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

Odell Wind Farm
Cottonwood, Jackson, Martin, and Watonwan Counties, Minnesota

Docket No. IP6914/WS-13-843

September 26, 2013

GERONIMO ENERGY

7650 Edinborough Way
Suite 725
Edina, MN 55435

Applicant:	Odell Wind Farm, LLC
Address:	7650 Edinborough Way, Suite 725 Edina, MN 55435
Authorized Representative:	Betsy Engelking Vice President of Development Geronimo Wind Energy, LLC d/b/a Geronimo Energy, LLC
Signature:	
Phone:	952-988-9000
Fax:	952-988-9001
Email:	betsy@geronimoenergy.com

TABLE OF CONTENTS

1.0 Applicant Information 1

2.0 Certificate of Need 1

3.0 State Policy 2

4.0 Project Description and Overview 2

5.0 Project Design 4
5.1 Description of Layout 4
5.2 Description of Turbines and Towers 9
5.2.1 Wind Turbine Design and Operation 9
5.2.2 Turbine Model Selection and Types 9
5.3 Description of Electrical System 11

6.0 Description and Location of Associated Facilities 12
6.1 Collector Lines and Feeder Lines 12
6.2 Additional Associated Facilities 13
6.3 Access Roads 13
6.4 Permitting for Associated Facilities 14

7.0 Wind Rights 14

8.0 Environmental Impacts 14
8.1 Demographics 14
8.1.1 Impacts 16
8.1.2 Mitigative Measures 16
8.2 Land Use 16
8.2.1 Local Zoning and Comprehensive Plans 16
8.2.2 Conservation Easements 18
8.2.3 Impacts 18
8.2.4 Mitigative Measures 19
8.3 Noise 19
8.3.1 Description of Resources 19
8.3.2 Impacts 21
8.3.3 Mitigative Measures 25
8.4 Visual Impacts 26
8.4.1 Existing Aesthetics 26
8.4.2 Visual Impacts on Public Resources 26
8.4.3 Visual Impacts on Private Lands and Homes 27
8.4.4 Shadow Flicker 28
8.4.5 Impacts 30
8.4.6 Mitigative Measures 31
8.5 Public Services and Infrastructure 32
8.5.1 Roads 32

8.5.2 Telecommunications ... 33
8.5.3 Communications Systems ... 33
8.5.4 Television ... 33
8.5.5 Other Infrastructure and Services ... 34
8.5.6 Impacts ... 34
8.5.7 Mitigative Measures ... 35
8.6 Cultural and Archaeological Resources ... 37
8.6.1 Description of Resources ... 37
8.6.2 Impacts ... 40
8.6.3 Mitigative Measures ... 40
8.7 Recreation ... 40
8.7.1 Description of Resources ... 40
8.7.2 Impacts ... 43
8.7.3 Mitigative Measures ... 43
8.8 Public Health and Safety ... 43
8.8.1 Description of Resources ... 43
8.8.2 Impacts ... 45
8.8.3 Mitigative Measures ... 47
8.9 Hazardous Materials ... 48
8.9.1 Description of Resources ... 48
8.9.2 Impacts ... 49
8.9.3 Mitigative Measures ... 49
8.10 Land-Based Economies ... 49
8.10.1 Description of Resource ... 49
8.10.2 Forestry ... 50
8.10.3 Mining ... 50
8.10.4 Impacts ... 51
8.10.5 Mitigative Measures ... 52
8.11 Tourism ... 52
8.11.1 Description of Resources ... 52
8.11.2 Impacts ... 52
8.11.3 Mitigative Measures ... 52
8.12 Local Economies ... 53
8.12.1 Impacts ... 53
8.12.2 Mitigative Measures ... 54
8.13 Topography ... 54
8.13.1 Description of Resources ... 54
8.13.2 Impacts ... 54
8.13.3 Mitigative Measures ... 54
8.14 Soils ... 55
8.14.1 Description of Resources ... 55
8.14.2 Impacts ... 55
8.14.3 Mitigative Measures ... 55
8.15 Geologic and Groundwater Resources ... 55
8.15.1 Description of Resources ... 55
8.15.2 Impacts ... 56

8.15.3 Mitigative Measures 56
8.16 Surface Water and Floodplain Resources 56
8.16.1 Description of Resources 56
8.16.2 Impacts 57
8.16.3 Mitigative Measures 58
8.17 Wetlands 58
8.17.1 Description of Resources 58
8.17.2 Impacts 59
8.17.3 Mitigative Measures 59
8.18 Vegetation 60
8.18.1 Description of Resources 60
8.18.2 Impacts 62
8.18.3 Mitigative Measures 62
8.19 Wildlife 63
8.19.1 Description of Resources 63
8.19.2 Impacts 67
8.19.3 Mitigative Measures 67
8.19.4 DNR Waterfowl Feeding and Resting Areas 68
8.19.5 Important Bird Areas Within and Adjacent to Project Area 68
8.20 Rare and Unique Natural Resources 68
8.20.1 Description of Resources 68
8.20.2 Identify Native Prairie Within or Adjacent to Project Area 71
8.20.3 Impacts 71
8.20.4 Mitigative Measures 72

9.0 Site Characterization 73
9.1 Site Wind Characteristics 73
9.1.1 Interannual Variation 74
9.1.2 Seasonal Variation 74
9.1.3 Diurnal Conditions 75
9.1.4 Atmospheric Stability 75
9.1.5 Hub Height Turbulence 75
9.1.6 Extreme Wind Conditions 76
9.1.7 Wind Speed Frequency Distribution 76
9.1.8 Wind Variation with Height 77
9.1.9 Spatial Wind Variation 77
9.1.10 Wind Rose 77
9.1.11 Other Meteorological Conditions 78
9.1.11.1 Average and Extreme Weather Conditions 78
9.2 Location of Other Wind Turbines within Ten Miles of Project Area 79

10.0 Project Construction 79
10.1 Roads and Infrastructure 80
10.2 Access Roads 81
10.3 Associated Facilities 82
10.3.1 Operation and Maintenance Facility 82

10.3.2 Step-Up Substation ... 82
10.3.3 Laydown and Staging Areas ... 82
10.3.4 Meteorological Towers ... 82
10.4 Turbine Site Location ... 82
10.4.1 Foundation Design ... 83
10.4.2 Tower ... 83
10.5 Post Construction Clean-up and Site Restoration ... 83
10.6 Operation of Project ... 84
10.6.1 Project Control, Management, and Service ... 84
10.7 Costs ... 86
10.7.1 Capital and Operational Costs ... 86
10.7.2 Site and Design Dependent Costs ... 86
10.8 Schedule ... 86
10.8.1 Land Acquisition ... 86
10.8.2 Equipment Procurement, Manufacture and Delivery ... 86
10.8.3 Construction ... 86
10.8.4 Construction Financing ... 87
10.8.5 Permanent Financing ... 87
10.8.6 Expected Commercial Operation Date ... 87
10.9 Energy Projections ... 87
10.9.1 Proposed Array Spacing for Wind Turbines ... 87
10.9.2 Base Energy Projections ... 87
10.10 Decommissioning and Restoration ... 87
10.10.1 Anticipated Life of the Project ... 88
10.10.2 Cost to Decommission ... 88
10.10.3 Decommissioning and Restoration Funds ... 88
10.10.4 List of Decommissioning and Restoration Activities ... 88

11.0 Identification of Other Permits ... 90

12.0 References ... 94

TABLES AND CHARTS

Table 4.1 – Project Location
Table 5.1 – Wind Turbine Setback Requirements for the Project
Table 5.2 – Representative Minimum Turbine Spacing Distances by Turbine Model
Table 5.3 – Turbine Siting Considerations and Approximate Schedule
Table 5.4 – Wind Turbine Characteristics
Table 8.1 – Demographic Information for the Counties and Townships in the Project Area
Table 8.2 – Comprehensive Plan Inventory for Local Governments within Project Area
Table 8.3 – Decibel Levels of Common Noise Sources
Table 8.4 – MPCA State Noise Standards – Hourly A-Weighted Decibels
Table 8.5 – Existing Sound Levels
Table 8.6 – Wind Turbine Specifications
Table 8.7 – Monitoring Site Characteristics
Chart 8.8 – Sound Level and Distance
Table 8.9 – L_{50} Sound Levels at Potential Receptors
Table 8.10 – Rotor Diameter and Number of Turbines
Table 8.11 – Wind Direction Distribution Assumptions for Shadow Flicker Model
Table 8.12 – Probability of Sunshine Assumptions for Shadow Flicker Model
Table 8.13 – Summary of Roadways within Project Area
Table 8.14 – FCC Licensed Signals within Five Miles of Project Area
Table 8.15 – Digital Television Signals in Project Area
Table 8.16 – Previously Identified Archaeological Sites
Table 8.17 – Previously Identified Standing Structures
Table 8.18 – Wildlife Management Areas less than Ten Miles from the Project Area
Table 8.19 – Waterfowl Production Areas Less than Ten Miles from the Project Area
Table 8.20 – FAA Registered Airports and Airstrips within 20 Miles of the Project
Table 8.21 – Unregistered Private Airstrips in the Project Area
Table 8.22 – Community Economic Benefits
Table 8.23 – FEMA Flood Insurance Rate Maps
Table 8.24 – NWI Polygon Data Wetland Areas by Type
Table 8.25 – NWI Line Data Wetland Length By Type
Table 8.26 – AES Vegetation Cover Type Descriptions
Table 8.27 – Vegetation-cover Types at the Odell Project Area
Table 8.28 – Completed Point Count Survey Effort at the Odell Project Area
Table 8.29 – Continuing Point Count Survey Effort at the Odell Project Area
Table 9.1 – Average Wind Speed
Chart 9.2 – Diurnal Wind Speeds

Table 9.3 – Extreme Wind Events
Chart 9.4 – Wind Speed Frequency Distribution
Chart 9.5 – Odell Wind Rose
Table 11.1 – Permits and Approvals

FIGURES

Figure 4.1 – Project Location
Figure 5.1-1 – Turbine Layout and Constraint (G97)
Figure 5.1-2 – Turbine Layout and Constraint (V110)
Figure 5.1-3 – Turbine Layout and Constraint (GE87)
Figure 5.1-4 – Turbine Layout and Constraint (GW87)
Figure 5.2 – Diagram of Wind Turbine Features
Figure 6.1-1 – Project Area G97 Turbine Layout and Associated Facilities
Figure 6.1-2 – Project Area V110 Turbine Layout and Associated Facilities
Figure 6.1-3 – Project Area GE87 Turbine Layout and Associated Facilities
Figure 6.1-4 – Project Area GW87 Turbine Layout and Associated Facilities
Figure 7.0-1 – Land Ownership (G97 Turbine)
Figure 7.0-2 – Land Ownership (V110 Turbine)
Figure 7.0-3 – Land Ownership (GE87 Turbine)
Figure 7.0-4 – Land Ownership (GW87 Turbine)
Figure 8.1-1 – Sound (G97 Turbine)
Figure 8.1-2 – Sound (V110 Turbine)
Figure 8.1-3 – Sound (GE87 Turbine)
Figure 8.1-4 – Sound (GW87 Turbine)
Figure 8.2 – Photos of Typical Landscapes within the Project Area
Figure 8.3 – Public Land Ownership and Recreation
Figure 8.4 – Land Cover
Figure 8.5-1 – Topographic Map (G97)
Figure 8.5-2 – Topographic Map (V110)
Figure 8.5-3 – Topographic Map (GE87)
Figure 8.5-4 – Topographic Map (GW87)
Figure 8.6-1 – Soils (G97)
Figure 8.6-2 – Soils (V110)
Figure 8.6-3 – Soils (GE87)
Figure 8.6-4 – Soils (GW87)
Figure 8.7-1 – Site Geology and Depth to Bedrock (G97)
Figure 8.7-2 – Site Geology and Depth to Bedrock (V110)
Figure 8.7-3 – Site Geology and Depth to Bedrock (GE87)
Figure 8.7-4 – Site Geology and Depth to Bedrock (GW87)
Figure 8.8 – Surface Waters
Figure 8.9-1 – Wetland Inventory (G97)
Figure 8.9-2 – Wetland Inventory (V110)
Figure 8.9-3 – Wetland Inventory (GE87)
Figure 8.9-4 – Wetland Inventory (GW87)

Figure 8.10-1 – Unique Natural Features (G97)
Figure 8.10-2 – Unique Natural Features (V110)
Figure 8.10-3 – Unique Natural Features (GE87)
Figure 8.10-4 – Unique Natural Features (GW87)
Figure 9.1 – Existing Wind Turbines

APPENDICES

Appendix A – Noise Analysis for the Proposed Odell Wind Farm
Appendix B – Shadow Flicker Assessment: Odell Wind Project
Appendix C – Archaeological and Architectural Technical Memorandum
Appendix D – Agency Correspondence
Appendix E – FEMA Flood Insurance Maps
Appendix F – Odell Wind Farm: Wildlife Assessment and Field Studies Report
Appendix G – Odell Wind Farm Draft Avian and Bat Protection Plan

ACRONYMS

Acronym	Definition
AADT	Annual Average Daily Traffic
ABPP	Avian Bat Protection Plan
AES	Applied Ecological Services, Inc.
APLIC	Avian Power Line Interaction Committee
ASOS	Automated Surface Observing Systems
AST	Aboveground Storage Tank
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
BWSR	Minnesota Board of Water and Soil Resources
CadnaA	Computer Aided Design for Noise Abatement
CN	Certificate of Need
CRP	Conservation Reserve Program
dB	Decibels
dB(A)	A-weighted scale
dB(C)	C-weighted scale
DNR	Minnesota Department of Natural Resources
DOC	Minnesota Department of Commerce
DOE	U.S. Department of Energy
EBH	Environmental Bore Hole
EFP	Minnesota Department of Commerce – Energy Facility Permitting
EGPNA	Enel Green Power North America, Inc.
EMF	Electromagnetic Field
ETSC	Endangered, Threatened and Special Concern
EWG	Exempt Wholesale Generator Self Certification
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
HH	Hub Height
HVTL	High Voltage Transmission Line
kV	Kilovolt
L_{eq}	Equivalent Sound Level

L_{10}	the sound level, expressed in dB(A), which is exceeded ten percent of the time for a one hour survey, as measured by test procedures approved by the commissioner.
L_{50}	the sound level, expressed in dB(A), which is exceeded 50 percent of the time for a one hour survey, as measured by test procedures approved by the commissioner.
LiDAR	Light detection and ranging
LWECS	Large Wind Energy Conversion System
m/s	Meters per second
MCBS	Minnesota County Biological Survey
MERRA	NASA Modern Era Retrospective Analysis for Research and Applications
MISO	Midcontinent Independent System Operator
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MSL	Mean sea level
MW	Megawatt
MWh	Megawatt hour
NHIS	Natural Heritage Information System
NLCD	National Land Cover Database
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWR	National Wildlife Refuges
NWS	National Weather Service
O&M	Operations and maintenance
OASIS	Open Access Same-Time Information
OATT	Open Access Transmission Tariff
OPH	Oregon Public Health
PPA	Power Purchase Agreement
PWI	Public Waters Inventory
QCEW	Quarterly Census of Employment and Wages
RD	Rotor diameter
RES	Renewable Energy Standard
RIM	Reinvest in Minnesota
SCADA	Supervisory Control and Data Acquisition

SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SNA	Scientific and Natural Area
SODAR	Sonic detection and ranging
SPCC	Spill Prevention Control and Countermeasure
SWPPP	Stormwater Pollution Prevention Plan
TI	Turbulence Intensity
TNC	The Nature Conservancy
USFWS	U.S. Fish and Wildlife Service
VSQG	Very Small Quantity Generator
WECS	Wind Energy Conversion Systems
WMA	Wildlife Management Area
WPA	Waterfowl Production Area

1.0 Applicant Information

Odell Wind Farm, LLC ("Odell" or "Applicant"), a wholly-owned subsidiary of Geronimo Wind Energy, LLC d/b/a Geronimo Energy, LLC ("Geronimo"), respectfully submits this application to the Minnesota Public Utilities Commission ("Commission") for a site permit to construct and operate the up to 200 megawatt ("MW") Odell Wind Farm ("the Project"). The Project is a large wind energy conversion system ("LWECS"), as defined in the Wind Siting Act, Minnesota Statutes Chapter 216F. The Project is located in southwestern Minnesota, across parts of Cottonwood, Jackson, Martin, and Watonwan Counties.

Odell will develop, design, construct, own, and operate the Project. Construction of the Project is scheduled to begin in second quarter 2014. Odell reserves the right to sell or assign the Project to another qualified entity before, during, or after the Project's construction, provided it receives the proper Commission approvals. Odell also proposes to construct an approximately 9.5 mile, 115 kilovolt ("kV") transmission line from the Odell Wind Farm substation in Cottonwood County to the planned 115 kV/345 kV interconnection substation in Martin County. Odell plans to submit a separate route permit application for a high voltage transmission line ("HVTL") for the 115 kV transmission line and associated facilities in Docket No. IP6914/TL-13-591. Odell will obtain an interconnection agreement with transmission owners and the Midcontinent Independent System Operator ("MISO").

Geronimo is a utility-scale renewable energy developer based in Edina, Minnesota. Geronimo has developed three operating wind energy projects in southern Minnesota. Geronimo's 200 MW Prairie Rose Project in Rock County, Minnesota was placed in service in December 2012; its 18.9 MW Marshall Wind Farm near Marshall was placed in service in 2009, and its neighboring 20 MW Odin Wind Farm, near Odin, was placed in service in 2007.

Geronimo has a strategic partnership with Enel Green Power North America, Inc. ("EGPNA"). EGPNA is a leading owner and operator of renewable energy plants in North America with projects operating and under development in 21 U.S. states and three Canadian provinces. EGPNA owns and operates over 90 plants with an installed capacity of more than 1.2 GW powered by renewable hydropower, wind, geothermal, solar and biomass energy. As Geronimo's largest shareholder, EGPNA supports Geronimo's project development and working capital needs. EGPNA provided common equity for the Prairie Rose project, and Geronimo plans to leverage EGPNA's vast experience and technical expertise in the renewable energy industry, along with its sources of capital, equipment and services to develop, construct and operate the Odell Wind Farm in a competitive, cost effective manner.

Geronimo is committed to developing renewable energy projects that meet the Minnesota state policies of locating energy facilities in an orderly manner compatible with environmental preservation and the efficient use of resources.

2.0 Certificate of Need

A certificate of need ("CN") is required for all "large energy facilities," as defined in Minnesota Statutes Section 216B.2421, subd. 2(1), unless the facility falls within a statutory exemption from the CN requirements. Because the Project is a generating plant larger than 50 MW, it meets the definition of a large energy facility and would require a CN prior to issuance of a site permit and construction. The Project is exempt, however from CN requirements because it was selected by Northern States Power Company d/b/a/ Xcel Energy ("Xcel") as part of a competitive bidding process as a resource to be used to meet Xcel's requirements under Minnesota Statutes Section 216B.1691, the Renewable Energy Standard ("RES"). Odell executed a power purchase agreement ("PPA") with Xcel for the full output of the facility in July 2013. Thus, the Project falls within the CN exemptions found in Minnesota Statutes Sections 216B.2422, subd. 5 and 216B.243, subd. 9.

Xcel filed a petition for approval of the Odell PPA on July 16, 2013 in Docket No. E002/M-13-603. On July 25, 2013, the Commission issued a notice requesting comments on, among other things, whether Odell is exempt from the CN requirements and, if so, which statutory exemption applies. Odell anticipates the Commission will issue a final order addressing those questions in late 2013.

3.0 State Policy

The contents and treatment of applications for LWECS site permits are governed by Minnesota Rule Chapter 7854 under the Wind Siting Act. The Wind Siting Act also requires an application for a site permit for an LWECS to meet the substantive criteria set forth in Minnesota Statutes Section 216E.03, subd. 7. This application provides information necessary to demonstrate compliance with these criteria and Minnesota Rule Chapter 7854. In addition, this application has been organized following the Minnesota Department of Commerce, Energy Facility Permitting ("EFP") Application Guidance for Site Permitting of Large Wind Energy Conversion Systems in Minnesota (Aug. 2010) ("LWECS Application Guidance").

The siting of an LWECS is to be made in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources (Minn. Stat. § 216F.03). Odell is designing the Project to comply with the Commission's wind turbine setback and siting guidelines.

4.0 Project Description and Overview

After analyzing a broader area for wind resource, geographic characteristics, easement availability, landowner interest, environmental resources, transmission availability and economic potential, Odell selected the area within the project boundary identified in Figure 4.1 of this Application (the "Project Area"). Odell selected the specific Project Area because of its available land, proximity to viable interconnection options, and interested local landowners. The Project Area was also identified as optimal from wind resource, environmental, and economic perspectives.

According to the National Renewable Energy Laboratory's "Wind Powering America," wind resources within the Project's region range from 8 to 9 meters per second ("m/s") at 80 m height (U.S. Department of Energy, Energy Efficiency and Renewable Energy 2012). Odell has performed an internal wind resource and energy assessment using data collected by a number of meteorological towers installed in and around the Project Area beginning in August 2006. Long-term data was available from the National Weather Service ("NWS") Automated Surface Observing Systems ("ASOS") network on Redwood Falls, Sioux Falls, and Estherville (Iowa) stations and two nearby model grid points in the NASA Modern Era Retrospective Analysis for Research and Applications ("MERRA") data set. This site-specific wind analysis indicates the Project has a highly-suitable wind resource for economical, sustainable, and reliable production of power. Odell also proposes to install up to four permanent meteorological towers to monitor the performance of the wind farm, conform to grid integration requirements, and validate wind turbine power curves.

Odell has modified the footprint of the Project over time to create the most efficient and effective wind energy project possible. The Project will be located across parts of Cottonwood, Jackson, Martin, and Watonwan Counties, near Mountain Lake, Minnesota. The Project will have up to 200 MW of wind energy capacity. Odell continues to assess its turbine options. Odell is evaluating wind turbines with rated power outputs of 1.5 MW, 1.6 MW and 2.0 MW, which would result in the installation of between 100 and 133 wind turbines. The Project Area contains approximately 34,592 acres, of which 20,780 are currently leased for the Project. The Project's above ground facilities will occupy less than one percent of that area.

The Project's facilities will include:

- Wind turbines and related equipment;
- New gravel access roads and improvements to existing roads;
- Underground electrical collection and communication lines;
- Operations and maintenance ("O&M") facility;
- Project substation facility;
- Up to four permanent meteorological towers (up to 80 m tall);
- A temporary batch plant and staging/laydown area for construction of the Project.

Odell is also proposing to construct a 115 kV transmission line, associated facilities and a 345/115 kV substation adjacent to the point of interconnect to connect the Project to the larger transmission grid. Odell plans to file a separate route permit application for the transmission facilities.

Table 4.1 lists the counties, townships, sections, and ranges that are included in the Project Area. Figure 4.1 shows the Project's location.

Table 4.1: Project Location

County Name	Township Name	Township	Range	Sections
Cottonwood	Lakeside	105N	35W	22, 23, 24, 25, 26, 35, 36
Cottonwood	Mountain Lake	105N	34W	12, 13, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
Jackson	Christiania	104N	35W	1, 2, 12
Jackson	Kimball	104N	34W	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 16, 17, 18, 19, 20, 21
Martin	Cedar	104N	33W	4, 5, 6, 7, 8, 9, 16, 17
Watonwan	Odin	105N	33W	7, 18

5.0 Project Design

5.1 Description of Layout

Odell is designing the Project to optimize the wind resource and minimize impacts to potentially sensitive infrastructure, ecological resources, and cultural features. As discussed in this section, the interaction among the local topography, the wind resource, applicable setbacks, landowner input and project design also influences the layout of the Project's facilities. Descriptions of the proposed turbine models are provided in Section 5.2. The specific design specifications of each turbine model will influence the final project micrositing activities.

The wind turbines and associated facilities will be sited primarily on agricultural land. The site is comprised of approximately 91.4 percent cropland, 3 percent grassland, 0.75 percent aquatic/wetland, and 2 percent forest/shrubland, with the remainder of the land characterized as developed land (e.g. roads, farmsteads, home sites) (U.S. Geological Survey 2012).

The Project's layout follows 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 (January 11, 2008) ("PUC General Permit Standards"), applicable local government ordinances and Geronimo's best practices. In instances when setbacks differ for the same feature, the most stringent setback distance is used. Table 5.1 and Figures 5.1-1, 5.1-2, 5.1-3, and 5.1-4 illustrate the relevant project setbacks.

Cottonwood County established an ordinance to regulate the installation and operation of wind energy conversion systems within Cottonwood County not otherwise subject to siting and oversight by the State of Minnesota. The Cottonwood County ordinance is not discussed in detail in this Application because the Project is subject to siting and oversight by the State of Minnesota. Jackson County adopted a Development Code that outlines specific setback requirements for wind energy conversion systems which are shown in Table 5.1. Watonwan County and Martin County do not have specific ordinances or guidelines for wind energy conversion systems over 5 MW in nameplate capacity.

Table 5.1: Wind Turbine Setback Requirements for the Project

Turbine Setback Requirement	Distance for Setback	Authority
Wind Access Buffer – Prevailing Wind Directions	5 x rotor diameter	PUC General Permit Standards
Wind Access Buffer – Non-Prevailing Wind Directions	3 x rotor diameter	PUC General Permit Standards
Residences	1,000 feet, or the minimum distance required to meet the state noise standard of 50 dB(A), whichever is greater. *	Odell
	750 feet and sufficient distance to meet the state noise standard	Jackson County**
	500 feet, or the minimum distance required to meet the state noise standard of 50 dB(A), whichever is greater.	PUC General Permit Standards
Other Structures	1.25 times their height	Jackson County
Public Roads and Trails	Minimum 250 feet	PUC General Permit Standards
Road ROW including Public Trails	Equal to height of structure including blades with a 250' minimum	Jackson County
Noise Requirements	Distance must meet the state noise standard of 50 decibels (dB(A))***	Minnesota Pollution Control Agency ("MPCA")
Participating Project Boundaries	Equal to height of structure including blades	Jackson County
Non-participating Project Boundaries	3 RD on non-prevailing wind axis and 5 RD on prevailing wind axis	Jackson County

Other Existing Wind Energy Conversions Systems ("WECS") and Internal Spacing	3 RD on non-prevailing wind axis and 5 RD on prevailing wind axis	Jackson County
Wetlands (Cowardin classification), Types III, IV and V (If listed on PWI map shoreland setbacks apply)	Equal to height of structure including blades	Jackson County
Protected Waters	See Jackson County Development Code, Shoreland Section 610	Jackson County

* PUC General Permit Standards identify the minimum setback from residences as 500 feet, or the minimum distance required to meet the state noise standard of 50 dB(A), whichever is greater. Odell follows the practice of siting turbines at least 1,000 feet from residences, unless other arrangements have been made with specific residents (while still complying with the MPCA's limit of the 50 dB(A) nighttime L50 noise level).

