirm that removal rates are not exceedingly short. If the removal time is very short, measures to address this will be developed so that additional uncertainty is not added into the analysis unnecessarily. These measures may

include increasing search frequency or, if avian scavengers are suspected of removing carcasses, placing carcasses at night (i.e., some avian predators that are active during the day may cue in on and remove carcasses immediately after placement). The frequency of the standardized searches may be increased if carcass persistence rates by scavengers are so high at the Project site that it precludes accurate bird and bat fatality estimates. For example, more frequent searches could be necessary if scavengers are removing a majority of carcasses from the site within a few hours or days. Based on removal trials at other wind project sites in the region, this level of carcass scavenging is not anticipated.

4.1.10 Estimation of Fatality

Fatality estimation is a complex task due to a number of variables present in every study. Fatalities occur at an unknown rate, persist for variable amounts of time, and can be detected with varying levels of success based on carcass characteristics and ground cover. To account for these variables, fatality rate estimation methods have been developed.

Estimates of facility-related fatalities are based on:

(1) Observed number of carcasses found during standardized searches during the monitoring year for which the cause of death is either unknown or is probably facility-related;
(2) Persistence rates expressed as the estimated average probability a carcass is expected to remain in the study area and be available for detection by the searchers during persistence trials:
(3) Searcher efficiency expressed as the proportion of planted carcasses found by searchers during searcher efficiency trials; and
(4) Search area adjustment based on the area searched and carcass density.

Annual and if necessary seasonal fatality estimates will be provided for the following groups: 1) all birds, 2) small birds, 3) large birds, 4) raptors, and 5) bats. The total number of fatalities in each group listed above will be estimated by adjusting for carcass persistence, searcher efficiency rates, and density weighted search area via a fatality estimator model. Per the MNDNR's recommended post-construction protocol, two estimators will be used to calculate fatality estimates, the Huso and Shoenfeld estimators if appropriate.

The per-turbine and/or per-megawatt fatality rate point estimates will be calculated using the two estimators. Standard errors and 90% confidence intervals will be calculated using bootstrapping (Manly 1997). Bootstrapping is a computer simulation technique that is useful for calculating point estimates, variances, and confidence intervals for complicated test statistics. A total of 1,000 bootstrap samples are planned to be used. The standard deviation of the bootstrap estimates is the estimated standard error. The lower 5th and upper 95th percentiles of the 1,000 bootstrap samples will be estimates of the lower limit and upper limit of 90% confidence intervals.

4.2 Incidental Monitoring

4.2.1 Training of On-Site Staff

Operations personnel will be trained to identify potential wildlife conflicts and the proper response. This training will include an awareness of potential avian and wildlife injuries or fatalities that may occur during operation of the facility following the incidental reporting procedure outlined in Appendix C.

4.3 Post-Construction Results and Recommendations Reporting Protocol

Lake Benton II will prepare an annual report summarizing the results of the monitoring and assessment completed as described in Section 4.1. This report will be submitted to the MNDOC, MNDNR, and USFWS.

Specific to the formal avian and bat fatality monitoring, the report will include turbine-specific information on found carcasses along with estimated fatality rates for birds and bats. Fatality estimates will be calculated for bats, all birds, and raptors, at a minimum. Seasonal estimates for both birds and bats will also be reported. Estimated fatality rates will be calculated using the total number of carcasses found along with data from searcher efficiency and carcass removal trials. The annual report will include the estimated bat fatalities per MW, as well as a facility-wide bat fatality estimate on an annual and operational lifespan scale for the Project. The report will include an analysis that provides a comparison of fatality estimates, searcher efficiency, and scavenger removal rates between the cleared plots and road and pad searches. Additionally, the report will include information on the results from incidental monitoring.

In addition to the summary report that will be completed after the post-construction monitoring, Lake Benton II will provide the necessary quarterly and annual incident reports as required by the site permit to the MNDOC, MNDNR, and USFWS, identifying recommendations for next steps. Data from these Tier 4 studies will be one component in implementing the adaptive management portion of this WCS (see Section 6.0).

5. RESEARCH (TIER 5)

In addition to Tiers 1 through 4 described above, the WEG contains a *Tier 5 Other Post-Construction Studies*. In general, the studies identified in Tier 5 are research-related and “will not be necessary for most wind energy projects.” Results from the Tier 4 studies will be reviewed to determine the necessity for Tier 5 studies; however, these studies are not anticipated for this Project.

6. ADAPTIVE MANAGEMENT

Within the WEG, the USFWS defines adaptive management as “an iterative decision process that promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood.

Comprehensively applying the tiered approach embodies the adaptive management process" (USFWS 2012). The WEG further notes that adaptive management at most wind facilities is unlikely to be needed if they are sited in accordance with the tiered approach. Nevertheless, Lake Benton II recognizes the value of applying this approach to its Project activities that include some uncertainty. As such, Lake Benton II has incorporated an adaptive approach for the conservation of wildlife potentially impacted by the Project.

6.1 Unexpected Avian, Bat, and/or Habitat Impacts

Based on the results of the Tier 4 monitoring program described in Sections 4.1 through 4.3, adaptive management measures could be considered to further avoid, minimize, or compensate for unanticipated and significant Project impacts to wildlife. Thresholds for considering an adaptive response will include:

- Mortality of an eagle or mortality of a species listed as endangered/threatened under the federal Endangered Species Act or Minnesota's Endangered Species Statute. Note that the final 4(d) ruling for the northern long-eared bat currently exempts wind energy projects from incidental take of this species during operation. Any documented northern long-eared bat mortality will be reported to the USFWS and MNDOC but no adaptive management measures are necessary or required under the current 4(d) rule. If the status of the northern long-eared bat is downgraded, or the 4(d) rule is changed, Lake Benton II will update this WCS and adaptive management measures as appropriate; or

- Significant levels of mortality of unlisted species of birds or bats. Significance will be determined by qualified biologists and will be based on the latest information available, including the most recent data on species' population sizes and trends. For example, even relatively high levels of mortality of the most common species may not be significant. Conversely, lower levels of mortalities of less common species may be of more concern, particularly if these species appear to be at risk (e.g., USFWS Birds of Conservation Concern).