** Jackson County setbacks were applied only (1) to turbines located in Jackson County and (2) when Jackson County's setback was more stringent than the PUC General Permit Standards.

*** Noise standards are regulated by the MPCA under Chapter 7030. These rules establish the maximum night and daytime noise levels that effectively limit wind turbine noise to 50 dB(A). The MPCA standards require A-weighting measurements of noise; background noise must be at least 10 dB lower than the noise source being measured.

As shown in Table 5.1, Odell adheres to siting turbines at least one thousand (1,000) feet from residences. Odell and a participating landowner may formally agree in writing to a setback of less than 1,000 feet in certain situations. In the event that such arrangements are made, those turbines will be setback at least 500 feet plus the distance required to comply with the MPCA limit of a 50 dB(A) nighttime L50 (the level exceeded for 50% of the time) noise level. Noise data for each turbine model described in Section 8.3 demonstrates that Odell's setback of 1,000 feet would exceed the distance required to meet the 50 dB(A) noise level setback for all turbine models.

In the absence of a more stringent local government ordinance, Odell applied a minimum setback of 250 feet from all public roads. All turbines will be located a minimum of five rotor diameters ("RD") from non-leased properties in the prevailing wind direction (generally the northern and southern edge of leased areas) and three RD in the non-prevailing wind direction (generally the eastern and western edge of leased areas) to accommodate disruption of the normal wind flow and protect the wind rights of non-participating landowners. Similarly, internal turbine spacing will be at least five RD prevailing and three RD non-prevailing, with no more than twenty percent (20%) of the Project's turbines closer than the prescribed setback. Table 5.2 reflects the differing setbacks based on rotor diameter for the types of turbines under consideration for the Project.

Table 5.2: Representative Minimum Turbine Setback Distances by Turbine Model

Turbine Description	5 RD* (ft)	3 RD* (ft)	Total Height (including blades, ft)
Goldwind GW87/1500	1,421	853	421/470
GE 1.6-87	1,427	856	405/458
Vestas V110	1,804	1,083	443/493
Gamesa G97	1,591	955	415/455

**The listed RDs provide the range of rotor sizes; depending on the final turbine selection, the RD could vary slightly from the listed values, but would remain between 82.5 m to 112 m.*

Additional turbine siting considerations and an approximate schedule for determining these factors are included in Table 5.3.

Table 5.3: Turbine Siting Considerations and Approximate Schedule

Issue	Expected Resolution Schedule	Siting Consideration
Items resolved during the Commission permitting process		
Exclusion Areas	At issuance of permit	All exclusion areas in the Application are those proposed by Odell and are based on environmental and existing infrastructure constraints.
Setbacks	At issuance of permit	All setbacks in the application are proposed by Odell and are based on the PUC General Permit Standards as well as Odell's commitments.
Items not dependent on the Commission permitting process but potentially resolved within the six month permitting timeline		
Turbine type	Once turbine purchase negotiations are complete	Siting turbines is based on A) Manufacturer specs and standards B) Turbine Interaction within the wind farm microclimate, etc.

Final leased land boundary	Once final lease and easement negotiations are complete with land owners	Odell will not site turbines on unleased properties and will observe a wind rights buffer from unleased property lines.
Title Clearance	After site control is complete	Odell will site turbines on leased land that has been properly cleared using any necessary subordination, non-Disturbance and attornment agreements and consent forms from appropriate parties. All signed land is to be insured through a title insurance policy. Odell will not site turbines on non-participating landowner properties.
Energy optimization	After all final leases and setbacks requirements are complete	Wind energy will be optimized by considering the turbine interaction with the site's microclimate and internal spacing between turbines within the wind farm.
Items resolved after the Commission permitting process		
Geotechnical analysis	After all other field surveys and turbine micrositing are complete	Geotechnical soil borings will be conducted at the location of final turbine placement to determine the soil suitability to support turbine foundations.
Wetlands	All wetlands and waters within the construction limits of project facilities will be delineated prior to construction. State and/or federal permits for unavoidable impacts must be obtained before any work occurs in those areas.	Permanent impacts to wetlands/waters subject to state and federal jurisdiction will be avoided or minimized as practicable.
Cultural	Surveys of all areas with proposed ground disturbance will be surveyed for cultural resources	Cultural resources identified within the proposed construction areas and existing known resources in the area will be avoided as feasible. If avoidance is not practical, additional investigation of the resource may be needed and further discussion with regulating agencies would be necessary.

This Application contains preliminary site layouts that reflect Odell's best effort to maximize the energy production of the Project, follow applicable setbacks and minimize impacts to the land, environment and surrounding community. The final, construction-ready site layout may differ from the layout proposed in the Application. Odell expects that the final layout will remain substantially similar but also recognizes that changes may occur as a result of the ongoing information gathering, permitting processes and micrositing activities.

5.2 Description of Turbines and Towers

5.2.1 Wind Turbine Design and Operation

A wind turbine generally consists of a nacelle, hub, blades, tower, and foundation. The nacelle houses the generator, gear boxes, upper controls, generator cabling, hoist, generator cooling, and other miscellaneous equipment. The hub supports the blades and connecting rotor, yaw motors, mechanical braking system, and a power supply for emergency braking. The hub also contains an emergency power supply to allow the mechanical brakes to work if electric power from the grid is lost. Each turbine has three blades composed of carbon fibers, fiberglass, and internal supports to provide a lightweight but strong component. The tip of each blade is equipped with a lightning receptor.

The tower supports the nacelle, hub, and blades. The tower houses electrical, control, and communication cables and a control system located at the base of the tower. Towers may include lifts for use by Project personnel. Tubular towers are painted a non-glare white, off-white or gray. Electrical equipment at the base of each tower conditions the generated electricity to match electric grid requirements. The expected tower foundation will be a spread foundation design. The above-ground portion of the foundation will be approximately twenty feet in diameter.

The wind turbine blades convert linear energy from wind into rotational energy. An anemometer and weather vane located on the turbine nacelle continuously sense wind speed and wind direction.

The hub and nacelle are constantly being rotated to match wind speed direction. Yaw motors rotate the blades to optimize blade angles in relation to wind speed and direction. The hub transfers mechanical force from the blades to the shaft connecting the hub to the gear box located within the nacelle. The mechanical braking system, located within the hub, locks the blade rotor to prevent the blades from spinning during maintenance periods or other times when the turbine is out of service. The gear box adjusts shaft speeds to match the required generator speed. Electricity is produced by the generator and transmitted through insulated cables to the power conditioning unit, known as a pad-mount transformer, located at the base of the tower.

5.2.2 Turbine Model Selection and Types

Odell has not yet finalized the specific turbine choice for the Project. The decision will be finalized closer to construction in order to create the most viable, cost-effective and optimal design for the Project. The turbines Odell is considering for the Project span the energy production range of 1.5 MW to 2.0 MW. Turbine hub heights would range from 78 to 100 m

(256 to 328 ft) and the RD would range from 87 to 110 m (285 to 361 ft). Table 5.4 shows the range of characteristics for the three representative turbines. A diagram of wind turbine features is presented in Figure 5.2.

Table 5.4 Wind Turbine Characteristics

Characteristic	Turbine			
	Gamesa G97	**Goldwind GW87/1500**	**GE 1.6-87**	**Vestas V110**
Nameplate capacity (kW)	2000	1500	1620	2000
Hub height (m)	78/90	85/100	80/96	80/95
Rotor Diameter (m)	97	86.6	86.6	110
Total height[1] (m)	126.5/138.5	119/423	123.5/144	135/150
Cut-in wind speed[2] (m/s)	3.0	3.0	3.5	3.0
Rated capacity wind speed[3] (m/s)	12.0	9.9	14.0	11.5
Cut-out wind speed[4] (m/s)	25.0	22	25.0	20.0
Maximum sustained wind speed[5] (m/s)	59.5	52.5	56	52.5
Wind Swept Area (m^2)	7389	5890	5944	9503
Rotor speed (rpm)	9.0-19.0	9-17.3	9.8-16.8	6-17.0

[1] Total height = the total turbine height from the ground to the tip of the blade in an upright position
[2] Cut-in wind speed = wind speed at which turbine begins operation
[3] Rated capacity wind speed = wind speed at which turbine reaches its rated capacity
[4] Cut-out wind speed = wind speed above which turbine shuts down operation
[5] Maximum sustained wind speed = wind speed up to which turbine is designed to withstand

Turbine

Table 5.4 provides details on the hub height, RD, and wind speed operation parameters for the GE 1.6-87 wind turbine, the Goldwind GW 87/1500 wind turbine, the Vestas V110 wind turbine, and the Gamesa G97 wind turbine. All four models have active yaw and pitch regulation and asynchronous generators. The turbines use a bedplate drive-train design where all nacelle components are joined on common structures to improve durability. All three turbine models are capable of operating with adjusted cut-in speeds and full blade feathering.

All proposed turbine models have Supervisory Control and Data Acquisition ("SCADA") communication technology to control and monitor the wind farm. The SCADA communications system permits automatic, independent operation and remote supervision, allowing the simultaneous control of the wind turbines.

Operations, maintenance, and service arrangements between the turbine manufacturer and the Applicant will be structured to provide timely and efficient operations and maintenance. The computerized data network will provide detailed operating and performance information for each wind turbine. The Applicant will maintain a computer program and database for tracking each wind turbine's operational history.

Other turbine specifications include:

- Rotor blade pitch regulation
- Gearbox with three-step planetary spur gear system (GE, Vestas and Gamesa)
- Direct drive permanent magnet generator (Goldwind)
- Double fed three-phase asynchronous generator (GE, Vestas, Gamesa)
- Multipole synchronous generator (Goldwind)
- A braking system for each blade and a hydraulic parking brake (disc brake)
- Yaw systems that are electromechanically driven
- Some of the turbines being considered also incorporate new technology compared to turbines currently in the landscape, including:
    - Force-flow bedplates (nacelle components joined on a common structure to improve durability)
    - New gearbox bearing designs (improving reliability by reducing bending and thrust)

Rotor

The rotor consists of three blades mounted to a rotor hub. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system, and other electrical and mechanical systems. Summary technical characteristics for each turbine model can be found in Table 5.4.

Tower

The towers are conical tubular in shape with a hub height of 78 to 100 meters (285 to 361 feet). The turbine tower, where the nacelle is mounted, consists of three to four sections manufactured from certified steel plates. Welds are made with automatically controlled power welding machines and are ultrasonically inspected during manufacturing per American National Standards Institute specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. Within the tower, access to the nacelle is provided by a ladder connecting four platforms and equipped with a fall arresting safety system.

5.3 Description of Electrical System

Construction of the Project will include up to 133 wind turbines, each potentially with a pad-mounted transformer at its base and both an underground and aboveground electrical collection system, including an occasional aboveground junction box that will deliver power to the Project substation. The power delivered to the substation will be converted to 115 kV and will then be transmitted to the interconnection substation where the power will be stepped up to 345 kV. After the interconnection substation, the electricity from the Project will enter the grid via Xcel's new 345 kV switching station to be built to interconnect the Project.

6.0 Description and Location of Associated Facilities

There are a number of facilities that will be constructed to support the operation of the wind turbines and facilitate the delivery of the electricity to consumers. Odell seeks permitting approval from the Commission through an LWECS site permit for the following associated facilities: up to four permanent meteorological towers and other weather data collection systems, an electrical collection and communications system, access roads, project substation equipment, a laydown yard and an O&M facility. As construction approaches, Odell may exercise an option to seek permitting approval for an O&M facility locally through the applicable local government.

The project substation will require approximately ten acre(s) of land within the Project Area. While the exact location of the substation has not been determined, it will be sited such that the disturbance from installation of the collection system is minimized to the extent feasible. A potential location for the Project facilities, including the Project substation, is shown on Figures 6.1-1, 6.1-2, 6.1-3, and 6.1-4. An overhead 115 kV transmission line is proposed to run from the Project substation located in Mountain Lake Township in Cottonwood County to the new 345/115 kV point of interconnection at the Lakefield Generation – Fieldon segment of Northern States Power's Lakefield Junction – Wilmarth 345 kV transmission line in Martin, County. The overhead transmission line from the Project substation to the interconnection substation will be permitted through the Commission's high voltage transmission line route permit process. The described overhead transmission route is Odell's proposed route; the final route will be determined through the Commission's permitting process.

6.1 Collector Lines and Feeder Lines

At the base, or within the tower section of each turbine, a step-up transformer will be installed to raise the voltage to the power collection line voltage of 34.5 kV. In some turbines (e.g. Gamesa G97 and Vestas V110), the transformer is located within the nacelle. If external transformers are used (e.g.GE 1.6-87), then small, concrete slab foundations will be constructed to support the transformers within the gravel area at the turbine base. The transformer is a rectangular steel box measuring approximately 2.3 by 2.6 m (7.5 by 8.5 ft). Support for the transformer is provided by a concrete pad or foundation approximately 8.0 in thick, which is placed over 0.6 m (2 ft) of concrete fill. The concrete fill will measure 2.3 by 4.1 m (7.5 by 13.5 ft) and will be placed under the transformer pad and between the transformer and the tower pedestal.

Power will run through an underground and/or aboveground collection system to the Project substation, which will raise the voltage to 115 kV. The electrical collection system will consist of a network of underground electrical cabling operating at 34.5 kV. Approximately 41.5 miles of underground lines will be installed by trenching, plowing, or where needed, directionally boring the cables underground. Generally, the electrical lines will be buried in trenches. Additionally, collector system cabling may go aboveground when conflicts with existing underground utilities, other infrastructure, or sensitive environmental conditions such as native prairie remnants cannot be resolved and still keep the line underground. At the public road at the edge of a farm field, the power collection lines will either rise to become aboveground lines (if shallow bedrock, sensitive environmental conditions, or conflicts with underground utility or other infrastructure are encountered) or continue as underground lines. The collection lines will occasionally require an aboveground junction box when the lines from separate spools need to be spliced together.

Conceptual electrical layouts based on the proposed turbine layouts are shown in Figures 6.1-1, 6.1-2, 6.1-3 and 6.1-4.

6.2 Additional Associated Facilities

An O&M building will be constructed on or near the site and will provide access and storage for project maintenance and operations. The location of the O&M facility has yet to be determined, but it will be located so as to easily access the project. Construction of the O&M facility will require a building permit from the applicable county and/or township. The buildings typically used for this purpose are approximately 3,000 to 5,000 square feet and house the equipment to operate and maintain the wind farm. The parking lot adjacent to the building is typically 3,000 square feet.

Currently, Odell is operating two temporary meteorological towers at the site, and one temporary meteorological tower near the site. Odell proposes to construct up to four permanent meteorological towers with the potential for a sonic detection and ranging ("SODAR") and/or a light detection and ranging ("LiDAR") unit. The expected locations of the four permanent meteorological towers are shown on Figures 6.1-1, 6.1-2, 6.1-3 and 6.1-4.

Odell will also grade a temporary laydown area of approximately ten acres, centrally-located within the Project Area, to serve both as a parking area for construction personnel and staging area for turbine components during construction. A separate staging area of approximately ten acres will serve as a parking and unloading area for large equipment deliveries.

6.3 Access Roads

The Project will include permanent all-weather gravel roads that provide access to the wind turbines. The primary function of the roads is to provide accessibility to the turbines for turbine maintenance crews. The roads will be low-profile to allow farm equipment to cross. Roads will initially be approximately 34 feet wide to accommodate transportation of heavy construction equipment. Once Odell completes construction of the turbines, the roads will be reduced to their permanent width of 16 – 18 feet.

Odell designs the access road network to serve the Project most efficiently. Odell also takes landowners' input on road locations and any concerns of the local road authorities into consideration.

6.4 Permitting for Associated Facilities

The Applicant will be responsible for undertaking all required environmental reviews. Odell will obtain all permits and licenses that are required following issuance of the LWECS Site Permit.

7.0 Wind Rights

Odell worked with landowners to secure sufficient land lease and wind easement/setback easement agreements to build an up to 200 MW (nameplate capacity) wind energy project. Land rights may include, but are not limited to, wind turbines and project facilities, wind and buffer easements, access roads, transmission feeder lines on public roads, and land to mitigate environmental impacts. Odell currently leases approximately 20,780 acres of the 34,592 acres within the Project boundary (sixty percent (60%) of the Project Area). Geronimo remains in negotiation with a number of landowners within the Project Area and anticipates significant acreage being added to the project leasehold before construction. All project facilities have been sited on leased land and the current leasehold is sufficient to accommodate the proposed facilities, required buffers, and turbine placement flexibility needed to avoid natural resources, homes, and other sensitive features. Figures 7.0-1, 7.0-2, 7.0-3, and 7.0-4 depict the project facilities and underlying parcels required to site the Project following applicable setbacks.

8.0 Environmental Impacts

This section provides a description of the environmental conditions that exist within the Project. Consistent with Commission procedures on siting LWECS and with applicable portions of the Power Plant Siting Act, various exclusion and avoidance criteria were considered in selecting the Project Area.

8.1 Demographics

The Project is located in a moderately to lightly populated rural area in southwestern Minnesota. The Project includes portions of Cottonwood, Jackson, Martin, and Watonwan Counties. There is no indication that any minority or low-income population is concentrated in any one area of the Project, or that the wind turbines will be placed in an area occupied primarily by a minority population. As shown in Figures 6.1-1, 6.1-2, 6.1-3 and 6.1-4, there are approximately 108 homes located within the Project Area.

Table 8.1 presents population information gathered from the U.S. Census Bureau 2010 Census (U.S. Census Bureau 2010) about Cottonwood, Jackson, Martin and Watonwan Counties and their relevant townships. The townships that are included in the Project are: Lakeside and Mountain Lake Townships in Cottonwood County, Christiania and Kimball Townships in Jackson County, Cedar Township in Martin County, and Odin Township in Watonwan County. The communities that are geographically closest to the Project are Bingham Lake and Mountain Lake.

The 2010 U.S. Census gathered a wide variety of data points. The discussion herein does not address every demographic measure, but instead addresses the most applicable statistics related to the Project. The demographic characteristics that relate closest to the Project include: total population, total households, median household income, per capita income, the percentage of the population below poverty level, and the median age (*See* Table 8.1).

Table 8.1: Demographic Information for the Counties and Townships in the Project Area

	Total Population	Total Households	Median Household Income (In 2011 Inflation-Adjusted Dollars)	Per Capita Income (In 2011 Inflation-Adjusted Dollars)	Percentage of Population Below Poverty Level	Median Age
Cottonwood County	11,687	4,857	$43,111	$22,028	11.7%	44.2
Lakeside Township, Cottonwood County	237	93	$64,583	$26,929	5.1%	48.9
Mountain Lake Township, Cottonwood County	384	100	$54,000	$18,237	21.7%	26.7
Jackson County	10,266	4,429	$47,455	$25,744	11.2%	44.1
Christiania Township, Jackson County	249	112	$60,000	$45,232	2.3%	50.3
Kimball Township, Jackson County	129	48	$66,000	$33,485	9.2%	41.3
Martin County	20,840	9,035	$44,791	$25,354	9.3%	45.5
Cedar Township, Martin County	223	90	$63,125	$24,991	4.8%	42.8
Watonwan County	11,211	4,520	$49,307	$24,187	10.4%	41.2
Odin Township, Watonwan County	170	71	$57,750	$34,626	0%	50.7

Source: U. S. Census Bureau, 2007-2011 American Community Survey

8.1.1 Impacts

The Project is designed to be socioeconomically beneficial to landowners, local governments, and communities. Wages will be paid and expenditures will be made to local businesses and landowners during the Project's construction and operation. The construction and operation of the Project will increase the counties' tax bases. In addition, lease payments paid to landowners will offset potential financial losses associated with removing a small of land from agricultural production. Landowner compensation is established by voluntary land lease and wind easement agreements. All landowners who are participating in the Project will receive compensation, whether or not they receive Project facilities on their land. This payment model provides an inclusive community-based economic benefit.

In general, the land surrounding each turbine can continue to be farmed or used for grazing. On average, approximately 0.5 acre to 1 acre of land per turbine is taken out of agricultural production. The annual lease payments to landowners are designed to positively compensate the landowners for any land removed from agricultural production and the inconvenience of farming around the new obstacles in the farm fields.

No substantial effects on permanent housing are anticipated. During construction, out-of-town laborers will likely use lodging facilities nearby. The operations and maintenance of the facility will require ten to fourteen staff. The Project anticipates that sufficient permanent housing will be available in or near the Project to accommodate these laborers.

8.1.2 Mitigative Measures

No mitigative measures are anticipated because the socioeconomic impacts associated with the Project will be positive.

Continuing to establish southern Minnesota as an important producer of alternative energy, such as wind, may also spur the development of more business in the area, in turn contributing to the economic growth in the region.

8.2 Land Use

8.2.1 Local Zoning and Comprehensive Plans

A comprehensive plan is a land use and community planning tool used to guide the growth and intentions of a municipality. Generally, comprehensive plans include details regarding existing and future land use, population and housing trends, economic development, and environmental characteristics. In preparing this application, the Applicant reviewed and analyzed the most recently adopted comprehensive plans of the municipalities within and adjacent to the proposed Project Area. A list of the plans reviewed can be found in Table 8.2.

Table 8.2: Comprehensive Plan Inventory for Local Governments within Project Area

Governing Body	Name of Plan	Year Adopted	Associated Development Plan(s)
Cottonwood County	Cottonwood County 2005 Comprehensive Plan	2005	Cottonwood County Local Water Management Plan 2007-2017, as amended; Cottonwood County Wind Energy Conversion Systems Ordinance
Jackson County	Jackson County Comprehensive Plan Planning Document, A Framework for Land Use and Guide for Future Growth	2010	Jackson County 2010 Development Code
Martin County	Martin County Land Use Plan	2003	Martin County, Minnesota All-Hazard Mitigation Plan 2013 Update
Watonwan County	None adopted	n/a	Watonwan County, Minnesota Zoning Ordinance (Section 12, Subdivision M-Windpower Management (for wind energy facilities with a rated capacity of less than 5 MW))
Lakeside Township, Cottonwood County	None adopted	n/a	n/a
Mountain Lake Township, Cottonwood County	None adopted	n/a	n/a
Christiania Township, Jackson County	None adopted	n/a	n/a
Kimball Township, Jackson County	None adopted	n/a	n/a
Cedar Township, Martin County	None adopted	n/a	n/a
Odin Township, Watonwan County	None adopted	n/a	n/a

Cottonwood County's Comprehensive Plan from 2005 lists four "goals and policies" for the county's economic development, including a specific mention of the development of renewable energy in the area (Cottonwood County 2005):

- Agriculture will continue to be a significant economic activity;
- The local labor force will have the skills and education to compete for 21st century jobs;
- The existing economic base will become more diversified; and
- New sources of renewable energy will be developed.

Jackson County's Comprehensive Plan from 2010 lists goals for agriculture and economic development which include the "preservation of commercial agriculture as a viable, permanent land use and as a significant economic activity in the county." Their comprehensive plan also describes the county as "an attractive location for wind energy development with growth of the industry …" (Jackson County Parks, Planning, and Environmental Services; Southwest Regional Development Commission 2010).

According to Martin County Land Use Plan from 2003, "The agricultural industry is very important to Martin County." The plan also notes that the number of farms in Martin County has declined over time (Martin County 2003).

Development of the Project appears to be consistent with the applicable local zoning ordinances and comprehensive plans.

8.2.2 Conservation Easements

Odell is currently conducting a title search to identify conservation easements on any properties within the Project Area. Based on existing data, conservation easements are known to exist within the Project Area. The U.S. Fish and Wildlife Service ("USFWS") administers a program by which it holds easements on private lands that have wetlands and/or grassland habitat. The Minnesota Department of Natural Resources ("DNR") and Minnesota Board of Water and Soil Resources ("BWSR") also administer conservation programs such as Reinvest in Minnesota ("RIM"), in which the DNR and/or BWSR holds easements on private lands for conservation purposes. A title review, which is ongoing, has identified that RIM lands are present in the Project Area. The Nature Conservancy ("TNC") is a non-profit, private organization that acquires lands for conservation purposes. There are no known TNC lands or other private conservation lands within or adjacent to the Project Area.

8.2.3 Impacts

Local Zoning and Comprehensive Plans

The Project is generally consistent with the counties' comprehensive plans. Agricultural use of the Project Area will continue. The Project will positively impact local economies by providing a diversified income stream for landowners, possible temporary jobs for local workers, and tax benefits to the local governments.

Conservation Easements

Odell will avoid conducting Project activities within conservation easements held by public agencies or private organizations to the extent practicable. In the event that impacts do occur, Odell will work with the DNR, USFWS or other relevant authority to develop appropriate mitigation.

8.2.4 Mitigative Measures

Local Zoning and Comprehensive Plans

Odell does not propose any mitigative measures because negative impacts to local zoning and comprehensive plans are not expected.

Conservation Easements

Odell does not propose any mitigative measures because impacts to lands subject to conservation easements are not anticipated.

8.3 Noise

Noise is defined as unwanted sound. It may be made up of a variety of sounds of different intensities, across the entire frequency spectrum. Noise is measured in units of decibels ("dB") on a logarithmic scale. Because human hearing is not equally sensitive to all frequencies of sound, certain frequencies are given more "weight." The A-weighted scale ("dB(A)") is used to reflect the selective sensitivity of human hearing. This scale puts more weight on the range of frequencies that the average human ear perceives, and less weight on those that we do not hear as well, such as very high and very low frequencies. The C-weighted scale ("dB(C)") is used to reflect human sensitivity at louder levels. This scale puts more weight on the lower frequencies than does the A-weighted scale.

8.3.1 Description of Resources

The term *ambient acoustic environment* refers to the all-encompassing sound in a given environment or community. The outdoor ambient acoustic environment is a composite of sound from varying sources, distances, and directions. Common sound sources within an agricultural and/or rural environment include, but are not limited to, sound from farm equipment such as tractors and combines, sound generated from traffic on roadways, sounds from birds, and wind rustling through the vegetation. Typically, the ambient acoustic environment of a rural or agriculturally-oriented community has equivalent continuous sound levels (Leq, which is an energy-based time-averaged noise level) ranging from 30 dB(A) to 60 dB(A).

In agricultural and/or rural communities, the higher sound levels typically exist near roadways and near areas that experience greater human activities such as farming. In addition, compared with similar environments with lower quality wind resources, those environments with higher wind resources generally experience higher sound levels. Different communities can experience a wide variety of sound levels within their given ambient acoustic environments, and this variation of sound creates their respective spectral content.

The background noise in the area is typically a result of wind, farming equipment/operations, and vehicles. A comparison of typical noise generators is outlined below in Table 8.3.

Table 8.3: Decibel Levels of Common Noise Sources

Sound Pressure Level (dBA)	Noise Source
140	Jet Engine (at 25 meters)
130	Jet Aircraft (at 100 meters)
120	Rock and Roll Concert
110	Pneumatic Chipper
100	Jointer/Planer
90	Chainsaw
80	Heavy Truck Traffic
70	Business Office
60	Conversational Speech
50	Library
40	Bedroom
30	Secluded Woods
20	Whisper

SOURCE: "A Guide to Noise Control in Minnesota" Minnesota Pollution Control Agency (2008)

The Minnesota Pollution Control Agency has the authority to adopt noise standards pursuant to Minnesota Statute Section 116.07, subd. 2. The adopted standards are set forth in Minnesota Rule Chapter 7030. The MPCA standards require A-weighted noise measurements. Different standards are specified for daytime (7:00 AM – 10:00 PM) and nighttime (10:00 PM – 7:00 AM) hours. The noise standards specify the maximum allowable noise volumes that may not be exceeded for more than 10 percent of any hour (“L_{10}”) and 50 percent of any hour (“L_{50}”). Household units, including farm houses, are included in Land Use Classification 1. Table 8.4 shows the MPCA State noise standards. All the land within the Project Area is considered Land Use Class 1.

Table 8.4: MPCA State Noise Standards – Hourly A-Weighted Decibels

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

Since wind farms generate a relatively constant noise volume, the anticipated noise from wind farms are typically reported in terms of an equivalent sound level (“L_{eq}”) that has the same energy and A-weighted level as the community noise over a given time interval, rather than reporting both L_{10} and L_{50}. When describing relatively constant sound levels, the L_{10} and L_{50} values will be roughly equal. This equivalent sound level is most appropriately compared to the state L_{50} standards. The difference between L_{eq} and L_{50} is mathematically similar to the difference between the mean and the median for a data set. These values will be roughly equal for data sets without extreme values or statistical outliers (such as wind turbine noise).

8.3.2 Impacts

Ambient noise monitoring was conducted in July 2013 at four locations. Three locations were within the Project Area and one was at an off-site location. Monitoring was completed in conformance with the Minnesota Department of Commerce, Energy Facility Permitting “Guidance for Large Wind Energy Conversion System Noise Study Protocol and Report”. The four monitoring locations are as follows and shown on Figures 8.1-1, 8.1-2, 8.1-3 and 8.1-4.

Site 1: Located north of 410th Street and west of 600th Avenue
Site 2: Located between County Road 13 and 430th Street west of 550th Avenue
Site 3: Located south of 920th Street between 570th Avenue and 580th Avenue
Site 4: Located between 395th Street and 400th Street (County Road 10) west of 630th Avenue (County Road 2)

As shown in Table 8.5, in the existing conditions, the current L_{10} and L_{50} sound levels range from 28 to 59 dB(A) during both the daytime and nighttime. The monitoring showed that the existing noise conditions at Site #2 during the nighttime hours exceeded the State Noise Standards for L_{10}. Existing L_{50} noise conditions ranged from 31.0 dB(A) to 41.6 dB(A) for the nighttime conditions and 29.6 to 43.9 for the daytime conditions.

Table 8.5. Existing Sound Levels

Time Period	Location	Noise Levels	
		L_{10}	L_{50}
Nighttime **6:00 – 7:00 AM**	Site 1	47.0	31.0
	Site 2	59.3	41.6
	Site 3	29.6	28.3
	Site 4	41.8	36.9
MN State Nighttime Standard		55	50
Daytime **5:00 – 6:00 PM**	Site 1	35.3	29.6
	Site 2	55.8	43.9
	Site 3	50.1	36.6
	Site 4	45.8	35.5
MN State Daytime Standard		65	60

Four wind turbine types and layout configuration were selected for analysis. Table 8.6 outlines the characteristics of each turbine type.

Table 8.6: Wind Turbine Specifications

Equipment	Hub Height	Rotor Diameter	Total Sound Power Level (dB(A))
GE 1.6-87	80m	87m	105.5
Vestas V110-2.0	80m	110m	107.5
Gamesa G97-2.0	78m	97m	105.8
Goldwind GW87	85m	84m	103.2

Figures 8.1-1, 8.1-2, 8.1-3 and 8.1-4 show the proposed wind turbine locations, for each type of turbine, in reference to the sensitive receptors and monitoring locations. Table 8.7 summarizes the selected monitoring sites including the distance from each monitoring location to the nearest sensitive receptor and the distance from each monitoring site to the nearest turbine for each type of turbine.

Table 8.7: Monitoring Site Characteristics

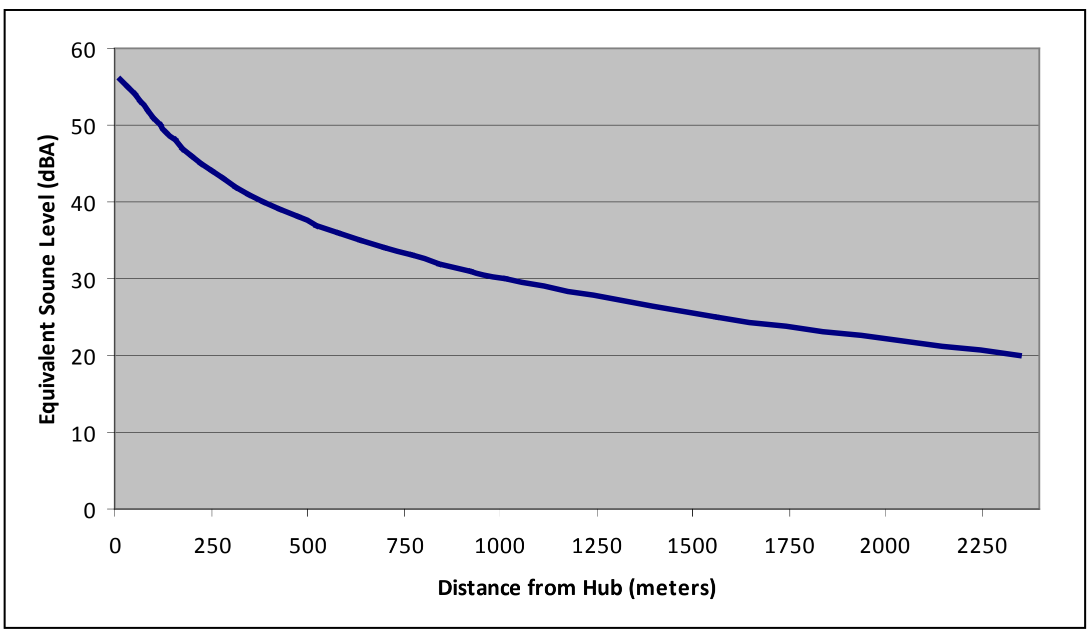
Location	Distance to Nearest Sensitive Receptor (ft)	Distance to Nearest Turbine (ft)			
		GE 1.6-87	Vestas V110–2.0	Gamesa G97–2.0	Goldwind GW87
Monitoring Site 1	1857 (Receptor 11)	2356 (Turbine 75)	1654 (Turbine 97)	1664 (Turbine 95)	2356 (Turbine 97)
Monitoring Site 2	411 (Receptor 39)	1910 (Turbine 60)	2318 (Turbine 39)	2281 (Turbine 70)	1910 (Turbine 82)
Monitoring Site 3	1090 (Receptor 113)	4846 (Turbine 84)	890 (Turbine16)	890 (Turbine 9)	1254 (Turbine 15)
Monitoring Site 4	5975 (Receptor 120)	18806 (Turbine 76)	17366 (Turbine 67)	18403 (Turbine 98)	18806 (Turbine 98)
Receptor 11	NA	1239 (Turbine 98)			
Receptor 63	NA	1475 (Turbine 59)			
Receptor 22	NA		1377 (Turbine 25)		
Receptor 13	NA		1442 (Turbine 67)		

Receptor 27	NA			1262 (Turbine 89)	
Receptor 25	NA			1282 (Turbine 85)	
Receptor 11	NA				1239 (Turbine 97)
Receptor 63	NA				1475 (Turbine 58)

A noise assessment was completed for each of the four wind turbine options using industry-accepted sound-modeling software. The program used to model the project was the Computer Aided Design for Noise Abatement (CadnaA), Version 4.1.137, published by DataKustik, Ltd., Munich, Germany. The CadnaA program is a scaled, three-dimensional program that takes into account air absorption, terrain, ground absorption, and ground reflection for each piece of noise-emitting equipment and predicts downwind sound-pressure levels.

The wind turbines proposed within the project site are warranted to generate a maximum apparent sound power level of 103.2 dB(A) to 107.5 dB(A) +/- 2 dB(A) immediately adjacent to the turbine hub. For the proposes of Odell's noise analysis, the lowest hub height under consideration for each turbine model was evaluated. The decibels decrease as the receptor moves further away from the turbine. Assuming a featureless plain and constant attenuation, a single turbine is expected to generate less than 50 decibels at approximately 100 meters (328 feet). Chart 8.8 below shows the relationship between the sound volumes created by a single turbine and the receptor distance from the base of the turbine.

Chart 8.8 – Sound Level and Distance



Based on the ambient monitoring, the monitoring data has been graphed by time of day for the daytime and nighttime conditions. The full noise report in **Appendix A** shows the noise levels over time at each monitoring site.

The monitored hourly L_{10} and L_{50} data was also compared to measured wind speeds. The full noise report in Appendix A shows hourly sound distributions in comparison to average wind speeds measured at microphone height at each monitoring site. In addition, Appendix A presents the A-weighted and C-weighted hourly Leq in comparison to wind speeds at hub height for each monitoring site.

Figures 6-9 in Appendix A depicts the sound contours anticipated by the construction of the Odell Wind Farm project for each of the optional turbine types. These figures depict only turbine-generated sound, and do not represent cumulative noise volumes including background or existing noise. It is also useful to consider the magnitude of the increase in sound levels by the Odell Wind Farm project.

Table 8.9 displays the sound levels from the turbines for the highest five (5) modeled receptor locations as well as the resulting cumulative sound levels. In Minnesota, the Minnesota Pollution Control Agency ("MPCA") State Noise Standards restrict noise levels to 60 dB(A) during the daytime. Since actual background noise levels are not known for each receptor, the sound impacts are summarized for three assumed L_{50} background noise levels: 40 dB(A), 50 dB(A) and 60 dB(A).

Table 8.9: L_{50} Sound Levels at Potential Receptors

Receptor	**Turbine Sound Impact** (dB(A))	**Background + Turbine Impact**		
		40 dB(A)	**50** dB(A)	**60** dB(A)
GE 1.6-87 Turbine				
73	43.7	45.2	50.9	60.1
63	42.8	44.6	50.8	60.1
60	42.7	44.6	50.7	60.1
114	42.1	44.2	50.7	60.1
106	42.0	44.1	50.6	60.1
Vestas V110-2.0 Turbine				
73	45.0	46.2	51.2	60.1
63	44.3	45.7	51.0	60.1
60	43.3	45.0	50.8	60.1
114	43.1	44.8	50.8	60.1
54	42.8	44.6	50.8	60.1

Gamesa G97-2.0 Turbine				
73	43.3	45.0	50.8	60.1
63	42.6	44.5	50.7	60.1
60	41.6	43.9	50.6	60.1
114	41.4	43.8	50.6	60.1
54	41.1	43.6	50.5	60.1
Goldwind G87 Turbine				
73	41.7	43.9	50.6	60.1
63	40.5	43.3	50.5	60.0
60	40.3	43.2	50.4	60.0
106	39.8	42.9	50.4	60.0
114	39.7	42.9	50.4	60.0

The analysis indicates that operation of the Odell Wind project does not have noise levels of 60 dB(A) or greater during the daytime conditions or 50 dB(A) or greater during the nighttime conditions on any modeled receptor, nor will the cumulative impact on any residence exceed 60 dB(A) or 50 dB(A) when assuming a 40 dB(A) background sound level. The highest monitored background noise levels ranged from 31.0 dB(A) to 41.6 dB(A) for the nighttime conditions and 29.6 to 43.9 for the daytime conditions. When assuming background sound levels of 40 dB(A), the cumulative sound levels range from 40.0 dB(A) to 46.2 dB(A), indicating that the change in sound levels caused by the wind farm would range from 0.0 dB(A) to 6.2 dB(A). This additional sound from the wind turbines would not be noticeable. During the daytime or nighttime conditions, only with a background sound level already approaching or exceeding the 60 dB(A) or 50 dB(A) thresholds would the cumulative sound level (background and wind turbine sound) exceed the MPCA requirements.

8.3.3 Mitigative Measures

Impacts to nearby residents and other potentially affected parties in terms of noise will be taken into consideration as part of the turbine siting. The Applicant proposes siting turbines at least 1,000 feet from residences, unless other arrangements have been made with specific residents. In the event that other arrangements are made with respect to turbine setbacks, those turbines will be setback the distance required to comply with the MPCA limit of a 50 dB(A) nighttime L_{50} noise level.

To the extent that the sound characteristics of the selected turbine vary, the Applicant will ensure compliance with MPCA noise standards. The preliminary layout has been modeled to help ensure that cumulative impacts from all wind turbines, and that the maximum calculated noise levels for all turbine models, are at least 5 dB below the MPCA's nighttime L_{50} noise limit of 50 dB(A).

8.4 Visual Impacts

8.4.1 Existing Aesthetics

The topography of the Project Area is glaciated, gently rolling plains with elevations ranging from 1,219 feet to 1,412 feet (372 meters to 430 meters) above sea level. Agricultural fields, farmsteads, and gently rolling topography visually dominate the Project Area. The landscape can be classified as rural open space. The photos in Figure 8.2 show typical landscapes within the Project Area.

Within the Project Area local vegetation is predominantly agricultural crops. Crops include corn, soybeans, green peas, forage, and wheat, which visually create a low uniform cover (Minnesota Department of Agriculture 2009). A mix of deciduous and coniferous trees planted for windbreaks typically surrounds farmsteads. Generally, these are isolated groves or windrows established by the landowner/farmers to prevent wind erosion and shelter dwellings. In the swales, there are occasional patches of native willows, cattails, sedges, and rushes.

The settlements in this area of southern Minnesota are residences and farm buildings (inhabited and uninhabited) situated along rural county roads. These structures are focal points in the dominant open space character of the vicinity.

In addition to residences and farm buildings, this area also has a number of existing wind farms and high voltage transmission lines that are visible from within the Project Area. There are 215 existing commercial scale wind turbines within 10 miles of the Project Area of varying heights and rotor diameters. These existing turbines include models such as the GE sle, GE xle, Suzlon S88, and Mitsubishi 2.4mw. The physical characteristics of these models is similar to the turbine models proposed for the Project. In addition, there are several existing high voltage transmission lines, including an existing 345 kV H-frame transmission line that runs diagonally across the southeastern part of the Project Area in Martin County.

8.4.2 Visual Impacts on Public Resources

The potential turbine models are similar in appearance. They feature a tubular tower, a single hub, and three blades. The primary difference among the models is the RD and hub height ("HH"), which influences the number of turbines on the landscape. In general, larger RD and HH turbines generate more power and thus fewer are required to obtain the same overall energy output. Table 8.10 outlines four representative turbine models' RDs and HHs, and the associated number of turbines for a 200 MW wind energy project.

Table 8.10: Rotor Diameter and Number of Turbines

Turbine Model	Nameplate Capacity (m)	Rotor Diameter (m)	Hub Height (m)	Number of Turbines for a 200 MW Project (m)
Goldwind GW87/1500	1.5 MW	86.6 m	85/100	133
GE 1.6 – 87	1.62 MW	87 m	80/96 m	123
Vestas V110	2.0 MW	110 m	80/95 m	100
Gamesa G97	2.0 MW	97 m	78/90 m	100

If a 2.0 MW wind turbine were selected, 100 turbines would be installed for the Project. If a 1.62 MW turbine were selected, 123 turbines would be installed; and, if a 1.5 MW turbine is selected, 133 turbines would be installed. Wind turbines with a larger nameplate capacity generally create less visual impact because fewer turbines would be installed.

Some of the Project's turbines will be located within the viewshed of DNR-managed Wildlife Management Areas ("WMAs"), USFWS Waterfowl Production Areas ("WPAs") or other natural areas and may be seen by people using those areas. Figure 8.3 identifies recreation and wildlife areas within the Project's vicinity.

As shown in Figure 8.3, there are 11 WMAs, five WPAs, and one Scientific and Natural Area ("SNA") within five miles of the Project Area. Further information regarding recreational lands in relation to the Project Area is found in Section 8.7. While wind turbines will impact the visual surroundings of the Project Area, the degree and nature of the visual impact will vary based upon personal perceptions and preferences.

8.4.3 Visual Impacts on Private Lands and Homes

Wind turbines will impact the visual surroundings of the Project Area. The degree of visual impact will vary based on personal preferences and subjective human responses. For some viewers, the Project could be perceived as a visual intrusion; for other viewers, the Project may have its own positive aesthetic qualities. Operation of the wind farm will generate minimal vehicle traffic and will not significantly increase day-to-day human activity in the area. Therefore, the Project Area will retain its rural character. Although industrial and high-tech in form and purpose, turbines are compatible with the rural and agricultural heritage of the area, which includes windmills, silos, and grain elevators.

The installation of the Project will alter the landscape and visual experience of the site. The topography in the vicinity is generally flat and the vegetation is uniformly low, making the high topography vulnerable to visual disruptions. Visual impacts will be most evident to people who live in and near the Project and people traveling on roads through and adjacent to the Project. While people living in or traveling through the area are accustomed to viewing wind turbines, the Project will add to the cumulative visual impacts by adding up to 133 new turbines in the area.

The Federal Aviation Administration ("FAA") requires obstruction lighting or marking of structures more than two hundred (200) feet above ground to provide safe air navigation (FAA 2005). Odell will apply to the FAA for approval of a lighting plan that is compliant with FAA requirements. It is anticipated that approximately fifty percent of the turbines will be lit. FAA requires synchronized flashing of red lights for wind turbines.

Odell will also consider the Project's lighting protocols to minimize potential impacts to aesthetics and wildlife while maintaining safe construction and operations. Some of the Project's goals pertaining to lighting include minimizing the number of lights, minimizing the duration of the light flash, maximizing the light-off period between flashes, and maintaining synchronized flashing among all turbines. In addition, non-turbine facility lighting will be minimized by various means, including only lighting the facilities when necessary, using downward facing lights and other means.

8.4.4 Shadow Flicker

Shadow flicker caused by wind turbines is defined as alternating changes in light intensity at a given stationary location, or *receptor*, such as the window of a home. In order for shadow flicker to occur, three conditions must be met: first, the sun must be shining with no clouds to obscure it; second, the rotor blades must be spinning and must be located between the receptor and the sun; and third, the receptor must be sufficiently close to the turbine to be able to distinguish a shadow created by it.

Shadow flicker intensity and frequency at a given receptor are determined by a number of interacting factors:

- Sun angle and sun path – As the sun moves across the sky on a given day, shadows are longest during periods nearest sunrise and sunset, and shortest nearest midday. They are longer in winter than in summer. On the longest day of the year (the summer solstice), the sun's path tracks much farther to the north and much higher in the sky than on the shortest day of the year (the winter solstice). As a result, the duration of shadow flicker at a given receptor will change significantly from one season to the next.
- Turbine and receptor locations – The frequency of shadow flicker at a given receptor tends to decrease with greater distance between turbine and receptor. The frequency of occurrence is also affected by the sightline direction between turbine and receptor. A turbine placed due east of a given receptor will cause shadow flicker at the receptor at some point during the year while a turbine placed due north of the same receptor at the same distance will not, due to the path of the sun.
- Cloud cover and degree of visibility – As noted above, shadow flicker will not occur when the sun is obscured by clouds. A clear day has more opportunity for shadow flicker than a cloudy day. Likewise, smoke, fog, haze, or other phenomena limiting visibility would reduce the intensity of the shadow flicker.
- Wind direction – The size of the area affected by shadow flicker caused by a single wind turbine is based on the direction that the turbine is facing in relation to the sun and location of the receptor. The turbine is designed to rotate to face into the wind, and as a

result, turbine direction is determined by wind direction. Shadow flicker will affect a larger area if the wind is blowing from a direction such that the turbine rotor is near perpendicular to the sun-receptor view line. Similarly, shadow flicker will affect a smaller area if the wind is blowing from a direction such that the turbine rotor is near parallel to the sun-receptor view line.

- Wind speed – Shadow flicker can only occur if the turbine is in operation. Turbines are designed to operate within a specific range of wind speeds. If the wind speed is too low (cut-in speed) or too high (cut-out speed), the turbine will not operate, eliminating shadow flicker.
- Obstacles – Obstacles, such as trees or buildings, which lie between the wind turbine and the receptor have a screening effect and can reduce or eliminate the occurrence of shadow flicker.
- Contrast – Because shadow flicker is defined as a change in light intensity, the effects of shadow flicker can be reduced by increasing the amount of light within a home or room experiencing shadow flicker.
- Local topography – Changes in elevation between the turbine location and the receptor can either reduce or increase frequency of occurrence of shadow flicker, compared to flat terrain.
- Maintenance – Turbines which are inoperable for maintenance reasons will obviously cause no occurrence of shadow flicker.

The shadow flicker frequency in the figure was created using the WindPro Modeling program (Version 2.7) using the typical assumptions for distribution of wind direction and sunshine probability (Table 8.11 and Table 8.12). The assumptions are specific to the Project area.

Table 8.11: Wind Direction Distribution Assumptions for Shadow Flicker Model

Direction	N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW
Percent Blowing in Direction	7.6	4.5	4.3	4.2	5.7	10.1	13.7	9.2	7.0	7.9	9.3	16.4

Table 8.12: Probability of Sunshine Assumptions for Shadow Flicker Model

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Sunshine Probability	39%	45%	51%	57%	61%	63%	62%	58%	52%	46%	40%	37%

Data gathered from WindPro

By simulating the sun path throughout a whole year, the software calculates the number of hours per year as well as maximum minutes per day during which a given receptor could realistically expect to be exposed to shadow flicker from nearby wind turbines. Shadow flicker can be modeled using either "expected" case or "worst case" scenarios. Worst case scenarios are based on simulated conditions where:

- There is always sunshine;
- The turbine is always in operation;
- The wind direction always orients the rotor perpendicular to the sun-receptor sightline;
- Specific window configurations on houses are not considered; and
- There are no local obstacles blocking potential shadows such as buildings or vegetation.

A worst case scenario can be refined to represent a less conservative expected scenario by incorporating one or more realistic features in the model:

- Wind Direction – Turbine rotors do not orient themselves to the sun all day, every day, as modeled in the worst case scenario. To adjust for actual rotor direction, wind data is entered into the model. For the analysis included in this application, wind data was taken from the two temporary meteorological towers located in the Project Area.
- Turbine Operating Hours – The turbine will not be operational all of the time due to local winds being outside of turbine operation specifications, or due to maintenance. Project specific wind rose data again was incorporated to reflect the frequency of sufficient wind speed to activate the turbine. The expected percentage of time the turbine is activated is multiplied by the number of minutes of shadow flicker.
- Actual Sunshine Hours – Sunshine hours are affected by cloud cover, fog or haze, time of day, and time of year. This data is provided by the WindPro software which selects the nearest weather station from its database.

Combining one or more of these three mitigating factors creates a less conservative scenario which aims to produce a scenario closest to the actual expected results. These "expected" results represent a significant reduction in shadow flicker hours per day or per year in contrast to a worst case scenario. However, if all of the above factors are incorporated into the model, it is possible – though not likely – to have lower modeled results compared to actual results in the field. This is due to the fact that true meteorological factors like wind direction or sunshine hours could be different from the averages used in a way that is worse for shadow flicker.

8.4.5 Impacts

A Shadow Flicker Assessment that details the expected impacts of the Project is included as **Appendix B**.

At a distance of 1,000 feet or greater (the Project minimum setback for inhabited structures), receptors will typically experience shadow flicker only when the sun is low in the sky, and only when the factors described in Section 8.4.4 dictate. If a receptor does experience shadow flicker, it most likely will be only during a few days per year from a given turbine, and for a total of only a fraction (typically less than 1 percent) of annual daylight hours.

Tables 6-9 in Appendix B show the hours/year of shadow flicker for the worst case and expected case scenarios (as defined in Section 8.4.4) for each turbine model type. As noted in Appendix B, no receptor is expected to experience more than 30 hours of flicker exposure per year under the expected case.

Shadow flicker from the proposed turbines is not harmful to the health of photosensitive individuals, including those with epilepsy. The frequency of shadow flicker due to wind turbines is a function of the rotor speed and number of blades, and it generally is no greater than approximately 1.5 hertz (i.e., 1.5 flashes per second). The Epilepsy Foundation has determined that generally, the frequency of flashing lights most likely to trigger seizures is between 5 and 30 flashes per second.

8.4.6 Mitigative Measures

To mitigate visual impacts of turbines, Odell will adhere to the following measures:

- Turbines will be uniform in color;
- Turbines will not be located in biologically sensitive areas such as parks, WMAs, WPAs, SNAs or wetlands;
- Turbines will have lighting only to meet the minimum requirements of FAA regulations;
- Existing roads will be used for construction and maintenance where possible to minimize the amount of new roads constructed; and
- Access roads created for the wind farm facility will be located on gentle grades to minimize erosion, visible cuts, and fills.

In addition to these measures, Odell will consider shadow flicker when siting wind turbines to minimize impacts to area residents. Flicker mitigation will be addressed as situations arise wherein a residence is experiencing inordinately more flicker than anticipated in the modeling, although it is highly unlikely more flicker than modeled will occur. Flicker occurrences should be documented daily for several consecutive months including time of day and duration. Documentation must include the location of where the shadow flicker is occurring at and thus disturbing the residence (such as a window or front porch), as well as the location of the turbine causing the flicker. Mitigation measures will be determined by the individual circumstances of residences experiencing shadow flicker, and as a reasonable function of the amount of flicker experienced. Such mitigation measures may include:

- Providing exterior screening such as vegetation, as a buffer from flicker where appropriate and reasonable.
- Providing indoor screening, such as curtains or blinds in windows, where appropriate and reasonable.
- Providing exterior screening such as awnings over windows, where appropriate and reasonable.

- Providing education about how to minimize the effect of shadow flicker, such as:
    - Lighting the room with the window(s) upon which shadow is cast.
    - Leaving the room with the window(s) upon which shadow is cast and instead occupying another room for a brief period of time.
    - Understanding how and why shadow flicker occurs.
    - Providing information on the Applicant's website about shadow flicker.

Appendix B provides additional information regarding the process Odell will follow in addressing any flicker concerns.

8.5 Public Services and Infrastructure

As shown in Figure 4.1, the Project is located in a lightly populated, rural area in southwestern Minnesota. There is an established transportation and utility network that provides access and necessary services to the light industry, small cities, homesteads, and farms existing near the Project Area. The closest communities near the Project are Bingham Lake and Mountain Lake, which are within two miles of the Project Area. Other communities within ten miles of the Project include Jackson, Odin, Ormsby, Trimont, Windom, and Butterfield. These communities generally provide sanitary sewer and water services within the city limits.