7. IMPLEMENTATION OF THE WCS

7.1 Document Availability

This WCS will be maintained by Lake Benton II's environmental representative and a copy of the WCS will be kept on-site throughout operations of the Project.

7.2 Annual Audits

Lake Benton II will, by March 15 following each complete or partial calendar year of operation, file with the PUC an annual report detailing findings of its annual audit of WCS practices. The annual report will include summarized and raw data of bird and bat fatalities and injuries. The annual report will also identify any deficiencies or recommended changes in the operation of the Project or in the WCS to reduce avian and bat fatalities and will provide a schedule for

implementing the corrective or modified actions. Lake Benton II will provide a copy of the report to the MNDNR and the USFWS at the time of filing with the PUC.

7.3 Reporting

Lake Benton II will provide quarterly wildlife incident reports (a summary) to the MNDOC, MNDNR, and USFWS for the life of the LWECS Site Permit. Additionally, the Project owner and the MNDOC, MNDNR, and the USFWS will be notified within 24 hours of the discovery of any of the following:

(a) An incident of one or more dead or injured state threatened, endangered, or species of special concern; or
(b) one or more dead or injured federally listed species; or
(c) one or more dead or injured bald or golden eagles.

7.4 Primary Contacts

Key resource personnel associated with this WCS include the following:

- Lake Benton II Wind Energy Center: Kate Schindler
  - Office: (651) 267-6044
  - Email: kate.schindler@xcelenergy.com

- US Fish and Wildlife Service: Mags Rheude
  - Office: (952) 252-0092 ext. 202
  - Email: Margaret_Rheude@fws.gov

- US Fish and Wildlife Service Law Enforcement
  - Office: USFWS Law Enforcement – St. Paul Station
  - Contact: (651) 778-8360

- Minnesota Department of Natural Resources: Cynthia Warzecha
  - Office: 651-259-5078
  - Email: Cynthia.warzecha@state.mn.us

- Minnesota Department of Commerce: Rich Davis
  - Office: (651) 539-1846
  - Email: richard.davis@state.mn.us

8. REFERENCES

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Appendix A. Agency Correspondence

Date	Task	Deliverable Type	Communication Type	To	From	Possible/Pending Action Items
9/26/2016	WRA	MNDNR Preliminary Review	Letter	NEER - Jennifer Field	MNDNR - Kevin Mixon	Preliminary review of Lake Benton II Wind area
3/28/2017	WRA		Email	MNDNR NHIS Review	Atwell - Sean Fitzgerald	NHIS Data Request for Lake Benton II
7/18/2017	WRA	NHIS Review	Email	MNDNR - Samantha Bump	Atwell - Sean Fitzgerald	NHIS review for general repower boundary. Additional survey recommendations and further NHIS review once infrastructure layout is finalized is requested.
9/26/2017	WRA		Meeting Minutes	MNDNR (various), USACE - Justin Berndt, Pipestone County - Kyle Krier	Atwell (various), NEER (various)	**Subject:** Lake Benton II Wind Project -Waters & Wetlands Permitting
10/19/2017	WRA		Meeting Minutes	MNDNR (various), USFWS - Mags Rheude	Atwell (various), NEER (various), WEST - Joyce Pickle, Xcel (various)	**Subject:** Lake Benton II Introductory Meeting

Appendix B. Wildlife Survey Results 2016-2018

As research reports are finalized this Appendix will be populated

Appendix C. Incidental Reporting Procedure

Operational Fatality Monitoring

O&M staff will conduct inspections for bird and bat fatalities each time a turbine is visited as an auxiliary effort to regular operations and maintenance activities. Any carcasses discovered by O&M staff will be recorded as incidental fatalities. Incidentally found wildlife will be documented for the life of the wind farm to identify wildlife concerns should they arise.

Training

All operations personnel will be trained to identify potential wildlife conflicts and the proper response, and training records will be maintained on-site. This training will include sensitivity to birds and other wildlife. An incidental reporting process will be developed for operations personnel ensuring they can document bird or bat casualties during routine maintenance work and at other times that they are within the Project. Incidentally found wildlife will be reported according to federal and state collection permits, as applicable.

Any injured wildlife observed during operations of the Project will be left in place until Lake Benton II's primary environmental representative has been contacted (see the table below for contact information). The environmental representative will decide the most appropriate course of action depending on the condition and species of injured animal discovered. All injured eagles or federally-listed species will be handled in accordance with applicable federal and state collection permits, as applicable, or as directed by appropriate law enforcement personnel.

Key Resources

Kate Schindler Xcel Energy/Environmental Analyst	Office:	651-267-6044
Environmental Incident Reporting Hotline (Xcel Energy)		TBD
Operations and Maintenance Building	On-Site:	TBD
US Fish and Wildlife Service, Region 3; Bloomington, MN Mags Rheude	Office:	952-252-0092 ext. 202
US Fish and Wildlife Service Law Enforcement St. Paul Station	Office:	(651) 778-8360
Minnesota Department of Natural Resources Cynthia Warzecha	Office:	(651) 259-5078