Homes and farms in the Project Area typically use private wells and septic systems for their household needs. Red Rock Rural Water System and the City of Windom also provide and distribute water to much of the Project Area (Red Rock Rural Water System 2013).

8.5.1 Roads

In general, the existing roadway infrastructure in and around the Project Area is characterized by county and township roads that generally follow section lines. Although outside of the Project Area, Minnesota State Highway 60 provides the main access to the communities closest to the Project (*See* Figure 4.1). Various county and township roads provide access to the proposed site. Access to the Project Area also includes two-lane paved and gravel roads. In the agricultural areas, many landowners use private, single-lane farm roads and driveways on their property. Roads within the Project Area are summarized in Table 8.13.

Table 8.13: Summary of Roadways within Project Area

Road Type	Miles within Project Area
Federal Highways	0
State Highways	0
County Highways/Road	40.5
Township Roads	59.8

For purposes of comparison, the functional capacity of a two-lane paved rural highway is in excess of 5,000 vehicles per day, or Annual Average Daily Traffic ("AADT"). The highest existing AADT in the Project Area is 450 vehicles per day along County-State Aid Highway 17/36 which runs east and west through the middle of the Project at the county border between Cottonwood and Jackson Counties. Along the county highways, the AADTs are generally below 350 vehicles per day. Minnesota State Highway 60, which serves as a main route to nearby communities, reports AADT levels of 5,200. (Minnesota Department of Transportation n.d.)

8.5.2 Telecommunications

Telecommunications providers in the Project Area include: Citizens Telecommunications Company of Minnesota, LLC; Integra Telecom of Minnesota, Inc.; Ionex Communications North, Inc.; NOS Communications Inc.; Qwest Corporation; Sprint Communications Company L.P.; Frontier Communications of Minnesota, Inc.; Embarq Minnesota, Inc. dba CenturyLink; Windstream Lakedale Link, Inc.; and USLink, Inc. dba TDS METROCOM (Minnesota Department of Commerce 2012).

8.5.3 Communications Systems

The Applicant has conducted a microwave beam path analysis, which did not identify any beam paths in the Project Area. Other communication signals licensed by the Federal Communications Commission ("FCC") within five miles of the Project Area are listed in Table 8.14.

Table 8.14: FCC Licensed Signals within Five Miles of Project Area

Communication System Type	Number of Signals
ASR	9
FM	1
Microwave	15
Cellular	3
LM broadcast	0
Total	**28**

Source: FCC GIS Data
ASR =Antenna Registration System
FM = FM Radio Signal
Microwave = Radio wave transmission
LM Broadcast = Land mobile broadcast tower

8.5.4 Television

Prior to construction, Odell will conduct an off-air television reception analysis of the Project. This study will provide a baseline evaluation of existing television reception in the area and estimate the potential for television interference that may be caused by turbines that obstruct existing television signals to homes in and near the Project Area. Digital signals within the Project Area are listed in Table 8.15.

Table 8.15: Digital Television Signals in Project Area

Call Sign	Network	City of License	Signal Strength
KEYC-TV	CBS	Mankato, MN	56
KSMN	PBS	Worthington, MN	64
Source: (Federal Communications Commission 2013) and (FCC GIS Data)			

8.5.5 Other Infrastructure and Services

No railroads are located within the Project Area. Two underground gas pipelines run diagonally through the Project. One pipeline operated by Northern Border Pipeline Company runs from the northwest corner of the project in Cottonwood County through to the southeast part of the Project in Jackson County. The other pipeline, which is owned by Northern Natural Gas Company, runs diagonally in a southwest/northeast trajectory in the western part of the Project in Lakeside Township in Cottonwood County in the western part of the Project. Northern States Power's Lakefield Junction-Field/Wilmarth 345 kV transmission line runs diagonally across the southeast part of the Project in Martin County. Missouri River Energy's Odin Tap to Odin 69 kV line is an underground line that runs near the boundary of Martin and Watonwan Counties. Distribution lines are present, but infrequent in the Project Area. The Project Area Facilities are shown in Figures 6.1-1, 6.1-2, 6.1-3, and 6-1.4.

8.5.6 Impacts

Roads

During the construction phase, temporary impacts are anticipated on some public roads within the Project Area. Roads will be affected by the wear and tear caused by vehicle trips required to deliver materials and equipment to and from the Project. Some specific routes will also be impacted by the temporary expansion of road widths and/or intersections to facilitate the safe and efficient delivery of equipment.

The Project may also temporarily affect traffic numbers in the area. Construction traffic will use the existing county and state roadway system to access the Project Area and deliver construction materials and personnel. The maximum construction workforce is expected to generate approximately 250 additional vehicle trips per day. Since many of the area roadways have AADTs that are well below capacity, increased traffic will likely be perceptible to area residents. Slow moving construction vehicles may also cause delays on smaller roads, similar to the impact of farm equipment during harvest.

Truck access to the Project Area is generally served by County Road 17/250th Street, which runs east and west through the center of the Project; County Road 1, which runs north and south through the center of the Project; or County Highway 21, which runs north and south in the western part of the Project. Specific additional truck routes will be determined by the location required for delivery. Additional operating permits will be obtained for over-sized truck movements.

After construction is complete, traffic impacts during the operations phase of the Project will be minimal. A small maintenance crew driving through the area in pickup trucks on a regular basis will monitor and maintain the wind turbines as needed. There would be a slight increase in traffic for occasional turbine and substation repair, but traffic function will not be impacted as a result.

Telecommunications

Telecommunications infrastructure and services could potentially be impacted by the Project's construction or operations including underground telephone and fiber optic cables. Feeder lines also have been identified as potentially impacting telephone land lines.

Communication Systems

Because of their height, modern wind turbines have the potential to interfere with existing communications systems licensed to operate in the United States. Comsearch conducted a Licensed Microwave Study for Odell. Odell has sited the Project's turbines in a manner that avoids all identified microwave beam paths and communication systems. Odell will not operate the wind farm so as to cause microwave, radio, or navigation interference contrary to FCC regulations or other law.

Television

Construction of wind turbines has the potential to impact television reception as a result of an obstruction in the line of sight between residents relying on digital antennas for TV reception and the TV station antennas. While the impact of this obstruction is unknown, Odell's television reception analysis will provide an estimate of the number of homes that may be affected. Television receptions at homes relying on cable or satellite television service will not be impacted by construction or operation of the Project.

Other Infrastructure

The Project will be constructed to avoid impacts to pipelines and other underground infrastructure.

8.5.7 Mitigative Measures

Roads

Turbines will be setback from all public roadways a minimum of 250 feet from the edge of the public right-of-way and 1.1 times the turbine height where required by county ordinance.

Impacted roadways will be restored and improved per a formalized road agreement between Odell and the relevant local governments. Odell is currently coordinating with all applicable counties and townships on the development and execution of a single, cooperative road maintenance agreement. Odell will ensure that the general contractor communicates with the relevant road authorities throughout the construction process, particularly regarding the movement of equipment on roads and the terms of the road agreement.

Telecommunications

If the Project negatively impacts telecommunication services, Odell will provide a specific mitigation plan and take the necessary steps to restore all impacted services. Odell will execute the necessary steps after the Project is constructed because it is very difficult to predict what services may ultimately be impacted (if any) before the project is constructed.

Communication Systems

Because of Odell's careful micrositing of turbines, interference with communications systems is not expected. If interference is identified during or after construction of the Project, Odell will address the interference on a case-by-case basis. Odell does not propose mitigative measures at this time.

Television

If interference to a residence's or business's television service is reported to Odell, Odell will work with affected parties to determine the cause of interference and, when necessary, reestablish television reception and service.

Odell plans to address any post-construction television interference concerns on a case-by-case basis. If television interference is reported to Odell, project representatives will:

- Log the contact in Odell's complaint database to track resolution efforts;
- Review results of the report to assess whether impacts are likely wind farm-related;
- Meet with landowner and local communication technician to determine the current status of their television reception infrastructure;
- 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 basic satellite television services at the residence;
- At the landowner's election, Odell will either install the necessary equipment or enter into an agreement to reimburse the landowner for the cost of basic satellite TV services;
- If the landowner chooses satellite service, Odell will consider the matter closed upon installation of the satellite dish;
- If the landowner chooses to have the antenna and/or amplifier installed and later complains of continued interference issues, Odell will send a technician to the site to assess whether the equipment is working properly and fix the equipment as needed and evaluate the reported interference issues;
- If wind-farm related interference remains an issue, Odell will propose an agreement that reimburses the landowner for the costs of basic satellite TV services and will remove the antenna and amplifier equipment, unless it was initially installed to serve multiple households;

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

Other Infrastructure

Odell will also coordinate with Gopher State One Call and the pipeline companies before and during construction to fully understand infrastructure and safety concerns and to prevent possible structural conflicts.

8.6 Cultural and Archaeological Resources

8.6.1 Description of Resources

The Project Area is located in the Prairie Lake archeological region. Within the Prairie Lake region, cultural resources would be expected to be found near woods, which historically were generally limited to water surrounded areas on major lakes or in major river valleys in much of the region. Additional areas where cultural resources could be found include (1) near larger river valleys; (2) near lakes and streams; (3) near resource procurement sites within upland settings; and (4) near the Minnesota River. There are few Middle Prehistoric sites within the region, with the majority of sites belonging to the Late Prehistoric period. A history of surveys resulting in the identification of unrecorded sites evidences moderate to high potential for cultural resources within many parts of the Project Area.

A records search was completed at the State Historic Preservation Office ("SHPO") on June 12, 2013 to identify previously recorded and reported archaeological and architectural sites within a half-mile of the Project Area. No previously recorded archaeological and two architectural sites have been identified within the Project Area. None of these have been evaluated for *National Register* eligibility. Within one mile of the exterior project boundaries, six archaeological and five historic structures have been identified. One of these archaeological sites (21CO0001) is listed on the *National Register.* The remaining sites have not been evaluated for *National Register* eligibility. Many properties in Minnesota have not been identified due to lack of survey, and so an absence of properties in this review does not preclude their existence. A technical memorandum from Blondo Consulting summarizing these findings is available in **Appendix C**. Tables 8.16 and 8.17 and Figures 8.10-1, 8.10-2, 8.10-3 and 8.10-4 show the cultural and archaeological sites in relation to the Project Area.

Table 8.16: Previously Identified Archaeological Sites

Number	Name	Description	Location	Relativity to Project Area	*National Register* Eligibility
21CO0001	Mountain Lake Site	Multicomponent Prehistoric Village Site	T105N R34W Section 2	Outside project area	**Listed on the *National Register***
21CO0002	Franz Site	Archaic Cache Site	T105N R34W Section 10	Outside project area	Unevaluated
21CO0050	T. Thompson Site	Fox Lake and Lake Benton Woodland Artifact Scatter	T105N R35W Section 34 Cottonwood County	Outside project area	Unevaluated
21JK0033		Woodland and Plains Village Artifact Scatter	T104N R34W Section 30 Jackson County	Outside project area	Unevaluated
21JK0035		Prehistoric Lithic Scatter	T104N R34W Section 30 Jackson County	Outside project area	Unevaluated
21JK0036		Prehistoric Artifact Scatter	T104N R34W Section 30 Jackson County	Outside project area	Unevaluated

Table 8.17: Previously Identified Standing Structures

Number	Name	Description	Location	Relativity to Project Area	*National Register* Eligibility
CO-MLT-002	Mountain Lake Mountain	"first settlement around Mt. Lake"	T105N R34W Section 10 Cottonwood County	Outside project area	Unevaluated
JK-CRS-8	Christiania Town Hall	Stucco covered school house	T104N R35W Section 23 Jackson County	Outside project area	Unevaluated
JK-CRS-9	Bergen Store	rural general store	T104N R35W Section 25 Jackson County	Outside project area	Unevaluated
JK-CRS-10	House	"Bergen's most intact house of this age"	T104N R35W Section 25 Jackson County	Outside project area	Unevaluated
JK-KIM-1	Kimball Town Hall	school	T104N R34W Section 15 Jackson County	Within project area	Unevaluated
JK-KIM-2 to JK-KIM-6	Calvin Fett Farmstead	historic farm consisting of house, barn, granary, garage, and chicken shed	T104N R34W Section 20 Jackson County	Within project area	Unevaluated
MR-CED-2	Church	Church	T104N R33W Section 20 Martin County	Outside project area	Unevaluated

A preliminary windshield survey of the Project Area was also completed by Blondo Consulting on June 13, 2013. Based on this review, most farmsteads in the area appear to be typical family farms, with occasional buildings aged 50 years or older. Tilled agricultural fields were cultivated in corn and other commodity crops. A slow spring planting season in 2013 allowed general visual inspection during the windshield survey of the ground and landscape.

The Applicant also conducted early coordination with SHPO. SHPO's response letter is included in **Appendix D.** SHPO has recommended additional surveys for properties and archaeological sites

8.6.2 Impacts

Any ground disturbing, activity within the Project Area can potentially impact known or unknown cultural resources. There may also be possible concerns regarding visual impacts to properties within and adjacent to the Project Area.

Odell intends to avoid impacts to archaeological and historical sites. Based on the data search at SHPO, no historic properties or archaeological sites were identified within a half-mile APE of the Project Area. The letter dated June 21, 2013 from SHPO recommends an additional survey be completed. The Applicant will complete this survey for the areas to be disturbed by the project.

8.6.3 Mitigative Measures

In the event that an archeological site is found during construction, the integrity and significance of the site will be addressed in terms of the potential of the site to be eligible for listing in the National Register of Historic Places ("NRHP"). If such sites are found to be eligible for listing in the NRHP, mitigation measures will be developed in consultation with SHPO, the State Archeologist, and any relevant American Indian communities. If previously unknown archaeological resources are inadvertently encountered during construction and/or operation, the discoveries will be reported to SHPO.

Odell will coordinate with SHPO in the event that new, unrecorded sites are discovered during any phase of the Project. Before the Project's construction, Odell will also prepare an Unanticipated Discoveries Plan. The plan will detail a process for prompt communication and action regarding the discovery of previously unknown archaeological resources or human remains should they be encountered. Once the plan is fully developed, it will be submitted to SHPO for review and approval.

8.7 Recreation

8.7.1 Description of Resources

Recreational opportunities in the Project Area include hiking, biking, boating, fishing, camping, swimming, horseback riding, cross country skiing, bird watching, snowmobiling, hunting, and nature viewing. Figure 8.3 depicts the locations of state and county parks, WMAs, SNAs and WPAs near the proposed Project Area.

Some of the popular recreation within ten miles of the Project include: Killen Woods State Park, Mountain County Park, and the Des Moines River Water Trail. Odell identified six recreational trail(s) (CR79, SCAH24, Des Moines River, Elm Creek Trail, a Park Entrance Road, and an Unnamed Trail (in Kilen Woods State Park)) and three snowmobile trails (Kilen Woods State Park Trails, Cottonwood-Jackson County Snowmobile Trail, and the Riverside Trail) outside of the Project Area but within ten miles.

Minnesota WMAs are managed to provide wildlife habitat, improve wildlife production, and provide public hunting and trapping opportunities. These DNR lands were acquired and developed primarily with hunting license fees. WMAs are closed to all-terrain vehicles and horses because of potential detrimental effects on wildlife habitat. There are no WMAs within the Project Area. There are two WMAs adjacent to the west side of the Project. WMAs located within ten miles of the Project Area are included in Table 8.18.

Table 8.18: Wildlife Management Areas less than Ten Miles from the Project Area

Distance from Project Area (mi)	WMA Name	Nearest to	WMA Area (acres)
9.37	Arnolds Lake	Windom	123.3
5.99	Arzt	Jackson	16.2
0*	Banks	Bingham Lake	312.2
0*	Bennett	Bingham Lake	344.2
8.69	Bootleg Lake	Lakefield	87.4
5.63	Caraway	Lakefield	208.1
6.74	Caron	Sherburn	416.4
1.79	Carpenter	Bingham Lake	60.8
6.90	Curry	St. James	111.3
5.38	Delft	Delft	351.7
7.27	Ewy Lake	Sveadahl	227.1
1.27	Fossum	Odin	138.8
9.00	Four Corners	Sherburn	309.4
1.11	Laurs Lake	Bergen	265.6
4.99	Lillegard	Wilder	37.5
6.73	Little Swan	Delft	411.8
3.04	Mountain Lake	Mountain Lake	70.1
0.71	Regehr	Mountain Lake	65
8.41	Rooney Run	Trimont	192.2
8.40	Seymour Lake	Sherburn	160.1

0.27	Sulem Lake	Butterfield	55
8.75	Timber Lake	Wilder	916.2
9.5	Toe	Lakefield	342.5
6.89	Turtle	St. James	12.6
4.96	Watline	St. James	106.8
8.33	Wilder	Wilder	3.6
9.26	Willow Creek	Ormsby	69.2
3.42	Wolf Lake	Windom	55.4
*Adjacent to Project, outside of Project Area			

SNAs are areas designated to protect rare and endangered species habitat, unique plant communities, and significant geologic features that possess exceptional scientific or educational values. The closest SNAs to the Project are located in or around the Des Moines River Valley to the west of the Project. SNAs located within ten miles of the Project Area include:

- Des Moines River SNA
- Holthe Prairie SNA
- Prairie Bush Clover SNA

WPAs are managed to protect breeding, forage, shelter, and migratory habitat for waterfowl or wading birds, such as ducks, geese, herons, and egrets. WPAs provide opportunities for viewing wildlife and intact ecosystems. WPAs located within ten miles of the Project Area are shown on Table 8.19.

Table 8.19: Waterfowl Production Areas Less than Ten Miles from the Project Area

Distance from Project Boundary (mi)	WPA Name	WPA Area (Acres)
1.1	Christiania WPA	132.7
7.1	Blixseth WPA	161.8
8.9	Bootlake WPA	434.5
2.8	Cottonwood Lake WPA	313.1
2.3	Fish Lake WPA	99.3
9.2	Harder Lake WPA	160.0
2.3	Mountain Lake WPA	16.3
9.9	Primrose WPA	70.6
8.3	String Lake WPA	230.9
8.1	Swan Lake WPA	146.5

9.8	Timber Lake WPA	387.1
8.6	Watonwan River WPA	356.7
2.5	Wolf Lake WPA	406.6

No National Wildlife Refuges ("NWR") were identified within ten miles of the Project Area.

8.7.2 Impacts

The Project will avoid all WMAs, WPAs, SNAs, USFWS lands, and public parks. In general, recreational impacts will be visual in nature affecting individuals using public land near the Project Area for recreation. *See* Section 8.4 for additional discussion of visual impacts and proposed mitigative measures. Visual impacts will be most evident to visitors using any recreational resource within a mile radius of the site.

8.7.3 Mitigative Measures

Project turbines and facilities will not be located within public parks, trails, WPAs, WMAs, or in USFWS lands. Turbines will be set back from public lands based on a minimum of the 3 RD by 5 RD setbacks from all non-leased properties per the LWECS Application Guidance, and at least 250 feet from public trails or the distance required by county ordinance, as applicable.

8.8 Public Health and Safety

8.8.1 Description of Resources

Public Health

Human health in a region is a function of demographics, environmental quality, social and behavioral trends, and access to health care. Demographics, as discussed in Section 8.1 of this application create the basis for human health in the Project Area. As is typical of Minnesota, the population in Jackson, Cottonwood, Watonwan and Martin Counties is aging. Poverty rates vary based on geographic scale but are generally typical of the broader state, as are income levels (U.S. Census Bureau 2010). Access to physicians is best in Martin County and poorest in Jackson County. Data on behavioral trends on a regional basis are scant but it is notable that children in the Project Area are immunized at rates typical of other parts of the state. (Minnesota Department of Health 2012).

On average, this region of Minnesota experiences three days of unhealthy air pollutant levels and the various regions in state of Minnesota experiences up to 33 days of unhealthy air pollutant levels annually. As MPCA notes in their 2013 report to the Minnesota Legislature. (Minnesota Pollution Control Agency 2013):

> "Air pollution can cause breathing problems, itchy throats, burning eyes, and trigger asthma and bronchitis attacks. It contributes to cancer, heart attacks, and other serious illnesses. Even healthy, athletic adults can be harmed by breathing air pollutants. Young

> children may be more susceptible to health problems from air pollution because of their small size and rapid breathing. The elderly and people with heart and lung conditions are also at increased risk of harm from air pollution."

EMF and Stray Voltage

The term electromagnetic field ("EMF") refers to electric and magnetic fields that are present around any electrical device. Electric fields arise from the voltage or electrical charges and magnetic fields arise from the flow of electricity or current that travels along transmission lines, power collection (feeder) lines, substation transformers, house wiring, and electrical appliances. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors (wire). EMF can occur indoors and outdoors. However, there are no discernible health impacts from power lines (NIEH 1999). Wind turbine generators and power lines will be setback from residences according to state and county standards, where EMF will be at background levels.

In those instances where distribution lines have been shown to contribute to stray voltage, the electric distribution system directly serving the farm or the wiring on a farm was directly serving the farm or the wiring on a farm was directly under and parallel to the transmission line. These circumstances are considered in installing transmission lines and can be readily mitigated. Problems related to distribution lines are also readily managed by correctly connecting and grounding electrical equipment.

Air Traffic

There are three FAA registered airports located within twenty (20) miles of the Project Area (Table 8.20). Jackson Municipal Airport is approximately nine miles south of the Project. The nearest municipal airport is the Windom Municipal Airport, located approximately 4.3 miles northwest of the Project Area. Turner Field Airport is a private use airport located within the Project Area.

Table 8.20: FAA Registered Airports and Airstrips within 20 Miles of the Project

Airport Name	MN City	MN County	Distance[a]	Runway Information[b]	Runway Elevation (feet)[c]
Jackson Municipal Airport	Jackson	Jackson	9 miles	Asphalt, in good condition	1146'
Windom Municipal Airport	Windom	Cottonwood	4.3 miles	Concrete, in good condition	1410'

Turner Field Airport*	Bingham Lake, MN	Cottonwood	Inside the Project Area	Turf	1410’
a Distance in miles from the nearest portion of the Odell project boundary. ***b Runway surface type and condition.*** ***c Elevation in feet at the highest point on the centerline of the useable landing surface. Measured to the nearest foot with respect to mean sea level (“MSL”).*** ****Private ownership, Private Use airstrip***					

Additionally, within the Project Area there are two unregistered private airstrips owned and operated by landowners. The known details of the two private airstrips are listed in Table 8.21 below.

Table 8.21: Unregistered Private Airstrips in the Project Area

FAA Registered Name	Distance*	Section/ Township/ Range	Township Name	County	Runway Information
n/a	Inside Project Area	22/105N/34W	Mountain Lake	Cottonwood County	East/West Orientation
n/a	Inside Project Area	29/105N/34W	Mountain Lake	Cottonwood County	North/South Orientation

**Distance in miles from the nearest portion of the Odell project boundary.*

Safety and Security

The Project is located in a rural setting that has a moderate population density. Construction and operation of the Project will have minimal impacts on the security and safety of the local populace. Odell is gathering information to coordinate with all emergency and non-emergency response teams for the area, including law enforcement agencies, ambulance services, fire departments, and 911 services.

8.8.2 Impacts

Public Health

In 2013, the Oregon Public Health (“OPH”) Division of the Oregon Health Authority completed a comprehensive study of health impacts from wind energy development which was unique in its broad sweeping assessment of health impacts from noise and flicker generation to economic impacts from wind energy. Because noise and flicker are discussed in Sections 8.3 and 8.4 of this application they are excluded here. Regarding other health impacts OPH found “…some positive effects from reductions in air pollution and greenhouse gas emissions, and from the economic benefits they bring to Oregon communities. The division believes any positive impacts could be maximized if people's concerns about noise, visual impacts and fairness are taken seriously and addressed during the siting process." (Oregon Health Authority 2013).[1]

Specific to the Odell project, the MPCA provided comments to the Commission regarding the power purchase contract between Odell and Xcel Energy as well as two other 200 MW wind energy projects Xcel intends to purchase power from. A copy of this letter is included in Appendix D. Using MPCA's analysis of the PPA documents, Odell estimates that the Project will generate between $20 and $50 million in health savings from year 2017 and beyond because of reduction in air pollutants. Because of these savings and the reduction in greenhouse gasses, MPCA states that it believes that the Odell wind proposal is in the public interest.

EMF and Stray Voltage

While the general consensus is that electric fields pose no risk to humans, the question of whether or not exposure to magnetic fields potentially causes biological responses or even health effects continues to be the subject of research and debate, EMF from underground electrical collection lines dissipates very close to the lines because they are installed below ground within insulated shielding. The electrical fields are negligible, and there is a small magnetic field directly above the lines that, based on engineering analysis, dissipates within 20 feet on either side of the installed cable. EMF associated with the transformers at the base of each turbine completely dissipates within 500 feet, so the 1,000 feet turbine setback from residences will be adequate to avoid any EMF exposure to homes.

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 the earth 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. Stray voltage is a particular concern for dairy farms because it can impact operations and milk production. Problems are usually related to the distribution and service lines directly serving the farm or the wiring on a farm affecting confined farm animals.

Air Traffic

Odell is coordinating with the Windom Municipal Airport, Jackson Municipal Airport, and three private airports/airstrips, the FAA, and MnDOT prior to construction to understand potential impacts.

Other air traffic may be present near the Project Area for crop dusting of agricultural fields. Crop dusting is typically carried out during the day by highly maneuverable airplanes or helicopters. The installation of wind turbine towers in active croplands and installation of aboveground collection lines, if needed, will create a potential collision risk with crop-dusting aircraft. However, aboveground collection lines are expected to be similar to existing

[1] http://public.health.oregon.gov/HealthyEnvironments/TrackingAssessment/HealthImpactAssessment/Documents/Wnd%20Energy%20HIA/Wind%20HIA_Final.pdf

distribution lines (located along the edges of fields and roadways) and the turbines themselves would be visible from a distance and lighted according to FAA guidelines.

The FAA reviewed Odell's preliminary turbine layout for the Project which resulted in "No Hazard" determinations. The FAA reviewed turbines with total height of up to 499 feet. If taller turbines are used, or if the project layout changes from what had been provided to the FAA, the Project will re-file with the FAA for the changes. The wind turbine towers and meteorological towers will have lighting to comply with FAA requirements. The Applicant will notify local airports about the Project including locations of new towers in the area to minimize impacts and reduce potential risks to crop dusters. Odell has prescreened the Project Area using the tools available on the FAA's Obstacle Evaluation website and found the area to have no identified impacts to aviation radar or military flight activities.

Safety and Security

In the event that emergency services are needed for local residents during construction, construction will stop, and any impeding equipment will be relocated so that emergency vehicles may access the emergency site. Once construction is complete, the Project will not impede emergency services.

No impacts on the security and safety of local communities from construction and operation of the Project are anticipated. Wind turbine towers will be locked when O&M personnel are not utilizing the towers. The substation and the O&M Building will also be secured, locked facilities.

8.8.3 Mitigative Measures

Public Health

No impacts to human health are anticipated and no mitigation is proposed. Issues associated with noise and shadow flicker mitigation are addressed in Sections 8.3 and 8.4, respectively.

EMF and Stray Voltage

No impacts due to electromagnetic fields or stray voltage are anticipated and no mitigation is proposed. Odell is committed to siting turbines and associated facilities to avoid conflicts with dairy farmers in the Project Area.

Air Traffic

Odell will mark and light the turbines to comply with FAA requirements. The Applicant will paint meteorological towers red at the top to improve visibility and will notify local airports about the Project and new towers in the area to reduce the risk to crop dusters. Odell will work with landowners on coordinating crop dusting activities. Permanent meteorological towers will be free-standing with no guy wires. Temporary meteorological towers will have supporting guy wires which will be marked with colored sleeves and safety shields (marker balls) for increased visibility.

Odell is currently working with the private owners (including the Turner Field Airport owner) regarding a strategy for continued safe airplane operations. Odell has offered to rent hangar spaces at the Windom Municipal Airport for the private airstrip owners. Odell has not received any major concerns from the landowners regarding the Project and private airstrips.

Safety and Security

Odell and its construction team will coordinate with first responders, including but not limited to air ambulance, local sheriff's office(s) and local fire services, to develop a safety plan during construction and operations of the Project. Odell will also be in contact with local first responders to offer information about the Project and to answer any questions response teams may have regarding Project plans and details. Odell will also coordinate with Gopher State One Call and the pipeline companies before construction begins.

The following security measures will also be taken to reduce the chance of physical and property damage, as well as personal injury, at the site:

- The towers will be setback from occupied homesteads according to state and county standards.
- Security measures will be taken during the construction and operation of the Project including temporary (safety) and permanent fencing, warning signs, and locks on equipment and wind power facilities.
- Regular maintenance and inspections will address potential blade failures, minimizing the potential for blade throw.
- Turbines will sit on solid steel enclosed tubular towers within which all electrical equipment will be located, except for the pad-mounted transformer where applicable. Access to the interior of the tower is only through a solid steel door that will be locked when not in use.
- Permanent meteorological towers will be free-standing. The guy wires on temporary meteorological towers will have color sleeves at ground level to increase visibility.
- Where necessary or requested by landowners, the Applicant will construct gates or fences.
- Safety training and standardized practices will be conducted for construction crews and on-site personnel.

8.9 Hazardous Materials

8.9.1 Description of Resources

The land within the Project Area is primarily rural and used for agriculture. Potential hazardous materials within the Project Area would be associated with agricultural activities, and include petroleum products (fuel and lubricants), pesticides, and herbicides. Older farmsteads may also have lead-based paint, asbestos shingles, and polychlorinated biphenyls in transformers. Trash and farm equipment dumps are common in rural settings. As part of the Project financing process, an ASTM conforming environmental site assessment will be conducted for the Project Area to identify any such existing hazards within the Project Area.

During project operations, three types of petroleum product fluids are necessary for the operation of each turbine and include:

- Gear box oil – synthetic or mineral depending on application (approximately 300 liters)
- Hydraulic fluid
- Gear grease

These wastes will be managed and, if disposal is necessary, disposed of in compliance with the requirements of applicable laws and regulations

8.9.2 Impacts

The Applicant will conduct an environmental site assessment prior to construction to locate and avoid hazardous waste sites.

Turbine hydraulic oils and lubricants will be contained within the wind turbine nacelle, or in the case of car, truck, and equipment fuel and lubricants, within the vehicle. Transformer oil will be contained within the transformer. Fluids will be monitored during maintenance at each turbine and transformer. A small amount of hydraulic oil, lube oil, grease, and cleaning solvent will be stored in the O&M building. When fluids are replaced, the waste products will be handled according to regulations and disposed of through an approved waste disposal firm.

8.9.3 Mitigative Measures

Because any potential hazardous waste sites identified will be avoided, no mitigative measures are necessary. If any wastes, fluids, or pollutants are generated during any phase of the operation of the Project, they will be handled, processed, treated, stored, and disposed of in accordance with Minnesota Rule Chapter 7045.

8.10 Land-Based Economies

8.10.1 Description of Resource

Agricultural/Farming

The majority of the Project Area is cultivated farmland, as shown in Figure 8.4. Cultivated land comprises approximately 32,151 acres (approximately 93 percent) of the Project Area. Grasslands comprise approximately 427 acres (approximately 1 percent) of the site. Essentially, the whole Project Area is used for agricultural purposes. Corn, soybeans, small grains, and forage crops are grown throughout the four counties. Cash crops and livestock production are the major sources of agricultural income. Martin County is listed as the second highest livestock producing county in Minnesota (Minnesota Department of Agriculture 2012). Martin and Jackson County are listed in the top ten counties for Minnesota crop production, with Martin

County ranking sixth and Jackson County ranking eighth among Minnesota's eighty-seven counties (Minnesota Department of Agriculture 2011).

Converting cropland to the Conservation Reserve Program ("CRP") and the RIM program is another source of farm income. CRP and RIM lands are cropland planted to conservation grasses and legumes to protect and improve the soil and cannot be harvested or pastured. Contracts for land enrolled in CRP are ten to fifteen years in length. The long-term goal of the program is to re-establish valuable land cover to help improve water quality, prevent soil erosion, and reduce loss of wildlife habitat (U.S. Department of Agriculture, Farm Service Agency 2013). RIM conservation easements are considered permanent.

The majority of cropland in the four counties is planted with corn and soybeans. Green peas, forage, and wheat are additional crops in the Project Area.

Large-scale animal production has been a growing component of the agricultural industry in recent years. Feedlots used for the confined feeding, breeding, or holding of animals are a common practice for animal production. There are 1,638 feedlots, either registered or required to be registered, in Watonwan (225), Jackson (547), Martin (538), and Cottonwood (328) counties (Minnesota Pollution Control Agency 2011).

Most of the soil within the Project Area is prime farmland. The U.S. Department of Agriculture Natural Resource Conservation Service ("NRCS") identifies prime farmland as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pasture land, forestland, or other land. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance (U.S. Department of Agriculture, Natural Resources Conservation Service 2009).

8.10.2 Forestry

Economically important forestry resources are not found in this region of Minnesota. Forested areas are primarily associated with homes in the form of woodlots and along the creeks within the Project Area.

8.10.3 Mining

Sand and gravel resources occur in glacial till and outwash deposits. Many of the pits are inactive, abandoned, or their use is limited to the landowner; there are no active industrial pits or quarries in the Project Area.

Based on Minnesota Department of Transportation ("MnDOT") County Pit Maps and topographic maps for the Project Area, Odell does not know of any gravel pits located within the Project Area. The closest gravel/aggregate pit is located in the Southeast Quarter of the Northwest Quarter of Section 1 in Mountain Lake Township in Cottonwood County (Minnesota Department of Transportation 2003).

8.10.4 Impacts

Agricultural/Farming

The presence of the Project will not significantly impact the agricultural land use or general character of the area. As demonstrated by other wind energy projects in the Midwest, agricultural practices continue during construction and operations.

Land will be taken out of agricultural production where the turbines and access roads are located (approximately 0.5 to 1 acre per turbine). Landowners may continue to plant crops near and graze livestock up to the turbine pads. In some instances, agricultural practices will be impacted by requiring new maneuvering routes around the turbine structures for agricultural equipment.

When construction occurs outside of winter months, temporary impacts to agriculture become more likely. These temporary impacts could include, but are not limited to, loss of planting opportunity, crop damage, drain tile damage, and soil compaction.

Specific impacts to agricultural lands will be determined once turbine model, turbine and road placement, and substation/O&M facility locations have been finalized. Most of the soil within the Project Area is considered prime farmland. The loss of agricultural land to the construction of the wind farm will reduce the amount of land that can be cultivated. Less than one half of 1 percent of the Project Area will be permanently converted to non-agricultural land use. This will not significantly alter crop production in the Project Area or the four counties.

Odell will coordinate with property owners to identify features on their property, including drain tile, which should be avoided. Any permanent impact to drain tile will be avoided by Odell. Although avoidance of drain tile is a goal, Odell recognizes that the excavation and heavy equipment associated with construction may cause damage to known or unknown drain tiles. If drain tile damage occurs during construction activities or operation of the LWECS, the tile will be repaired as soon as possible and according to the land lease and wind easement agreement between Odell and the landowner.

The Applicant will minimize impacts to CRP land and avoid all impacts to RIM lands.

Forestry

No impacts are anticipated to forestry resources. Since a majority of the woodlots are associated with homesteads, no impacts are anticipated to woodlots.

Mining

Negative impacts to mining are not anticipated. Sand and gravel operations tend to be small and other occurrences of these materials are likely to be present in nearby areas, including large commercial operations in the general area.

8.10.5 Mitigative Measures

Agricultural Farming

Only the land for the turbine, certain electrical equipment, and access roads will be taken out of crop production. Once the wind turbines are constructed, all land surrounding the turbines and access roads may still be farmed. The conversion of agricultural land to a site for a wind energy facility will not result in the loss of any agriculture-related jobs or any net loss of income. Revenue lost from the removal of land from agricultural production will be positively offset by lease payments to landowners hosting the Project facilities.

The Applicant will minimize impacts to CRP land and avoid all impacts to RIM lands. If CRP land is impacted, the Applicant will work with the landowner and the NRCS to remove the impacted portion of the enrolled parcel from the CRP program. There will be no impacts to RIM land; therefore no mitigation is proposed.

Forestry

No impacts are anticipated. No mitigation is proposed.

Mining

Project facilities, including towers and roads, will not be located within sand and gravel operations.

8.11 Tourism

8.11.1 Description of Resources

Tourism in the Project Area and the local counties focuses on promoting the area's game and wildlife, lakes, farms, and villages. The general area boasts cultural resources (museums, art, and antiques) and recreational resources (parks, hiking trails, camping, canoeing, horseback riding, fishing, wildlife refuges, snowmobiling, golf courses, swimming pools, tennis courts, and skiing). The counties and local cities host a variety of festivities and cultural events throughout the year.

8.11.2 Impacts

Because all Project facilities will be located on private lands, there will be no direct impacts to recreational facilities, public lands, or other tourism-related activities. Proposed setbacks from recreational trails, public roads, and non-leased properties (including public lands) will minimize any indirect impacts. The Project is not anticipated to have a significant effect on area tourism.

8.11.3 Mitigative Measures

Because no significant impacts are anticipated, no mitigation beyond the minimum turbine setbacks is proposed.

8.12 Local Economies

According to Minnesota's Quarterly Census of Employment and Wages ("QCEW"), the main industries in the four counties in the Project Area include agriculture; trade; manufacturing; construction; educational services; public administration; and accommodation and food services. In all four counties, manufacturing and agriculture were particularly strong facets of the local economies (Minnesota Department of Employment and Economic Development 2012).

8.12.1 Impacts

The Project provides landowners and farmers with opportunities for higher agricultural profitability and a more diverse revenue stream. Wind energy is an income-generating opportunity that will provide a long-term, annual benefit to landowners who have chosen to participate in the Project.

The Project will also positively impact the counties' tax bases and local economies. In addition to contributing to a charitable community fund, creating jobs and supplementing personal income, the Project will pay a wind energy production tax to local units of government. This production tax credit is $0.0012 per kWh of electricity produced, resulting in an annual wind energy production tax payment of approximately $850,000.00.

Local contractors and suppliers will be used for portions of the construction. Total wages and salaries paid to contractors and local workers will contribute to the total personal income of the region. Additional personal income will be generated for residents in the county and state by circulation and recirculation of dollars paid out by the Applicant for business expenditures and for state and local taxes. Expenditures made for equipment, fuel, operating supplies, and other products and services benefit businesses in the county and the state. Landowners having turbine or other Project facilities on their land will receive a royalty or lease payment annually for the life of the Project. Table 8.22 provides estimates of the anticipated economic benefits to local governments, communities, and landowners. These payments diversify and strengthen the local economy.

Odell will form the "Odell Community Fund," a 501(c)(3) organization for the purpose of engaging in and contributing money to the support of charitable activities within the communities near the Project. Assuming the Project is constructed at 200 MW, Odell will contribute $40,000 annually to the Odell Community Fund to support charitable activities within the neighboring communities. The funds will be administered by a volunteer board of directors consisting of participating landowners, township officials and one at-large community member. The Odell Community Fund will help ensure that the entire community surrounding the Project, not just the participating landowners, see benefits from construction of the Project.

Table 8.22: Community Economic Benefits

Community Economic Benefits	Annual	20-yr Total
Tax Revenue (Co. & Twps.)	$850,000	$17,000,000
Odell Community Fund	$40,000	$800,000
Total Landowner Group Revenue	$1,100,000	$22,000,000
Total Economic Benefits	**$1,990,000**	**$39,800,000**

8.12.2 Mitigative Measures

Socioeconomic impacts associated with the Project will be primarily positive with an influx of wages and expenditures made at local businesses during Project construction and an increase in the counties' tax bases from the construction and operation of the wind turbines.

8.13 Topography

8.13.1 Description of Resources

The Project is located in the Minnesota River Prairie subsection of the Minnesota DNR's Ecological Classification System (Minnesota DNR 2013). Subsection boundaries delineate a significant regional change in geology, topography, and vegetation. The Minnesota River Prairie subsection consists of a gently rolling ground moraine about sixty miles wide. The Minnesota River occupies a broad valley that splits the subsection in half. Ground moraine topography is level to gently rolling. The steepest topography of the subsection is along the Minnesota River and on the Big Stone Moraine, which has steep kames and broad slopes. (Minnesota DNR 2013). In the Project Area, elevations range from 1,219 feet to 1,412 ft (372 meters to 430 meters) above sea level. A topographic map of the Project Area is shown in Figures 8.5-1, 8.5-2, 8.5-3 and 8.5-4.

8.13.2 Impacts

No impacts to topography are anticipated. Wind turbines and access roads will not require significant excavation or fill.

8.13.3 Mitigative Measures

No impacts are anticipated, and as such, no mitigative measures are proposed.

8.14 Soils

8.14.1 Description of Resources

Figures 8.6-1, 8.6-2, 8.6-3 and 8.6-4 show the characteristic soils of the Project Area. The Project Area's loamy soils are formed in till of Des Moines lobe origin. The soils are largely silt and silty loam with some sandy loam. Sand composes only a small percentage of soils in the subsection. Most of the subsection is Udolls and Aquolls on relatively gentle topography, generally with fifteen feet or less of local relief over the general slope of the area. Roughly half of the area is hydric or drained. There is the potential for loss of disturbed soil due to wind since the soil is dominantly fine clastic material (very fine sand and silt).

8.14.2 Impacts

As with any soil disturbance, construction of the turbines and access roads can increase the potential for erosion and sedimentation. Construction of the turbine sites and access roads will involve temporarily disturbing at the most approximately two to six acres of land per turbine. The amount of land that will be converted to wind turbines, transformer pads, and access roads will be determined once the site layout has been finalized. Soil compaction is another impact associated with the construction of the Project.

8.14.3 Mitigative Measures

Erosion control methods such as silt fence and temporary mulch will be used during construction. The topsoil is generally removed and stockpiled where the roads and turbines are constructed and then spread back over the disturbed areas. In areas where soil compaction occurs, Odell will use soil decompaction methods to restore the soil.

A National Pollutant Discharge Elimination System ("NPDES") permit application to discharge stormwater from construction facilities will be acquired by the Applicant from the MPCA. Best Management Practices ("BMP") will be used during construction and operation of the Project to protect topsoil and adjacent resources and to minimize soil erosion, whether the erosion is caused by water or wind. Practices may include containment of excavated material, protection of exposed soil, stabilization of restored material, and treating stockpiles to control fugitive dust. A Stormwater Pollution Prevention Plan ("SWPPP") will be developed prior to construction that will include BMPs such as silt fencing, revegetation plans, management of exposed soils to prevent erosion.

8.15 Geologic and Groundwater Resources

8.15.1 Description of Resources

The project is located on deposits of glacial till more than 150 feet thick. Figures 8.7-1, 8.7-2, 8.7-3 and 8.7-4 show the geology of the Project Area. The underlying bedrock is Sioux Quartzite. There is some Cretaceous shale and sandstone on top of the quartzite. The Cretaceous strata are largely eroded away, occurring as discontinuous islands of variable thickness. The glacial sediments are mostly unsorted till that is predominantly loam and silt. No adverse geological conditions, such as sinkholes, are expected in this Project Area.

The vast majority of wells in the Project Area draw water from any of several buried confined sand and gravel aquifers. Most of these wells are less than 100 feet deep. Turbine foundation construction is unlikely to affect local water supply from the buried confined sand and gravel aquifers. Geotechnical testing will occur at all turbine locations and will consist of core-penetration testing. According to the MN Department of Health's County Well Index online database, there are approximately fifty (50) wells located in the Project Area (Minnesota Department of Health – Division of Environmental Health 2007).

8.15.2 Impacts

Construction and operation of the Project will not significantly impact the water supply. A water supply may be necessary for the operations and maintenance facility which might require a new private well. Water usage during the operating period will be similar to household volume; less than five gallons per minute.

Water supply needs will be minimal and can be accommodated locally. Shallow artesian aquifers have not been identified; therefore, the risk of impacting them is quite small. A worst case scenario would involve the compromise of local water levels, which may cause interference with the operation of some nearby wells.

8.15.3 Mitigative Measures

The risk of impacting geologic and groundwater resources is quite small, therefore, no specific mitigation is proposed. In the event that a well is abandoned, it will be capped as required by Minnesota law.

8.16 Surface Water and Floodplain Resources

8.16.1 Description of Resources

The Project Area is located within the Blue Earth River and Watonwan River watersheds. According to the Minnesota Public Waters Inventory ("PWI") data (DNR 2008) there are four water courses within the Project Area for a total length of 22.9 miles of permanent and intermittent streams. The South Fork of the Watonwan River flows from west to east across the center of the Project Area for a length of 11.8 miles. The North Fork of Elm Creek has its headwaters in the Project Area and flows south for a length of 3.4 miles through the Project Area. The Cedar Creek also has its headwaters in the Project Area and flows southeast from the Project Area's southeastern corner for a length of 4.5 miles. Judicial Ditch 1 flows west to east along the Project Area's northern boundary, and occasionally crosses the Project Area's northern boundary. It crosses the boundary five times for a total of 2.9 miles within the Project Area. Finally there are 0.2 miles of unnamed tributaries. All of these are considered natural watercourses.

There are two PWI wetlands within the Project Area and one PWI basin adjacent to the Project Area along the northern boundary. One wetland is located along the western boundary along the South Fork of Watonwan Creek and is 31.6 acres. The second wetland is located in the southern portion of the Project Area near the North Fork of Elm Creek and is 31.5 acres in size. The public water basin is 147.7 acres in size, of which 1.0 acre is located within the Project Area. This basin is protected as part of the Bennett WMA. Figure 8.8 shows the locations of the public waters identified above.

Federal Emergency Management Agency ("FEMA") Flood Insurance Rate Maps (Table 8.23) indicate floodplains along the judicial ditch just north of the Project Area, along the South Fork of the Watonwan River in the center of the Project Area, along the North Fork of Elm Creek in the southern portion of the Project Area, and along Cedar Creek in the southeastern portion of the Project Area (**Appendix E**).

Table 8.23: FEMA Flood Insurance Rate Maps

FEMA FIRM Community Panel Number	County	Project Area PLSS TRS
270622 0225 B (FEMA 1981a)	Cottonwood	T105N R34W S12-17, 19-24, 26-36
270622 0195 B (FEMA 1981a)	Cottonwood	T106N R35W S35-36
270622 0185 B (FEMA 1981a)	Cottonwood	T106N R35 W S22-26
270649A Map 21 (FEMA 1985)	Watonwan	T105 R33 S7, 18
270641B Map 1 (FEMA 1988)	Martin	T104 R33 S4-9, 16-17
270632 0200 B (FEMA 1981b)	Jackson	T 104 R34 S1-4, 9-10, 12, 15-16, 21
2706232 0150 B (FEMA 1981b)	Jackson	T 104 R34 S5-8, 17-20 T104 R35 S1-2, 12

There are no designated wildlife lakes in or adjacent to the Project Area.

8.16.2 Impacts

The Project will not require the appropriation of surface water or permanent dewatering. Temporary dewatering may be required during construction for specific turbine foundations and/or electrical trenches.

Project facilities will be designed to avoid impacts on surface water resources to the extent practicable. Wind turbines will be built on uplands to avoid surface water resources in the lower elevations. However, Project facilities, such as underground electrical collector lines, access roads, crane paths, turbine pads, and the O&M building, will impact land and, therefore, potentially impact surface water runoff within the Project Area. Ground disturbing construction activities may also cause sedimentation. These impacts are expected to be minimal.

The Project will not impact known floodplain areas.

8.16.3 Mitigative Measures

Turbines will be constructed on relatively high elevation portions of the Project Area to maximize the wind resource, and as such are likely to avoid direct impacts to surface waters and floodplains, which tend to be in lower topographical positions.

Access roads and substations will be designed to minimize impacts on surface waters and floodplains. Temporary impacts associated with crane walkways will also be minimized. Installation of underground utilities is expected to avoid impacts by boring under surface water features as necessary.

Best practices will be used during construction and operation of the Project to protect topsoil, minimize soil erosion and protect surface water and floodplain resources from direct and indirect impacts. Practices may include containing excavated material, using silt fences, protecting exposed soil, stabilizing restored material, and re-vegetating disturbed areas with non-invasive species.

If the Project will permanently or temporarily impact waters of the U.S., Minnesota PWI's or 100-year floodplains, the Applicant will apply for the necessary permits prior to construction, and will work with officials to minimize impacts. Access roads will be constructed to allow appropriate drainage. Prior to construction, a Storm Water Pollution Prevention Plan will be prepared and an NPDES permit will be obtained.

8.17 Wetlands

8.17.1 Description of Resources

According to the National Wetlands Inventory ("NWI") polygon data, there are 177 wetlands totaling 248.3 acres within the Project Area (Table 8.24, Figures 8.9-1, 8.9-2, 8.9-3 and 8.9-4). These wetlands are primarily small (74% under one acre in size) isolated wetlands located in agricultural fields. A site visit indicated that many of these wetlands are currently cropped. Many of these wetlands have been either excavated or drained. Line data shows an additional 91 wetlands within the Project Area. These are primarily emergent and riverine wetlands associated with the natural water courses identified at the Project Area (South Fork of the Watonwan River, North Fork of Elm Creek, Cedar Creek and Judicial Ditch 1) (Table 8.25, Figure 8.8). Finally point data shows an additional seven wetlands, two of which are drained. These are small, temporarily flooded emergent wetlands (Figures 8.9-1, 8.9-2, 8.9-3 and 8.9-4).

Table 8.24: NWI polygon data wetland areas by type

NWI Type (Circular 39)	Acres
Deep Marsh	31.5
Open Water Wetland	7.47
Seasonally Flooded Basin/Floodplain	29.19
Shallow Marsh	140.70
Shrub Swamp	3.31
Wooded Swamp	8.29
Lacustrine Wetland	27.80
Total	**248.26**

Table 8.25: NWI line data wetland length by type

Wetland (Circular 39)	Length (Miles)
Seasonally Flooded Basin/Floodplain	0.03
Shallow Marsh	2.55
Wooded Swamp	0.87
Deep Marsh	0.21
Riverine System	20.11
Total	**23.77**

8.17.2 Impacts

Turbines will be constructed on high portions of the Project Area to maximize the wind resource, and as such are likely to avoid direct impacts to wetlands, which tend to be in lower topographic positions.

Access roads and substations will be designed to avoid impacts to wetlands whenever feasible. Temporary impacts associated with crane walkways will also be minimized. Installation of underground utilities is expected to avoid impacts by boring under surface water features as necessary.

8.17.3 Mitigative Measures

Odell will mitigate direct or indirect impacts to wetlands during construction and operation by protecting topsoil, minimizing soil erosion and protecting adjacent wetland resources. Practices may include containing excavated material, use of silt fences, protecting exposed soil, stabilizing restored material, and re-vegetating disturbed areas with non-invasive species.

Formal wetland delineations will be conducted in the Project Area prior to construction. Layout of turbines, access roads, and other facilities will be designed to avoid and minimize wetland impacts to the extent possible. If wetland impacts cannot be avoided, the Applicant will submit Section 404 and Minnesota Wetland Conservation Act permit applications to the U.S. Army Corps of Engineers and the state prior to construction.

8.18 Vegetation

8.18.1 Description of Resources

According to the Ecological Classification System of Minnesota, the Project Area is located in the Prairie Parkland Province, the North Central Glaciated Plains section and the Minnesota River Prairie subsection (DNR 2005). Prior to agricultural clearing, the Project Area and the surrounding landscape were covered in upland and wetland prairie with oak savannas on fire-protected uplands, and floodplain forest along protected waterways (Marschner 1974). The most recent glacial period left the region pock marked with small wetlands and kettlehole lakes.

Upland prairie systems were dominated by grass species including big bluestem (*Andropogon gerardii*), prairie dropseed (*Sporobolus herterolepis*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), porcupine grass (*Stipa spartea*) and side-oats grama (*Bouteloua curtipendula*). The wet prairie communities were also dominated by grass species, but include a greater forb component. Dominant species include: big bluestem, prairie cordgrass (*Spartina pectinata*), Indian grass, switchgrass (*Panicum virgatum*) and mat muhly grass (*Muhlenbergia richardsonis*). In savanna habitats herbaceous prairie species dominated the ground cover, and the community had scattered trees comprising 25-50% canopy cover. Common tree species included bur oak (*Quercus macrocarpa*) and northern pin oak (*Quercus ellipsoidalis*). Floodplain forests were dominated by trees that could handle flooding and siltation including: silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), cottonwood (*Platanus occidentalis*) and American elm (*Ulmus americana*).

Current vegetation cover type mapping was based on data from the National Land Cover Database ("NLCD") raster dataset developed in 2001 by the US Geological Survey, based on LANDSAT images from March 1997-Sept 2001 (Homer et al. 2004). Applied Ecological Services, Inc. ("AES"), Odell's environmental consultant, assigned each NLCD land cover type to an AES vegetation cover type (Table 8.26, Figure 8.4). The accuracy of the data was generally confirmed via aerial photographs and a visit to the Project Area in 2013.

The NLCD mapping of permanent grassland that could serve as long-standing wildlife habitat was inaccurate as determined by AES field checks. Consequently, in 2013, Odell re-mapped permanent grasslands in the Project Area. Odell mapped grassland polygons based on remote analysis of 2010 National Ag Imagery Program aerial photographs, and field verified grasslands in April 2013. Permanent grasslands included CRP lands, RIM lands, hay meadows and pastures. Small linear areas of grassland in stream corridors, ditches and rights-of-way were not mapped. Therefore, the refined land cover mapping combined NLCD land cover data with Odell's field-verified grasslands. Areas identified in the NLCD land cover data and aerial photographs as grassland and pasture were field-verified and mapped by Odell. Other than grasslands, Odell's 2013 field observations confirmed that the NLCD land cover had not changed significantly from 2001 when the NLCD data were developed.

Table 8.26: AES Vegetation cover type descriptions

AES Habitat Cover Type	Description
Developed	Residential, commercial, industrial, and other developed land, including developed green space (e.g., golf course, city park).
Cropland	Regularly cultivated land. Pasture, hay meadow, and fallow field are grasslands.
Barren Land	Land with sparse to no vegetation (e.g., mines, landfills, construction sites, sparsely vegetated shores).
Grassland	Grass and herbaceous plants cover ≥90% of the ground in uplands; includes pasture, hay meadow and fallow field.
Upland Shrub-Scrub	Shrubs and scrubby or mature trees cover 10-50% of the ground. Includes brushland and savanna with trees and shrubs.
Upland Forest	Trees cover ≥50% of the ground.
Forested Wetland	A wetland or lowland flooded area with 50-100% tree cover.
Shrub-Scrub Wetland	A wetland with 10-50% cover by shrubs, scrubby and mature trees. Includes savanna with trees and shrubs.
Emergent Wetland	A wetland with ≥90% cover of herbaceous plants.
Open Water	Water and sparse to no vegetation cover; rivers, streams, lakes, ponds.

Today, approximately 91.4% of the Project Area supports agriculture (Table 8.27, Figure 8.4). These agricultural areas are cropland with corn (*Zia mays*) and soy (*Glycine max*) plantings predominating. Within the cropland matrix, small natural patches include grasslands along drainage ditches, fence rows, and woodlots and wind breaks associated with farmsteads. These drainage ditches and small grasslands are typically dominated by cool season grasses such as smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*) and quack grass (*Elytrigia repens*). Tree species in woodlots and wind breaks associated with farmsteads are typically quick growing trees such as cottonwood, American elm, silver maple, aspen (*Populus* spp.) and willow (*Salix* spp).

Natural habitats in the Project Area are concentrated along the riparian corridors of the South Fork of the Watonwan River in the center of the Project Area, the North Fork of Elm Creek in the south of the Project Area, and the Cedar Run in the southeastern corner of the Project Area. These habitats consist primarily of grassland (3.0%) and emergent wetland (0.5%) with scattered shrub-scrub and small patches of forested habitat (0.2%). Natural habitats are also concentrated along the northern boundary of the Project Area in the Bennett and Banks WMAs. The National Wetland Inventory shows additional wetlands not identified by the NLCD data. Most of these are small scattered wetlands located in cropland habitat, and likely farmed. Only 4.7% of the Project Area is developed, consisting primarily of roads, farmsteads and home sites.

Grassland habitat in the Project Area is a combination of a few small prairie remnants, planted grasslands enrolled in the RIM program and pasture. RIM plantings are a combination of cool season and warm season grasses. The Minnesota County Biological Survey identified two native prairies within the Project Area. In the northeastern corner of the Project Area there is a 70-acre mesic/wet prairie complex. Along the South Fork of the Watonwan River there is a 120-acre dry hill prairie. When these prairie patches are combined with other non-native grasslands, grassland habitat comprises 3% of the Project Area.

Table 8.27: Vegetation-cover types at the Odell Project Area

Land Classification (combined NLCD data)	Area (acres)	Percent of Total
Developed	1,634.4	4.7
Cropland	31,626.9	91.4
Barren Land	12.0	0.03
Grassland	1,028.2	3.0
Upland Forest	60.3	0.2
Emergent Wetland	177.4	0.5
Open Water	52.8	0.2
Total	**34,591.9**	**100.0**

8.18.2 Impacts

Vegetation will be removed for the installation of turbine pads, access roads, substations and operations and maintenance facilities. It is expected that the majority of the turbines will be sited in plowed crop fields that are typically planted in row crops. Access roads in the agricultural landscape are expected to impact crop fields, and potentially grassed areas of ditches and roadsides, or small wooded areas. Temporary vegetation impacts will be associated with crane walkways, the installation of underground collection lines, and contractor staging and lay down areas. With ground disturbance and equipment deliveries from different geographic regions, Odell will work together with all parties entering the Project Area to control and prevent the introduction of invasive species. To the extent practicable, direct permanent and temporary impacts to natural areas, including wetlands and native prairies, will be avoided and minimized.

8.18.3 Mitigative Measures

Odell completed a Tier 1 and 2 analysis of the Project Area that is discussed fully in **Appendix F**. The analysis followed the USFWS' Land-Based Wind Energy Guidelines. The Tier 1 and Tier 2 analysis includes and identifies an inventory of existing biological resources, native prairie and wetland areas. The data gathered in the Tiers 1 and 2 analyses was used to inform the following mitigation measures Odell plans to implement to avoid and minimize impacts to vegetation in the Project Area during siting, construction and operation to the extent practicable:

- Avoid impacts to native plant communities, including native prairie remnants, during siting and design, construction and operations;
- Avoid and minimize disturbance to wetlands and drainage systems;
- Avoid impacts to wildlife management areas;
- Minimize the area disturbed during construction of the Project;
- Minimize clearing of trees and shrubs;
- Utilize best management practices during construction and operations to protect topsoil and minimize soil erosion;
- Reseed disturbed non-cropland areas with non-invasive species; and
- Develop a management plan to prevent the spread of noxious and invasive weeds throughout the Project Area during construction and ongoing operations.

8.19 Wildlife

8.19.1 Description of Resources

Tier 1& 2 Analysis Methods & Agency Communications.

In order to assess potential impacts at the Project Area, Odell consulted with agency staff, reviewed recent literature, requested natural heritage database records from the Minnesota Natural Heritage Information System ("NHIS"), examined USFWS data and DNR documents for information on Endangered, Threatened and Special Concern ("ETSC") species and migratory birds and bats. Odell also contracted with AES to review relevant literature on avian and bat fatalities at wind energy facilities, general literature, and specific information on habitat, migratory behavior, and flight trajectories in order to assess risk to these species from wind energy facilities.

NHIS review and records of rare species have been obtained several times during the development of this Project. On September 30, 2008 Geronimo requested NHIS review for the North Star Wind Farm. The North Star project encompassed a similar boundary to the Odell Wind Farm. A response was received on November 17, 2008. On June 11, 2009 Geronimo requested NHIS review for the Odell wind project. At the time that request was made, the boundary was smaller than the current Project Area. A response was received on August 26, 2009. Most recently, on April 8, 2013, Odell requested a NHIS review for the current Project Area boundary. A response to this request was received on June 24, 2013. Results of these requests are discussed in Section 8.20.1 below and provided in Appendix F.

Additional communications with the DNR include a letter dated October 28, 2009 that provided a preliminary review of the Odell project, and a conference call on April 28, 2013 to review proposed wildlife surveys. During the April 2013 communication, the DNR indicated that as proposed the Odell Project Area was likely to have low impacts to wildlife provided certain precautions are taken during site design. This opinion was confirmed in a letter from the DNR dated June 24, 2013. (*See* Appendix D).

Existing data on bald eagle nest locations were requested from the USFWS on March 28, 2013, and a response was received on May 16, 2013. A teleconference occurred on May 13, 2013 with the USFWS to discuss potential impacts to bald eagles in the Project Area and proposed survey methods. The USFWS responded with eagle recommendations via e-mail on May 16, 2013. Copies of these communications can be found in Appendix D.

Tier 3 Surveys.

Tier 3 studies began in the spring of 2013 and will continue through fall 2013 in order to provide data to help address the following questions:

- What bird and bat species are present within the Project Area?
- What is the distribution, relative abundance, and behavior of bird species in the Project Area?
- What is the activity level of bat species in the Project Area?
- How do these factors expose birds and bats to risk from the proposed wind project?

Completed and proposed avian surveys are listed in Tables 8.28 and 8.29 below. Avian surveys consist of point-count surveys of either 10 or 60 minutes in length. Ten minute surveys are designed to describe passerine activity in the Project Area, although all species are recorded. Sixty minute surveys are designed to describe raptor and large bird activity in the Project Area. Passerine species are not recorded during raptor and large bird surveys. Raptor and large bird surveys are conducted at 30 points within the Project Area, and passerine surveys at 25 points. Overall, the total survey effort is approximately 145 hours.

Table 8.28: Completed point count survey effort at the Odell Project Area

Survey Season	Survey Dates	# of Points	# of Counts per Point	Minutes per Count	Total Survey Hours	Survey Hours
Early Spring Migration	April 3-6, 2013	30	1	60	30.0	7:00am to 7:30pm
Early Spring Migration	April 23-26, 2013	30	1	60	30.0	7:00am to 7:30pm
Spring Migration	May 14 – 16, 2013	25	2	10	8.3	6:30am to 11:00am; 5:00pm to 8:45pm
Breeding	June 25 – 28,	25	2	10	8.3	5:00am to

	2013					10:00am
Total	**-**	**55**	**-**	**-**	**76.6**	**-**

Table 8.29: Continuing point count survey effort at the Odell Project Area

Survey Season	Survey Dates	# of Points	# of Counts per Point	Minutes per Count	Total Survey Hours	Survey Hours
Fall Migration	Proposed late August to mid-September, 2013	25	2	10	8.3	7:00 am to 8:00 pm
Late Fall Migration	Proposed October 2013	30	1	60	30.0	7:15am to 7:00pm
Late Fall Migration	Proposed November 2013	30	1	60	30.0	6:30am to 5:30pm
Total	**-**	**34**	**-**	**-**	**68.3**	**-**

Bat surveys consist of acoustic monitoring with full-spectrum monitoring devices at three met towers. On each met tower microphones are deployed at 3m and 55m in elevation. Acoustic monitoring began at one met tower on April 29, 2013. Monitoring on-site began on June 5, 2013. Monitoring at all locations will continue through November 1, 2013.

Regional Wildlife. In the early 1800s, the county's abundant wildlife included large herds of bison (*Bison bison*) and American elk (*Cervus canadensis*). The numerous wetlands provided habitat for waterfowl and waterbirds, including trumpeter swan (*Cygnus buccinator*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), canvasback (*Aythya valisineria*), blue-winged teal (*Anas discors*), gadwall (*Anas strepera*), redhead (*Aythya americana*), northern shoveler (*Anas clypeata*), wilson's snipe (*Gallinago delicate*), American bittern (*Botaurus lentiginosus*), sora (*Porzana carolina*), Virginia rail (*Rallus limicola*) and western grebe (*Aechmophorus occidentalis*). In upland grassland birds such as marbled godwit (*Limosa fedoa*), upland sandpiper (*Bartramia longicauda*), bobolink (*Dolichonyx oryzivorus*), western meadowlark (*Sturnella neglecta*), and greater prairie-chicken (*Tympanuchus cupido*) thrived (DNR 2006).

With the plowing of the prairie and the draining of wetlands, the large herds of ungulates were eliminated, and many of the other formerly conspicuous wildlife are now rare. There are 116 Species of Greatest Conservation Need ("SGCN") known or predicted to occur in the subsection, which represent 40% of the SGCN species identified for the state (DNR 2006). These are species that are rare, declining, or vulnerable or dependent upon habitats that are rare, declining or vulnerable. Habitat loss and degradation is a problem for nearly 90% of SGCN identified for the subsection (DNR 2006). In order to persist, these rare species generally require extensive habitat, many large habitat patches near each other, or high quality habitat. While large and high quality habitat is generally lacking from the Project Area, protected areas around the Project Area do provide potential habitat for some of these SGCN species.

Currently, the wildlife encountered near the Odell Project Area is adapted to agriculture and development. Commonly encountered wildlife species include white-tailed deer (*Odocoileus virginanus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quisculua*), common crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), and the introduced house sparrow (*Passer domesticus*), house finch (*Carpodacus mexicanus*), rock pigeon (*Columa livia*), ring-necked pheasant (*Phasianus colchicus*) and European starling (*Sturnus vulgaris*). The agricultural landscape and developments of the region have determined the type of wildlife present, supporting chiefly those that can adapt to intensive human land use.

Birds. The Project Area is predominantly cropland, and the most common birds in the Project Area in cropland during spring migration surveys were red-winged blackbird (*Agelaius phoeniceus*), common grackle (*Quiscalus quiscula*), brown-headed cowbird (*Molothrus ater*), American goldfinch (*Carduelis tristis*) and horned lark (*Eremophila alpestris*). These species comprised 62% of all individual birds observed in cropland. Greater overall bird diversity was observed in riparian and grassland habitats within and adjacent to the Project Area. Overall, during the spring 2013 surveys 66 species were observed. Details of the spring survey results can be found in Appendix F.

The Project Area is not located on a known raptor migration route, or near topographic features likely to concentrate raptor migration. However, southwestern Minnesota is known for high levels of waterfowl activity, particularly during migration. Activity at the site was high, particularly along the site's western and northern boundaries where protected wetlands occurred. Large mixed flocks of geese and ducks were observed moving in these areas.

Seven Minnesota River Prairie SGCN bird species were observed in or near the Project Area. These are in addition to the three SGCN species with state status described below. SGCN species are considered vulnerable, declining or rare. None of these species was common in the Project Area. Bobolink (*Dolichonyx oryzivorus*) and northern harrier (*Circus cyaneus*) were the most frequently observed SGCN classified species. Northern harrier typically has low reported mortality at wind facilities likely due to its low flight behavior (Smallwood et al. 2009). Bobolink was primarily observed in grassland habitat. Of the remaining SGCN species, only upland sandpiper (*Bartramia longicauda*) was observed in cropland habitat, and mortality for sandpipers is typically low (NRCNA 2007).

Bats. There are seven bat species known to occur in Minnesota – big brown bat (*Eptesicus fuscus),* silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*) and tri-colored bat (eastern pipistrelle, *Perimyotis subflavus*) (Bat Conservation International 2013). All of these species could be present in the Project Area during the spring and fall migration, and possibly during the breeding season. Northern long-eared bat and tri-colored bat are both species of state special concern. Calls of big brown bat, eastern red bat and hoary bat have been identified through acoustic monitoring. Details of spring acoustic monitoring can be found in the wildlife studies interim report (Appendix F). Activity levels in cropland are typically low during the spring and breeding periods (April – mid-July) and higher during the fall migratory period (mid-July – late September).

8.19.2 Impacts

Overall wildlife impacts at the Odell facility are expected to be similar to wildlife impacts at other Midwestern wind facilities sited in cropland. Wildlife impacts are predicted primarily for bird and bat species. For birds, the mean mortality rate at several wind energy facilities in the Upper Midwest is 2-2.5 birds of all species per turbine per year (NWCC 2004; CEIWEP 2007), and for seventeen Midwestern facilities 2.5 birds per turbine per year (Stantec 2012). Recent mortality reported from the nearby Lakefield Wind Project utilizing newer, more conservative mortality estimates was 4.13 birds/turbine/year (Westwood Professional Services 2013). The Lakefield Wind Project is in similar habitat approximately 10 miles southwest of the Project Area. It was constructed in 2011 with post-construction monitoring conducted in 2012. Bird mortality is likely to consist to a large extent of migratory passerine species (NRCNA 2007, Westwood Professional Services 2013).

For bats, the mean mortality rate at seventeen wind energy facilities in the Midwest is 9.6 bats per turbine per year (s.d. 24.1) (Stantec 2012). At the Lakefield Wind Project bat mortality was at the high end of Midwestern facilities with 29.80 bats/turbine/year (Westwood Professional Services 2013). Bat mortality is likely to be greatest for migratory tree bat species, including hoary, eastern red and silver-haired bats during the fall migration period (Johnson 2005, Arnett et al. 2008).

8.19.3 Mitigative Measures

The Applicant is committed to minimizing wildlife impacts within the Project Area during design, construction and operations. The following measures will be used to avoid and minimize impacts to wildlife in the Project Area during siting, construction and operation to the extent practicable:

- Conduct Tier 1 and 2 analysis of the Project Area including inventory of existing biological resources, native prairie and wetland areas;
- Conduct Tier 3 avian and bat surveys to better understand potential risk at the project;
- Consider and minimize risks to avian and bat species through site layout design;
- Avoid or minimize impacts to native plant communities, including native prairie remnants and all MCBS “Sites of Biodiversity Significance” ranked as “Outstanding,” “High,” or “Moderate,” and to the extent practicable sites ranked as “Low” or “Below;”
- Avoid or minimize disturbance to wetlands and drainage systems;
- Avoid and minimize impacts to wildlife management areas;
- Conduct Tier 4 post-construction mortality monitoring to manage mortality risk;
- Minimize the area disturbed;

- Minimize clearing of trees and shrubs;
- Utilize best management practices during construction and operations to protect topsoil and minimize soil erosion;
- Place collector lines underground to avoid avian collision risk;
- Handle hazardous materials in accordance with federal and state regulations in order to minimize the danger to water and wildlife resources from spills;
- Minimize lighting, while meeting the FAA's minimum requirements; duration of the flash will be minimized, duration between flashes maximized, and the lights will flash simultaneously across the Project;
- Control lighting at turbines and substations for safety and security with motion detectors or infrared sensors;
- Post project access roads with a 25mph speed limit;
- Follow Avian Power Line Interaction Committee "APLIC" (2006) guidelines for overhead utilities maintenance where possible;
- Prepare and implement an Avian and Bat Protection Plan ("ABPP") during construction and operation of the project (draft plan available in **Appendix G**);

8.19.4 DNR Waterfowl Feeding and Resting Areas

There are no DNR Waterfowl Feeding and Resting Areas within or adjacent to the Project Area.

8.19.5 Important Bird Areas Within and Adjacent to Project Area

There are no important bird areas within or adjacent to the Project Area.

8.20 Rare and Unique Natural Resources

8.20.1 Description of Resources

As described in Section 8.19.1 above, the Minnesota NHIS, DNR and USFWS have been consulted with to identify potential rare species in or near the Project Area.

Minnesota NHIS Species Data. The Minnesota NHIS database requests (included as a part of Appendix F) in 2008, 2009 and 2013 reported records for the State Threatened Sullivant's milkweed (*Asclepias sullivantii*), State Special Concern phlox moth *(Schinia Indiana),* and State Endangered Henslow's sparrow (*Ammodramus henslowii*) in or adjacent to the Project Area. The Sullivant's milkweed and phlox moth records are associated with a high quality mesic prairie remnant in the northeastern corner of the Project Area. The Henslow's sparrow record is from 2007 in grassland at the south end of the Bennett WMA along the Project Area's northern boundary. Records also identified Sullivant's milkweed and the State and Federally Threatened prairie bush clover (*Lespedeza leptostachya*) associated with railroad prairies approximately 2 miles northwest of the Project Area.

Henslow's sparrow breeds in grasslands, including old fields, pastures, hayfields and meadows with scattered shrubs. It typically requires large grassland habitats of 100 to 250 acres or larger for nesting (Herkert 1994), and is typically found in damp lowland locations. It has shown a preference for areas with widely scattered shrubs, tall and dense grass cover, and dense standing dead vegetation (Currier 2001). Changes in agricultural land use from hayfields and pasture to specialized crops have been largely responsible for the reduction of available Henslow's sparrow habitat.

Federal Species Known from County Records. The USFWS considers the Poweshiek skipperling (*Oarisma Poweshiek*) and the prairie bush clover to be within possible range in the Project Area. The Poweshiek skipperling is a federal candidate species and state special concern species found in native prairie remnants. The prairie bush clover is a federal and state threatened species typically found in dry prairie sites.

State Endangered, Threatened or Special Concern Species Identified in Tier 3 Surveys.

Three state special concern species (bald eagle (*Haliaeetus leucocephalus*), Franklin's gull (*Leucophaeus pipixcan),* and American white pelican (*Pelecanus erythrorhynchos*)) were observed in the Project Area during the spring surveys. None of these species are protected by the federal Endangered Species Act.

Bald Eagle. In 2007, the bald eagle (State Special Concern) was delisted from its federally threatened status in the lower 48 states, but it is still federally protected under the Bald and Golden Eagle Protection Act ("BGEPA"). It was also delisted in Minnesota in 2013.

There is a known bald eagle nest approximately 3.5 miles west of the Project Area boundary along the Des Moines River. The nest was confirmed as occupied on April 29, 2013; however since that date no activity has been observed during repeat visits. Observations of the nest were made on May 13, 14, 15 and June 25 and 26 for a total of 6 hours. No other bald eagle nests have been identified within the Project Area or within two miles of the Project Area boundary.

A stick nest survey of this area was conducted from public roads on May 2-3, 2013. During this visit, four adult bald eagles were observed in the vicinity of Fish Lake, approximately one mile west of the Project Area. Records of bald eagle nests within 10 miles of the Project Area were requested from the USFWS, but the only nest reported within 10 miles of the Project Area is the Des Moines River nest (Appendix D).

Bald eagles associate with distinct geographic areas and landscape features, including nest sites, foraging areas, communal roost sites, migration corridors, and migration stopover sites (USFWS 2013). They are typically found in close proximity to water bodies, natural and manmade, due to the presence of fish. They prefer to nest, perch, and roost in old-growth or mature stands of trees, and they usually select a nesting tree that is the tallest among those in its vicinity, to provide visibility. Nesting trees are usually situated near a water body that supports fish, their main preferred prey.

Two bald eagles and one possible bald eagle were observed during the 60 hours of spring raptor and large bird surveys. One of these observations was outside the Project Area, and one was over 800m from the survey point. No bald eagles were observed during the spring passerine survey. No bald eagles were observed within the Project Area during the April site visit.

Bald eagles are likely to occasionally fly over the Project Area, but bald eagle activity in the Project Area has been observed to be low, as concluded from 68 hours of surveys during spring migration and the breeding season which detected only 3 minutes of eagle activity within the Project Area. Habitat in the Project Area is generally of poor quality for nesting and foraging due to the lack of mature trees and open water. Eagles associated with the Des Moines River nest are likely to forage along the Des Moines River and neighboring bodies of water, and are less likely to forage in the Project Area. It is possible that bald eagle activity in the Project Area will increase as the regional bald eagle population increases; however it is unlikely that bald eagles would nest in the Project Area itself due to lack of appropriate nest sites. It is possible that an eagle passing through the area may forage along the Project Area's riparian corridors or on a road-killed carcass, but the Project Area is not within the typical home range distance (Buehler 2000) of high quality bald eagle habitat in the vicinity of the Project, where most foraging is likely to occur. As discussed above, the nearest bald eagle nest is 3.5 miles from the Project Area.

Franklin's Gull. The Franklin's gull is also listed as a Special Concern Species by the State of Minnesota. It was observed in large numbers during the second spring raptor and large bird survey. During this survey 2,833 individual Franklin's gulls were observed at 12 different points (47.2 gulls/hour obs.). Additionally 1,271 unidentified gulls were observed that were likely Franklin's gull or ring-billed gull. These gulls were observed in cropland habitats flying at heights from 5 to 60m in elevation. Of all individuals observed the mean flight height was 20m and 81% were flying below the rotor swept area.

This species is known to nest within large wetland complexes or lakes within the Prairie Parkland Province. The Franklin's gull is a colonial nesting species that utilizes extensive prairie marshes for breeding, where it nests over water on floating vegetation or muskrat houses. Franklin's gull colonies are known to switch locations from one year to another in response to changing water levels, and water level disturbances are one of the largest threats to this species. It is this sensitivity to water level changes and colony nesting behavior that resulted in the classification of this species as special concern. A large colony of Franklin's gulls occurs at Heron Lake in Jackson County, approximately 12 miles west of the Project Area, and 4 miles northwest of the Lakefield Wind Project. No Franklin's gulls were reported in post-construction mortality monitoring from that project. Colony locations for this species are generally known, and there are no other known locations near the Project Area (DNR 2013).

American White Pelican. American white pelicans (State Special Concern) were observed on two occasions during the second raptor and large bird spring survey. Two flocks were observed, one with 16 individuals and one with 40 individuals. Overall 0.93 individuals per hour were observed during the spring raptor migration. None were observed during the spring passerine migration surveys. The two flocks observed were flying above the RSA at 200 and 300m.

The DNR currently lists this species as special concern and several studies have shown this species increasing in abundance across its range over the past 20-25 years (Wires et al. 2001; Evans and Knopf 1993). This species is a colonial nesting species that selects large, shallow bodies of water that are rich in fish which it preys on. Usually the nesting site is a flat, bare island isolated from human disturbance (Coffin and Pfannmueller, 1988). There is a small, recently established nesting colony at Big Twin Lake in Martin County (Wires et al. 2005) approximately 3 miles southeast of the Project Area.

8.20.2 Identify Native Prairie Within or Adjacent to Project Area

The Minnesota NHIS database requests (Appendix F) in 2008, 2009 and 2013 reported records for five native plant community locations. Three of the four known prairie locations (a dry hill prairie and two mesic prairies) were railroad prairies approximately 2 miles northwest of the Project Area. The fourth known prairie location is a mesic prairie located in the northeastern portion of the Project Area. The final identified native plant community is a Basswood-Bur Oak (Green Ash) forest located a half mile outside the Project Area's northern boundary.

The Minnesota County Biological Survey ("MCBS") has completed a survey of this area for native plant communities. The 82-acre mesic prairie in the northeast corner of the Project Area is mapped as a site of high biodiversity significance, and contains several rare native plant communities, including mesic prairie, wet prairie, mixed cattail marsh, seepage meadow/carr and southern basin wet meadow/carr. Native plant communities were identified at Banks and Bennett WMAs (110-acres at 3 locations) on the northern boundary of the Project Area. Communities in this area include dry hill prairie, prairie wetland complex, mesic prairie and prairie mixed cattail marsh. All of these communities are considered of moderate biodiversity significance. There is another 18-acre dry hill prairie of moderate biodiversity significance along the Project Area's northern border, and a 121-acre dry hill prairie with moderate biodiversity significance was identified in the center of the Project Area along the South Fork of Watonwan Creek. Finally, a 67-acre site just below the threshold for statewide significance occurs in the northeast corner of the Project Area, along the judicial ditch just south of Sulem Lake WMA. The presence of these native plant communities was confirmed during a site visit on April 2 and 3, 2013.

8.20.3 Impacts

Impacts to rare and unique natural resources will be minimal. Impacts to Sullivant's milkweed, phlox moth and, if present, Poweshiek skipperling and prairie bush clover can be avoided by avoiding impacts to prairie remnants. The Applicant will avoid native plant community resources, including prairie remnants to the extent practicable. In particular, the Applicant will avoid all "Sites of Biodiversity Significance" ranked as "Outsanding," "High," or "Moderate" and will coordinate with the DNR if impacts are proposed to sites ranked as "Low" or "Below."

Henslow's Sparrow. Impacts to Henslow's sparrow can be avoided by setting turbines back from large grassland habitat. The majority of the Project Area is cropland habitat without significant grasslands. Larger grasslands in and near the Project Area are associated with the Banks and Bennett WMAs along the Project Area's northern border, with two grassland locations in the northeastern portion of the project, and along the South Fork of Watonwan Creek. If the species were present, typical flight heights would be well below the RSA, and direct impacts would be unlikely. Habitat displacement caused by tall structures, such as wind turbines, is known in grassland bird species, although it has not been documented in Henslow's sparrow.

Bald Eagle. Existing data suggest that wind energy facilities are not a significant cause of mortality for bald eagles. From 2006 through 2011, there were five known fatalities of bald eagles at wind facilities in North America (Allison 2012). Based on USFWS Region 3 bald eagle population numbers and trends, the USFWS has determined that 244 individual bald eagles can be taken each year without compromising the long-term sustainability of the population (USFWS 2009). This is likely a conservative estimate, given that the methodology allows for loss of only half the maximum sustainable yield as calculated by Millsap and Allen (2006). The increase in post-construction monitoring occurring at wind energy facilities across the country will provide important data for better understanding the threat of wind energy facilities to bald eagles and will promote improved avoidance, minimization, and mitigation measures.

The bald eagle population continues to increase in the lower 48 states, including Minnesota. Some 631 new territories were established in Minnesota between 2001 and 2006 (USFWS 2012). This species appears to be occupying locations that in the past may have been considered less than optimal. Because the population is expanding, it is possible that in the future bald eagle nests may be located within ten miles of the Project Area. However, due to the lack of open water and mature tree stands in the Project Area it is unlikely that they would nest in the Project Area.

Franklin's Gull. The Franklin's gulls observed in the Project Area were engaged in migration and did not appear during the surveys to exhibit a tendency to nest in the WMAs around the Project Area. There is a risk of mortality to this species during the spring migration, but no Franklin's gull mortality was observed at the Lakefield Wind Project in 2012 (Westwood Professional Services 2013), and mortality rates for waterfowl and waterbirds are typically low (NRCNA 2007, Jain 2005). For these reasons the risk of collision by Franklin's gulls at the Project is considered low.

American White Pelican. Mortality risk for American white pelican in the Project Area is predicted to be low. No mortality of this species has been observed at the nearby Lakefield Wind Project (Westwood Professional Services 2013), and waterfowl and waterbirds are generally able to see and avoid turbines (Madsen and Boertmann 2008 and AES staff observations).

8.20.4 Mitigative Measures

The Applicant is committed to minimizing impacts to rare and unique natural resources within the Project Area during design, construction and operations. The following measures will be used to avoid and minimize impacts to rare and unique natural resources during siting, construction and operation to the extent practicable:

- Conduct Tier 1 and 2 analysis of the Project Area including inventory of existing biological resources, native prairie and wetland areas;
- Conduct Tier 3 avian and bat surveys to better understand potential risk at the project;

- Avoid and minimize risks to rare and unique features through site layout design;
- Avoid or minimize impacts to native plant communities, including native prairie remnants and all Minnesota County Biological Survey ("MCBS") "Sites of Biodiversity Significance" ranked as "Outstanding," "High," or "Moderate," and to the extent practicable sites ranked as "Low" or "Below;"
- Avoid and minimize disturbance to wetlands and drainage systems;
- Avoid and minimize impacts to wildlife management areas;
- Consider post-construction mortality monitoring to manage mortality risk;
- Minimize the area disturbed;
- Minimize clearing of trees and shrubs;
- Utilize best management practices during construction and operations to protect topsoil and minimize soil erosion;
- Place collector lines underground to avoid avian collision risk;
- Handle hazardous materials in accordance with federal and state regulations in order to minimize the danger to water and wildlife resources from spills;
- Minimize lighting, while meeting the FAA's minimum requirements; duration of the flash will be minimized, duration between flashes maximized, and the lights will flash simultaneously across the project;
- Control lighting at turbines and substations for safety and security with motion detectors or infrared sensors;
- Post project access roads with a 25 mph speed limit;
- Follow APLIC (2006) guidelines for overhead utilities maintenance where possible;
- Implementation of an ABPP during construction and operation of the project (draft plan available in Appendix G)

9.0 Site Characterization

9.1 Site Wind Characteristics

Access to quality wind resources has guided the site selection. However, other factors, including environmental concerns, relative interest from communities and landowners, and access to cost effective transmission, play a part in the selection of a site. This process allows Odell to maximize the use of Minnesota's wind resource in a cost-effective manner.

The United States Department of Energy ("DOE") and the Minnesota Department of Commerce ("DOC") have conducted wind resource assessment studies in Minnesota since 1982. In October 2002, the DOC published the latest "Wind Resource Analysis Program" report that presents wind analysis data from monitoring stations across Minnesota (Minnesota DOC 2002). Near the Project Area, the mean annual wind speed at an elevation of 70m (230 ft) is mapped as 7.17 to 7.51 m/s.

Odell has two temporary meteorological towers in the Project Area which have been collecting weather data since August of 2010.

9.1.1 Interannual Variation

Interannual variation is the expected variation in wind speeds from one year to the next. There is a very strong correlation between Odell's meteorological tower data and the long-term reference data sets available through the National Oceanic and Atmospheric Administration's ("NOAA") NCEP/NCAR reanalysis program and the weather monitoring stations available at airports in the vicinity. Based on analysis of weather stations and model data in the vicinity of the project, the annual variation of wind speed is expected to be 5 percent or approximately 0.4 m/s.

9.1.2 Seasonal Variation

Seasonal variation is represented by the shift in wind speeds from one month to the next. Table 9.1 shows the estimated average seasonal variation based on long-term correlations with on-site data. The months of October through January are expected to have the highest wind speeds, while the months of July and August are expected to have the lowest wind speeds.

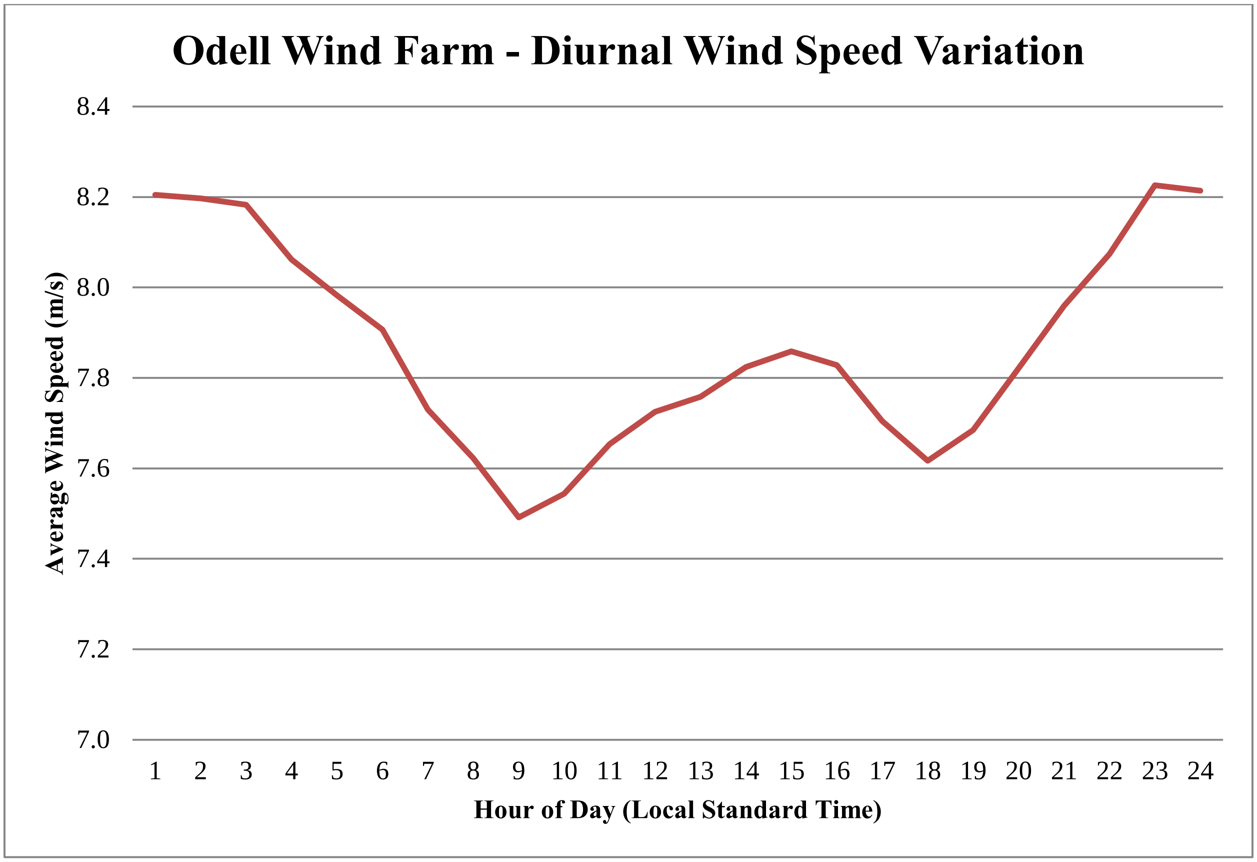
Table 9.1: Average Wind Speed

Month	Wind Speed (m/Sec)
January	8.1
February	8.0
March	7.9
April	7.6
May	7.8
June	6.6
July	6.0
August	5.6
September	6.8
October	8.1
November	7.6
December	7.5
Annual Average	**7.3**

9.1.3 Diurnal Conditions

Diurnal variation occurs through the shift in day and nighttime weather patterns. Chart 9.2 shows the expected variation in wind speeds at the site. On average, the wind speeds are higher in the evening and nighttime hours, and lower in the morning and at midday.

Chart 9.2 Diurnal Wind Speeds



9.1.4 Atmospheric Stability

The atmospheric stability is defined by lateral fluctuation of the wind, or sigma theta. Stability level is characterized by sigma theta 0 to 2.5 degrees as stable, 2.5 to 7 as moderately stable, 7 to 9 as neutral, 9 to 15 as moderately unstable, and greater than 15 degrees as very unstable (Slade 1968). The atmospheric stability based on the Odell meteorological tower sites at the 60 meter level is 6.5 degrees, or moderately stable.

9.1.5 Hub Height Turbulence

The Turbulence Intensity ("TI") is defined as the measured standard-deviation of wind speed over an hour, divided by the mean for the same time period. For 15 m/s wind speeds, the average TI is 10 percent. For 15 m/s wind speeds, the characteristic TI is 12 percent.

9.1.6 Extreme Wind Conditions

The maximum hourly wind speed measured at the Odell meteorological tower site was 25.4 m/s. Site extreme wind events for a one-year event will likely be 25 m/s. Table 9.3 provides the 20- through 100-year maximum means and gusts for the site based on the data collected by the two meteorological towers at the site. To extrapolate from the three year data record at the site to the longer periods, a Gumbel distribution was fit to the observed maximum wind speeds in each year of the site data record (Harris 1999). The result is a plot of the wind speed versus the probability of exceedance; the return period is the inverse of the probability of exceedance (i.e. a 1% probability of exceedance translates to a 100-year return period).

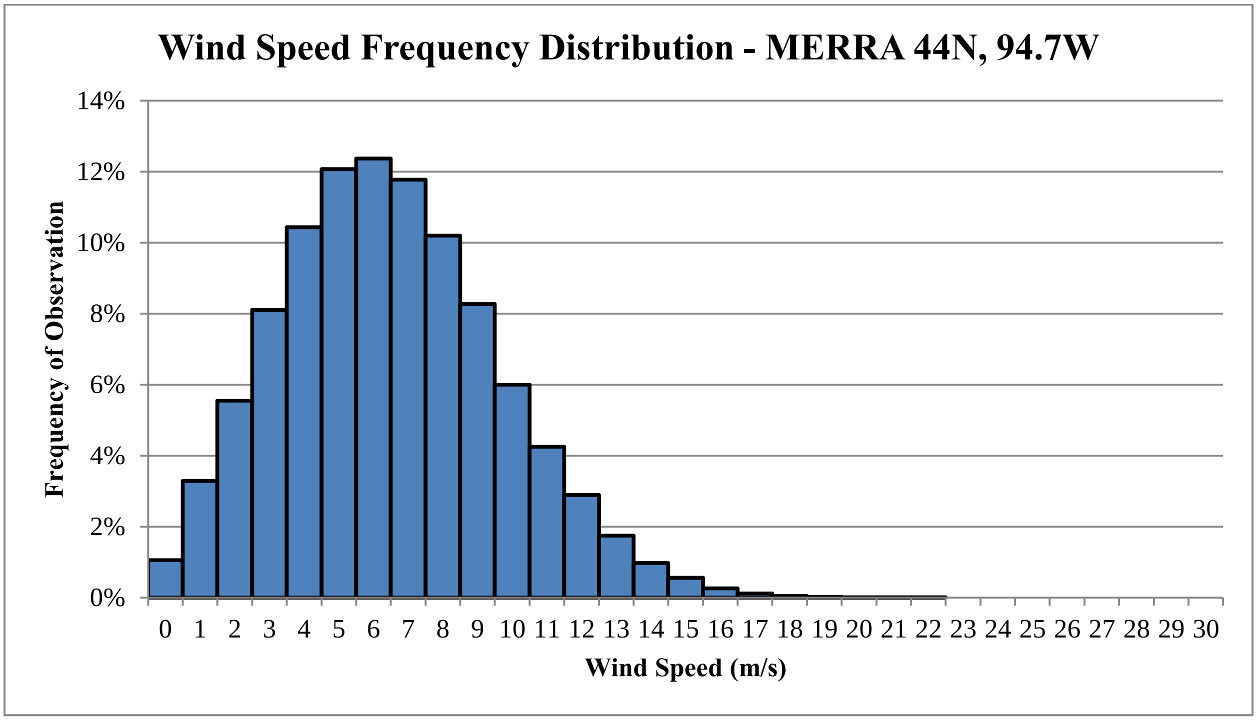
Table 9.3: Extreme Wind Events at 80m

Period (yr)	Extreme Wind Speed (m/s)	
	10-min means	Gusts
20	28.8	43.6
25	29.3	44.7
50	30.8	48.1
100	32.2	51.5

9.1.7 Wind Speed Frequency Distribution

Chart 9.4 shows the wind speed frequency distribution calculated from hourly 50-meter data at the nearest member grid point of the NASA MERRA dataset (Rienecker 2011). A majority of the winds occur between 3 m/s and 13 m/s. The characteristics of this distribution are consistent with wind regimes observed elsewhere in Minnesota.

Chart 9.4 Wind Speed Frequency Distribution



9.1.8 Wind Variation with Height

Wind shear is the relative change in wind speed as a function of height. Wind shear is calculated using a power function based upon the relative distance from the ground. The general equation used for calculating wind shear is $S/S_o = (H/H_o)^a$ where S_o and H_o are the speed and height of the lower level and α is the power coefficient. The power coefficient can vary greatly due to terrain roughness and atmospheric stability. The power coefficient will also change slightly with variation in height. The vertical variation with height or shear coefficient, based on the 32 to 60 meter level at the Odell meteorological tower site, is approximately 0.22.

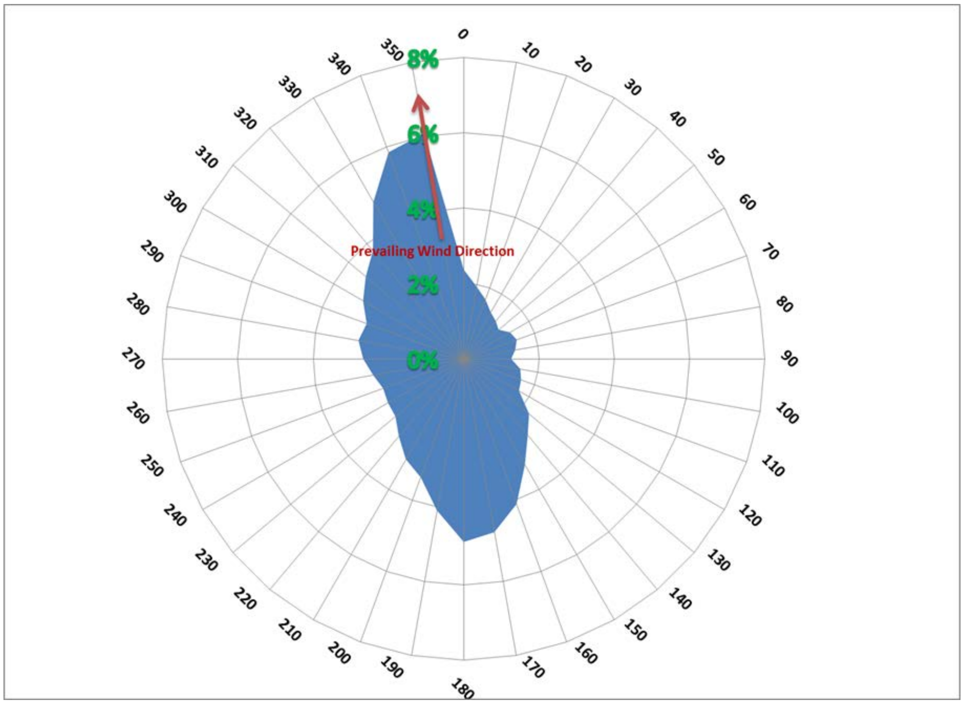
9.1.9 Spatial Wind Variation

As noted above, the DOC's wind resource analysis program estimates that the spatial variation in wind speed across the Project Area is between 8 and 9 m/s. This estimate is confirmed by the onsite data and the analysis performed by Odell.

9.1.10 Wind Rose

A wind rose is a graphical representation of wind speeds based on the direction the wind comes from and the frequency it comes from each direction. Chart 9.5 shows the wind rose at one of the two Odell meteorological tower locations; this tower is representative of the site as a whole.

Chart 9.5 – Odell Wind Rose



Based on the data collected from Odell's existing meteorological monitoring stations, the predominant wind direction at the site is 350 degrees with 0/360 degrees representing due north.

9.1.11 Other Meteorological Conditions

9.1.11.1 Average and Extreme Weather Conditions

Long term average temperatures and precipitation were evaluated from the Midwest Regional Climate Center (2009) Windom Station (219033) located approximately 5 miles west of the Project Area. The average minimum temperature in the area ranges from 3.8 degrees Fahrenheit in January to 60.6 degrees in July; the average maximum temperature ranges from 21.7 degrees in January to 83.2 degrees in July. Average precipitation in the area ranges from 0.76 inches in December to 4.47 inches in June.

Extreme weather events for the Project Area include thunderstorms, tornadoes, hail, heavy snow and ice, extreme cold, heat waves, flash floods/floods, heavy rain, lightning, and drought. Tornadoes, thunderstorms, and extreme winds strike occasionally. The state of Minnesota experiences approximately 15 to 20 tornadoes per year. National Climatic Data Center (NOAA, National Climatic Data Center 2013) records include 164 thunderstorms, eight high wind events, and 39 tornadoes from January 1950 to February 2010. Such storms are usually of short duration and localized, leading to damage in small geographic areas. Wind turbines are built to withstand hail and lightning, but are not designed to survive tornado-force winds of 89 + m/s (200+ mph).

Turbines under consideration for this Project are capable of withstanding most of the extreme weather conditions that occur in the area. All turbines being considered have lightning protection systems, turbine blades that "feather" into the prevailing wind direction during high wind events to minimize the risk of damage, and turbines that shut down above the cut-out wind speed (generally 45-55 mph).

During the winter, there is potential for icing events to result in ice accumulation on turbine blades with variable frequency. Although the turbines are not equipped with specific ice-sensing equipment, the turbine will stop turning if significant ice accumulation causes an imbalance. The mechanical safeguards and turbine setbacks mitigate the potential hazard associated with ice throw, and minimize the potential that ice thrown from turbine blades could reach public roads and residences. Ice throw is not expected to be a hazard for this Project.

9.2 Location of Other Wind Turbines within Ten Miles of Project Area

Based on the FAA obstacle database (FAA 2013) and Ventyx information (Ventyx 2012), there are existing turbines to the south, southwest and northwest of the Project. Figure 9.1 shows the location of existing wind turbines and wind energy projects. There are 215 known commercial-scale wind turbines in operation within ten miles of the Project Area, with most of those located south of the Project Area. The FAA obstacle database lists 348 existing turbines within twenty miles of the Project Area (including the 215 turbines within the ten mile boundary).

Odell constructed a search across the four counties for wind energy projects that are not built but have submitted a LWECS Site Permit Application to the Commission. Odell found one project that is being developed in Brown and Cottonwood County. Odell did not find any pending wind energy projects that had submitted a LWECS Site Permit Application in Cottonwood, Jackson, or Watonwan Counties. (Minnesota Department of Commerce, Energy Facility Permitting 2013).

10.0 Project Construction

Land will be graded on site for the turbine pads. Drainage systems, access roads, storage areas, and shop facilities will be installed as necessary to fully accommodate all aspects of the construction, operation, and maintenance of the wind farm.

Several activities must be completed prior to the proposed commercial production date. The majority of the activities relate to equipment ordering lead-time, as well as design and construction of the facility. Below is a preliminary schedule of activities necessary to develop the Project. Preconstruction, construction, and post-construction activities for the Project include:

- Order all necessary components including towers, nacelles, blades, foundations, transformers, etc.;
- Finalize turbine micro-siting;
- Complete survey to establish locations of structures and roadways;

- Complete soil borings, testing, and analysis for proper foundation design and materials;
- Complete construction of access roads, to be used for construction and maintenance;
- Construct aboveground or underground feeder lines;
- Design and construct the metering station adjacent to the interconnection substation;
- Design and construct the step-up substation;
- Determine potential upgrades to the interconnection substation as determined by MISO;
- Install tower foundations;
- Install underground cables;
- Place towers and set wind turbines;
- Complete facility acceptance testing; and
- Commence commercial production.

Odell and its engineering contractor will perform or manage all development activities. Specifically, Odell will:

- Perform site resource analysis;
- Undertake environmental review; and
- Obtain specific permits and licenses for the Project.

Under the oversight of Odell's staff, the engineering and construction contractors will:

- Perform civil engineering for access roads and turbine foundations;
- Construct foundations, towers, and transformers;
- Assemble and install turbines;
- Install the communication system, including telephone and fiber-optic cable, and SCADA software and hardware;
- Construct the project substation;
- Construct the electrical feeder and collection system; and
- Construct radial interconnection.

10.1 Roads and Infrastructure

During the construction phase, several types of light, medium, and heavy-duty construction vehicles will travel to and from the site, as well as private vehicles used by construction personnel. The Applicant estimates that there will be 375 large truck trips per day and up to 875 small-vehicle (pickups and automobiles) trips per day in the area during peak construction periods. That volume will occur when the majority of the foundation and tower assembly is taking place. Prior to construction, the Applicant will coordinate with local jurisdictions (counties and townships) in order to obtain the necessary road access and overwidth/overweight permits. At the completion of each construction phase, this equipment will be removed from the site or reduced in number.

Improvements to existing access roads may include re-grading and filling of the gravel surface to allow access in inclement weather and widening select intersections to accommodate truck traffic. No asphalt or other paving is anticipated. Odell will coordinate with the county and the township road authorities to develop a road agreement prior to construction.

10.2 Access Roads

Constructing the Project will require approximately 20 to 30 miles of gravel access roads, depending on the size of turbine selected and final design. They will be located to facilitate both construction access (cranes) and access by operation and maintenance crews while inspecting and servicing the wind turbines. The access roads will be between towers, with one road required for each string. The roads will be approximately sixteen (16) feet wide and of low profile to allow cross-travel by farm equipment.

The Applicant will work closely with landowners to locate access roads to minimize land-use disruptions. Siting will be completed in accordance with state and local requirements. Siting roads in areas with unstable soil will be avoided whenever possible. All roads will include appropriate drainage and culverts and allow for farm equipment crossing.

The roads will be approximately 4.9 meters (16 feet) wide and will be improved with class-5 (gravel) cover, which is adequate to support the size and weight of maintenance vehicles. The roads will meet all state and local requirements. The specific turbine locations will determine the amount of roadway that will be constructed for this Project. In addition, an up to thirty (30) foot diameter gravel work area will surround each turbine base.

The roads will consist of graded dirt overlaid with geotechnical fabric (if needed) covered with gravel. To facilitate crane movement and equipment delivery, an additional 3.5 to 12 feet of gravel roadway will be temporarily installed on either side of the permanent roadway (40 foot total width).

After construction, temporary construction laydown areas adjacent to turbine pads will be restored, and access roads will be restored to their permanent 16-foot width. The site will be graded to natural contours, soil will be loosened if needed, and the site will be re-seeded if needed. Once construction is completed, the access roads will be regraded, filled, and dressed as needed.

Odell will repair or replace any existing fences or gates that are impacted during construction, and will coordinate with participating landowners to provide suitable fencing or gates if access roads cross into existing pastures.

10.3 Associated Facilities

10.3.1 Operation and Maintenance Facility

An O&M building will be constructed on or near the site and will provide access and storage for project maintenance and operations. Such buildings are typically 3,000 to 5,000 square feet and house the equipment to operate and maintain the wind farm. The parking lot adjacent to the building is typically 3,000 square feet. Odell anticipates that a new well will provide water service for the O&M building, and that on-site septic system will provide for sanitary needs.

10.3.2 Step-Up Substation

The project step up substation will consist of a switch gear, metering, transformers, electrical control and communications systems, and other high voltage equipment needed to convert the electricity generated by the project from 34.5 kV to 115 kV. Final specification of the substation will be determined by the agreements the Project has with MISO, as well as the transmission owner and power off taker, Xcel Energy. The project substation will be approximately 10 acres in size including the graded area which may be larger than the area actually fenced.

10.3.3 Laydown and Staging Areas

The laydown and staging areas will be temporary during construction of the Project. These parcels will be the central place for construction and delivery activities for the Project as well as provide office space for the construction management team. Each area will be approximately 10 acres in size and will have temporary structures for the offices and storage of equipment. Both areas will be gravel pads and will have geotextile fabric placed in between the gravel and the soil on the site to increase the ease of site restoration.

10.3.4 Meteorological Towers

Odell also proposes to install up to four permanent meteorological towers to maintain the performance of the wind farm, conform to grid integration requirements and validate wind turbine power curves.

10.4 Turbine Site Location

Construction of the turbines will include temporary impacts of approximately an additional 12 ft of gravel roadway on either side of the permanent roadway (40 ft total width), a 40-ft-by-120-ft gravel crane pad extending from the roadway to the turbine foundation which will be graded to a minimum of 1 percent, and a component laydown and rotor assembly area centered close to the turbine foundation which will be graded to a minimum of 5 percent. The component laydown area will range from approximately 260 by 260 feet to 335 by 335 feet, depending on the turbine size selected. In addition to the disturbances associated with temporary travel roads for cranes, it is possible that temporary impacts could occur when cranes move cross-country between strings of turbines.

Each turbine is equipped with a lightning protection system. The turbine is grounded and shielded to protect against lightning. The grounding system will be installed during foundation work and must be accommodated to local soil conditions. The resistance to neutral earth must be in accordance with local utility or code requirements. Lightning conductors are placed in each rotor blade and in the tower. The electrical components are also protected

10.4.1 Foundation Design

The wind turbines' freestanding tubular towers will be connected by anchor bolts to a concrete foundation. Turbine foundations will use a pad-and-pier tower mounting system consisting of top and bottom templates. These templates consist of anchor bolts and reinforcing steel bar (rebar); they are placed within the excavated portion of the turbine footing and filled with concrete. The anchor bolts protrude from the concrete pad surface and the turbine base is fastened to these bolts. The excavated portion of the concrete turbine pad ranges from approximately 291 to 737 cubic yards depending on soil requirements and turbine size. The turbine pad dimensions are approximately twenty feet in above-ground diameter and typically range in depth from four to six feet. An approximate height of two to three feet of the turbine pad remains above grade. Geotechnical surveys, turbine tower load specifications, and cost considerations will dictate final design parameters of the foundations.

In addition, turbine assembly will require a 40 by 120 foot gravel crane pad extending from the access road to the turbine foundation, which will be graded to a maximum of one percent, and an approximate 260 by 260 feet to 335 by 335 feet area for component laydown and rotor assembly centered close to the turbine foundation, which will be graded to a maximum of five percent.

10.4.2 Tower

The towers are conical tubular steel with a hub height of seventy-eight (78) to one hundred (100) meters (285 to 361 feet). The turbine towers, where the nacelle is mounted, consist of three to four sections manufactured from certified steel plates. Welds are made in automatically controlled power welding machines and are ultrasonically inspected during manufacturing per American National Standards Institute specifications. All surfaces are sandblasted and multi-layer coated for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. Access to the nacelle is provided by a ladder connecting four internal platforms and equipped with a fall arresting safety system.

10.5 Post Construction Clean-up and Site Restoration

After construction, temporary construction areas, such as crane pads adjacent to the turbine pad and access road additional width, will be restored. The site will be graded to natural contours and soil will be loosened and seeded if necessary. Once construction is completed, the access roads will be regraded, filled, and dressed as needed. Although few, if any, temporary roads will be constructed with the project, all temporary roads will be decommissioned and restored. Erosion control methods will depend on the contours of the land, as well as requirements of the general contractor and relevant permits. Odell anticipates that the post-construction clean-up and site restoration process will last approximately thirty days.

10.6 Operation of Project

Each wind turbine in the Project will communicate directly with the SCADA system for performance monitoring, energy reporting, and trouble-shooting. The SCADA system also provides the overall control of the wind farm.

The Applicant will augment its O&M staff as needed with appropriate contractors to service and maintain the Project.

10.6.1 Project Control, Management, and Service

In addition to providing wind farm control, the SCADA system offers access to wind turbine generation or production data, availability, and meteorological and communications data, as well as alarm and communication error information. Performance data and parameters for each machine (generator speed, wind speed, power output, etc.) can be viewed, and machine status can be changed. There is also a snapshot facility that collects frames of operating data to aid in diagnostics and problem troubleshooting.

The primary functions of the SCADA are to:

- Control and monitor the wind farm;
- Alert operations personnel to wind farm conditions requiring resolution;
- Provide a user/operator interface for controlling and monitoring wind turbines;
- Collect performance data from turbines;
- Monitor field communications;
- Provide information on wind turbine performance for operators and maintenance personnel;
- Collect data on wind turbine and wind farm maintenance;
- Serve as an information archive;
- Provide spare parts inventory control; and
- Generate operations and maintenance reports.

General Maintenance Duties

The O&M field duties include performing all scheduled and unscheduled maintenance including periodic operational checks and tests, regular preventive maintenance on all turbines, related plant facilities and equipment, safety systems, controls, instruments, and machinery, including:

- Maintenance on the wind turbines and on the mechanical, electrical power, and communications system;
- Performance of all routine inspections;
- Maintenance of all oil levels and changing oil filters;

- Maintenance of the control systems, all structures associated with the wind farm, access roads, drainage systems, and other facilities necessary for the operation of the wind farm;
- Maintaining all O&M field maintenance manuals, service bulletins, revisions, and documentation for the wind farm;
- Maintaining all parts, price lists, and computer software;
- Maintenance and operation of interconnection facilities;
- Providing all labor, services, consumables, and parts required to perform scheduled and unscheduled maintenance on the wind farm, including repair and replacement of parts and removal of failed parts;
- Assisting as needed with avian and other wildlife studies;
- Management of lubricants, solvents, and other hazardous materials as required by local and/or state regulations;
- Maintenance of all appropriate levels of spare parts in order to service equipment;
- Obtaining all necessary equipment including the rental of industrial cranes for removal and reinstallation of turbine components;
- Hiring, training, and supervising a work force necessary to meet wind farm general maintenance requirements; and
- Maintaining site security.

Maintenance Schedule

Equipment will be monitored by local O&M staff and remotely by the Applicant's operations and power scheduling desk, which is staffed 24 hours a day. When needed during off hours, local personnel will be dispatched to the site by the remote monitoring staff. Performance testing is done during the early months of operation to see that the wind farm is operating within expected parameters.

Project inspection and maintenance is performed on the following intervals:

A. **First Service Inspection.** The first service inspection will take place one to three months after the turbines have been commissioned. At this inspection, particular attention is paid to tower bolt tensioning and equipment lubrication.
B. **Semi-Annual Service Inspection.** Regular service inspections commence six months after the first inspection. The semi-annual inspection consists of lubrication and a test of the turbine trip system.
C. **Annual Service Inspection.** The yearly service inspection consists of a semi-annual inspection plus a full component check. Bolts are checked with a torque wrench. The check covers 10 percent of the bolts. If any bolts are found to be loose, all bolts in that assembly are tightened and the event is logged.
D. **Two Year Service Inspection.** The two year service inspection consists of the annual inspection, plus checking and tightening of electrical terminal connectors.

E. **Five Year Service Inspection.** The five year inspection consists of the annual inspection, an extensive inspection of the wind braking system, checking and testing of oil and grease, balance check, and tightness of terminal connectors.

10.7 Costs

10.7.1 Capital and Operational Costs

The total Project-installed capital costs are estimated to be approximately $330 million, including wind turbines, associated electrical and communication systems, and roads. Ongoing operations and maintenance costs and administrative costs are estimated to be approximately $6.5-7.5 million per year, including royalties to landowners for wind easement rights.

10.7.2 Site and Design Dependent Costs

The overall cost of developing the project will depend primarily on site selection and construction timing. Site-dependent costs will include: the relative ease of access to the individual wind turbine locations, site-specific subsurface conditions that determine foundation design, site access road design and layout, ease of underground work, and the layout of the turbine arrays which affects road and electrical cable cost. Both underground and aboveground cable may be employed to connect turbines, transformers, and the interconnect point. The underground placement of the cables is preferable.

10.8 Schedule

10.8.1 Land Acquisition

The Applicant will be responsible for all land acquisition and will obtain the necessary easements or purchase agreements from landowners. Odell may either lease or purchase the necessary parcels for the substation, O&M facilities, and temporary laydown area. The expected timeline for land acquisition completion is third quarter 2013.

10.8.2 Equipment Procurement, Manufacture and Delivery

Odell is in the process of procuring turbines for the Project and its other wind farm sites. Turbines will be allocated to the Project after meteorological and economic studies are completed to achieve the best match of turbines and sites. Turbines could arrive on site in third quarter 2014.

10.8.3 Construction

Odell personnel will oversee the primary contractors performing Project construction, including roads, wind turbine assembly, electrical, and communications work. The construction will take approximately twelve months to complete; however, depending upon seasonal or weather-related constraints (i.e. minimal work would occur during winter months) it may take less time.

10.8.4 Construction Financing

The Applicant will be responsible for financing all predevelopment, development, and construction activities. The Applicant anticipates financing the cost of all predevelopment activities through internal funds. Construction will be financed with internal funds or a combination of internal funds and third-party sources of debt and equity capital.

10.8.5 Permanent Financing

Odell plans to work with Enel to secure permanent financing either through internal funds or a combination of internal funds and third-party sources of debt and equity capital. Geronimo typically retains a long-term interest in its wind projects.

10.8.6 Expected Commercial Operation Date

The Applicant anticipates that the Project would begin commercial operation by fourth quarter 2015. The commercial operation date is dependent on the completion of the interconnection process, permitting and other development activities. Odell has negotiated and executed a PPA with Xcel Energy for the purchase of electricity produced by the Project.

10.9 Energy Projections

10.9.1 Proposed Array Spacing for Wind Turbines

Wind turbines will be placed on lands in the Project Area that are leased by Odell. The turbines will be installed in relatively high elevation areas to access the best wind resource in the Project Area. The Proposed internal array spacing for the Project's turbines is a minimum of three (3) RD in a crosswind spacing (non-prevailing direction) and a minimum of five (5) RD in a downwind spacing (prevailing direction), with up to twenty percent (20%) of the turbines spaced closer. The spacing is dependent upon the selected equipment and the site topography. Odell developed the Project to maximize the wind resource and minimize array wake losses.

10.9.2 Base Energy Projections

The Project will have a nameplate generation capacity of up to 200 MW and a net capacity factor of between 40 to 45 percent. Odell estimates an average annual output of between approximately 700,800 and 788,400 megawatt hours ("MWh"). Annual energy production output will depend on final design, site specific features, and the equipment selected. Gross to net calculations take into account, among other factors, energy losses in the gathering system, mechanical availability, array losses, and system losses. An industry-wide estimate of energy losses ranges from eight to ten percent (8-10%) of maximum output.

10.10 Decommissioning and Restoration

The Project decommissioning and restoration plan is in accordance with the requirements of Minnesota Rule part 7836.0500, subp. 13. A decommissioning plan will be developed by Odell prior to the Project's pre-operation meeting. At the end of commercial operation, Odell or the

Project owners will be responsible for removing wind facilities, and removing the turbine foundations to a depth of four feet below grade. Odell reserves the right to extend operations instead of decommissioning at the end of the site permit term. As necessary, Odell may apply for an extension of the LWECS Site Permit to continue operation of the Project. In this case, a decision may be made on whether to continue operation with existing equipment or to retrofit the turbines and power system with upgrades based on newer technologies.

10.10.1 Anticipated Life of the Project

The anticipated Project life is approximately thirty (30) years beyond the date of first commercial operation.

10.10.2 Cost to Decommission

The estimated decommissioning cost in current dollars is expected to be around $34,000 per turbine after salvage value, including associated facilities. Odell will be responsible for all costs to decommission the Project and associated facilities. The cost to decommission will depend upon the prevailing rates for salvage value of the equipment and labor costs.

Because of the uncertainties surrounding future decommissioning costs and salvage values, Odell will review and update the cost estimate of decommissioning and restoration for the Project fifteen years after Project commissioning. This revised cost estimate of decommissioning and salvage value will be submitted to the Commission and the counties for review and comment.

10.10.3 Decommissioning and Restoration Funds

Beginning in year fifteen of the Project's operational life, the Applicant will either create a reserve fund, enter into a surety bond agreement, create an escrow account, or provide another form of security that will ultimately fund decommissioning and site restoration costs after Project operations cease, to the extent that the salvage value does not cover decommissioning costs. The exact amount to be allocated for decommissioning will be determined by a third party study in year fourteen that will assess the difference between estimated decommissioning costs and the salvage value

10.10.4 List of Decommissioning and Restoration Activities

Consistent with the terms of the Site Permit and the wind lease and easement agreements with individual landowners, Odell will complete the following list of decommissioning and restoration activities:

Turbine removal - Access roads to turbines will be widened to a sufficient width to accommodate movement of appropriately-sized cranes, trucks and other machinery required for the disassembly and removal of the turbines. Control cabinets, electronic components, and internal cables will be removed. The rotor, nacelle and tower sections will be lowered to the ground where they may be transported whole for reconditioning and reuse, or disassembled/cut into more easily transportable sections for salvageable, recyclable, or disposable components.

Turbine and substation foundation removal - Topsoil will be removed from an area surrounding the foundation and stored for later replacement, as applicable. Turbine foundations will be excavated to a depth sufficient to remove all anchor bolts, rebar, conduits, cable, and concrete to a depth of 48 inches below grade. The remaining excavation will be filled with clean sub-grade material of quality comparable to the immediate surrounding area. The sub-grade material will be compacted to a density similar to surrounding sub-grade material. All unexcavated areas compacted by equipment used in decommissioning shall be de-compacted in a manner to adequately restore the topsoil and sub-grade material to the proper density consistent and compatible with the surrounding area.

Underground collection cables - The cables and conduits contain no materials known to be harmful to the environment. As part of the decommissioning, these items will be cut back to a depth of at least 48 inches. All cable and conduit buried greater than 48 inches will be left in place and abandoned.

Substation and interconnection facilities - Disassembly of the substation and interconnection facilities will include only the areas owned by Odell. Components (including steel, conductors, switches, transformers, fencing, control houses, etc.) will be removed from the site and reconditioned and reused, sold as scrap, recycled, or disposed of appropriately, at Odell's sole discretion. To remove foundations and underground components without damaging or impacting adjacent facilities to the extent possible, such foundations and underground components will be removed to a depth of 48 inches and the excavation filled, contoured and re-seeded.

Access roads - Unless requested otherwise by the landowner, permanent access roads constructed to accommodate the Project will be removed. Ditch crossings connecting access roads to public roads will be removed unless the landowner requests they remain. Improvements to town and county roads that were not removed after construction will remain in place.

Odell will restore and reclaim the site to its pre-project topography and topsoil quality using BMPs consistent with those outlined by 2012 USFWS Land- Based Wind Energy Guidelines. The goal of decommissioning will be to restore natural hydrology and plant communities to the greatest extent practical while minimizing new disturbance and removal of native vegetation. The decommissioning BMPs that will be employed on the Project to the extent practicable with the intent of meeting this goal include:

1. Minimize new disturbance and removal of native vegetation to the greatest extent practicable.

2. Remove foundations to four feet below surrounding grade, and cover with soil to allow adequate root penetration for native plants, and so that subsurface structures do not substantially disrupt ground water movements.

3. Stockpile topsoil that is removed and use as topsoil when restoring plant communities. Once decommissioning activity is complete, restore topsoils to assist in establishing and maintaining pre-construction native plant communities to the extent possible, consistent with landowner objectives.

4. Stabilize soil and re-vegetate with native plants appropriate for the soil conditions and adjacent habitat, and use local seed sources where feasible, consistent with landowner objectives.

5. Restore surface water flows to pre-disturbance conditions, including removal of stream crossings, roads, and pads, consistent with storm water management objectives and requirements.

6. Conduct survey, using qualified experts, to detect populations of invasive species, and implement and maintain comprehensive approaches to preventing and controlling invasive species as necessary.

7. Remove any unnecessary overhead pole lines.

8. After decommissioning, install erosion control measures in all disturbance areas where potential for erosion exists, consistent with storm water management objectives and requirements.

9. Remove fencing unless the landowner will be utilizing the fence.

10. Remediate any petroleum product leaks and chemical releases prior to completion of decommissioning. Decommissioning and restoration activities will be completed within 12 months after the date the Project ceases to operate.

11.0 Identification of Other Permits

The Applicant will be responsible for undertaking all required environmental review and will obtain all permits and licenses that are required following issuance of the LWECS Site Permit. The potential permits or approvals that have been identified as being required for the construction and operation of the Project are shown in Table 11.1.

Table 11.1: Permits and Approvals

Regulatory Authority	Permit Approval
Federal Approvals	
U.S. Army Corps of Engineers	Wetland Delineation Approvals
	Jurisdictional Determination
	Federal Clean Water Act Section 404 and Section 10 Permit(s)
U.S. Fish and Wildlife Service	Review for Threatened and Endangered Species

Environmental Protection Agency (region 5) ("EPA") in coordination with the Minnesota Pollution Control Agency ("MPCA")	Spill Prevention Control and Countermeasure ("SPCC") Plan
Lead Federal Agency	Federal Section 106 Review
Federal Aviation Administration	Form 7460-1 Notice of Proposed Construction or Alteration (Determination of No Hazard)
	Notice of Actual Construction or Alteration (Form 7460-2)
Federal Land Manager (BLM, USBR, Forest Services)	Right-of-Way Grant over Federal Lands
National Historic Preservation Act	Class I Literature Review / Class III Cultural Field Survey
U.S. Department of Agriculture	Ford AD-1006
	Conservation / Grassland / Wetland Easement and Reserve Program releases and consents
	FSA Mortgage Subordination & Associated Environmental Review
Federal Communications Commission	Non-Federally Licensed Microwave Study
Federal Energy Regulatory Commission	Exempt Wholesale Generator Self Cert. ("EWG")
	Market-Based Rate Authorization
	Waiver of Open Access TransmissionTariff ("OATT"), Open Access Same-Time Information System ("OASIS"), and Standards of Conduct requirements applicable to transmission providers with respect to Seller's ownership of generator interconnection facilities
Department of Transportation	Utility Line Crossing License
Federal Emergency Management Agency	Flood Plain Designation

State of Minnesota Approvals	
Minnesota Board of Water and Soil Resources	Wetland Conservation Act Approval
Minnesota Department of Labor and Industry	Building Plan Review and Permits
Minnesota Public Utilities Commission	Site Permit for Large Wind Energy Conversion System ("LWECS")
	Exemption from Certificate of Need for LWECS
Minnesota State Historic Preservation Office (SHPO)	Cultural and Historic Resources Review and Review of State and National Register of Historic Sites and Archeological Survey
Minnesota Pollution Control Agency	Section 401 Water Quality Certification
	National Pollutant Discharge elimination System Permit ("NPDES") – MPCA General Storm water Permit for Construction Activity
	Very Small Quantity Generator ("VSQG") License – Hazardous Waste Collection Program
	Aboveground Storage Tank ("AST") Notification Form
Minnesota Department of Health	Environmental Bore Hole ("EBH")
	Water Supply Well Notification
	Plumbing Plan Review
Minnesota Department of Natural Resources	License to Cross Public Land and Water
	Native Prairie Protection Plan
	Biological Preservation Survey
	General Permit for Water Appropriations (DeWatering)

Minnesota Department of Transportation	Utility Permits on Trunk Highway Right-of-way
	Oversize/Overweight Permit for State Highways
	Access Driveway Permits for MnDOT Roads
	Tall Structure Permit
Local Approvals	
Counties	Right-of-way permits, road access permits, driveway permits for access roads and electrical collection system, Wetland Conservation Act Approval
Townships	Right-of-way permits, crossing permits, road access permits, and driveway permits for access roads and electrical collect system

12.0 References

Allison, T.D. 2012. Eagles and wind energy: identifying research priorities. National Wind Coordinating Committee. http://awwi.org/uploads/files/AWWI_White_Paper_Eagles_and_Wind_Energy_May_2012.pdf (Accessed 2012).

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski and R.D. Tankersley, Jr. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72:61-78.

Bat Conservation International. 2013a. Species profiles. http://www.batcon.org/SPprofiles/index.asp (Accessed 2013).

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). pp 1-39. In A. Poole and F. Gill (ed.) The Birds of North America. Vol. 506. The Birds of North America, Inc. Philadelphia, PA, USA.

CEIWEP (Committee on Environmental Impacts of Wind Energy Projects). 2007. Environmental impacts of wind-energy projects. National Research Council of the National Academies. The National Academies Press, Washington DC.

Coffin B. and L. Pfannmuller (eds.). 1988. Minnesota's endangered flora and fauna. University of Minnesota Press. Minneapolis, MN.

Cottonwood County. "2005 Comprehensive Plan." 2005

Currier, C. 2001. Special animal abstract for *Ammodramus henslowii* (Henslow's Sparrow). Michigan Natural Features Inventory. Lansing, MI.

DNR – Division of Waters. 1997. National Wetlands Inventory Points. http://deli.dnr.state.mn.us (Accessed 2013)

DNR – Division of Waters. 1997. National Wetlands Inventory Polygons. http://deli.dnr.state.mn.us (Accessed 2013)

DNR – Division of Waters. 1997. National Wetlands Inventory Lines. http://deli.dnr.state.mn.us (Accessed 2013)

DNR. 2005. Field guide to the native plant communities of Minnesota: the Prairie Parkland and Tallgrass Aspen Parklands Provinces. Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MNDNR St. Paul, MN.

DNR (Minnesota Department of Natural Resources). 2006. Tomorrow's habitat for the wild and rare: an action plan for Minnesota wildlife. Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

DNR – Division of Waters. 2008. Public Waters Inventory (PWI) Watercourse Delineations. http://deli.dnr.state.mn.us (Accessed 2013).

DNR. 2013. Franklin's Gull. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNNM03020 (Accessed 2013).

Evans R.M. and F.L. Knopf. 1993. American White Pelican. In The Birds of North America, No. 57. (A. Poole, P. Stettenheim, and F. Gill, Eds.).

FAA. *Federal Aviation Administration Terrain and Obstacles Data (TOD) Team, AJV-222* May 21, 2013. http://tod.faa.gov/tod/public/index.html (accessed May 22, 2013).

Federal Communications Commission. *The Digital TV Transition: Reception Maps*. 2013. http://transition.fcc.gov/mb/engineering/maps (accessed June 21, 2013).

FEMA (Federal Emergency Management Agency). 1981a. Flood Insurance Rate Map (FIRM). County of Cottonwood, Minnesota (unincorporated areas). Community panel numbers 270622 0185B, 0195B and 0225B https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1 (Accessed 2013)

FEMA.1981b. FIRM County of Jackson, Minnesota (unincorporated areas). Community panel numbers 2706320150B and 0200B. https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1 (Accessed 2013)

FEMA.1985. FIRM County of Watonwan, Minnesota (unincorporated areas). Community panel number 270649A map 21. https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1 (Accessed 2013)

FEMA.1988. FIRM County of Martin, Minnesota (unincorporated areas). Community panel number 270641B map 1. https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1 (Accessed 2013)

Gomberg, Joan, Eugene Schweig. "Earthquake Hazard in the Heart of the Homeland: U.S. Geological Survey Fact Sheet FS-131-02." http://pubs.usgs.gov/fs/fs-131-02/fs-131-02.pdf. October 2002. (accessed May 22, 2013).

Harris, R.I. "Improvements to the Method of Independent Storm." *Journal of Wind Engineering and Industrial Aerodynamics* 80 (1999): 1 – 30.

Herkert, J.R. 1994. Status and habitat selection of the Henslow's Sparrow in Illinois. Wilson Bulletin. 106:35-45.

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

Jackson County Parks, Planning, and Environmental Services: Southwest Regional Development Commission. "Jackson County Comprehensive Plan: A Framework for Land Use and Guide for Future Growth." Planning Document, 2000.

Jain, A.A. 2005. Bird and bat behavior and mortality at a northern Iowa windfarm. Thesis. Iowa State University, Ames, IA.

Johnson, G.D. 2005. A Review of bat mortality at wind-energy developments in the United States. Bat Research News 46:45-49.

Madsen, J. and D. Boertmann. 2008. Animal behavioral adaptation to changing landscapes: Spring-staging geese habituate to wind farms. Landscape Ecology 23:1007-1011.

Marschner, F.J. 1974. The Original Vegetation of Minnesota (map, scale 1:500,000). USDA Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota (redraft of the original 1930 edition).

Martin County. "Martin County Land Use Plan." 2003.

Millsap, B.A. and G.T. Allen. 2006. Effects of falconry harvest on wild raptor populations in the United States: theoretical considerations and management recommendations. Wildlife Society Bulletin 34: 1392-1400.

Minnesota Department of Agriculture. “Minnesota Crops Profile.” Minnesota Department of Agriculture. 2001 http://www.mda.state.mn.us/food/business/~/media/Files/food/business/economics/mnlivestockprofile.ashx (accessed June 21, 2013).

“Minnesota Livestock Profile.” Minnesota Department of Agriculture. 2012. http://www.mda.state.mn.us/food/business/~/media/Files/food/business/economics/mnlivestockprofile.ashx (accessed June 21, 2013).

Minnesota Department of Commerce. *Minnesota Phone Service Providers*. 2012 http://mn.gov/commerce/topics/telecom/telephone-service/minnesota-phone-service-providers.jsp (accessed August 14, 2013.)

Minnesota Department of Employment and Economic Development. *MNDEED-LMI-QCEW*. 2012. http://www.positivelyminnesota.com/apps/lmi/qcew/AreaSel.aspx (accessed June 19, 2013).

Minnesota Department of Health – Division of Environmental Health. *Minnesota County Well Index Online*. 2007. http://mdh-agua.health.state.mn.us/cwi/cwiViewer.htm (accessed May 2, 2013).

Minnesota Department of Transportation. *MN/DOT County Pit Maps*. 2003. http://www.dot.state.mn.us/materials/aggcopitmaps.html (accessed May 15, 2013).

Mn/DOT Traffic Data, n.d. http://dotapp7.dot.state.mn.us/geocortex/essentials/web/viewer.aspx?site=TrafficData (accessed June 25, 2013).

Minnesota Department of Agriculture. *County Economic Profiles*. November 2009. http://www.mda.state.mn.us/food/business/agmktg-research/economicreports.aspx (accessed June 19, 2013).

Minnesota DNR. *Ecological Classification System (ECS): Minnesota DNR*. 2013. http://www.dnr.state.mn.us/ecs/index.html (accessed May16, 2013).

ECS: Minnesota River Prairie Subsection: Minnesota DNR. 2013. http://www.dnr.state.mn.us/ecs/251Ba/index.html (accessed May 16, 2013).

Minnesota Pollution Control Agency. “County Feedlot Officers, Delegated Counties, and Number of Registered Feedlots.” *Minnesota Pollution Control Agency*. September 2011. http://www.pca.state.mn.us/publications/wq-fl-12.pdf (accessed May 15, 2013).

NOAA. National Climatic Data Center. *Storm Events Database*. 2013. http://www.ncdc.noaa.gov/stormevents/ (accessed May 22, 2013).

NRCNA (National Research Council of the National Academies). 2007. Environmental impacts of wind NWCC (National Wind Coordinating Committee). 2004. Wind turbine interactions with birds and bats: A summary of research results and remaining questions. Fact Sheet, Second Edition. Resolve Inc. Washington DC. http://www.nationalwind.org/publications/wildlife/wildlife_factsheet.pdf (Accessed 2006).

Red Rock Rural Water System. *Red Rock Rural Water: History*. 2013. http://redrockruralwater.com/?page_id=242 (accessed May 2, 2013).

Rienecker, Michelle M., and Coauthors “MERRA: NASA’s Modern-Era Restrospective Analysis for Research and Applications.” *Journal and Climate* 24 (2011): 3624-3648.

Stantec Consulting Services, Inc. 2012. Avian and Bat Protection Plan for the Buckeye Wind Power Project. Stantec Consulting Ltd.

U.S. Census Bureau, *American Fact Finder*. 2010. http://factfinder2.census.gov (accessed April 30, 2013).

U.S. Department of Agriculture, Natural Resources Conservations Service. *Official Soil Series Descriptions (OSDs) NRCS Soils*. 2009b. http://soils.usda.gov/technical/classification/osd/ (accessed May 15, 2013).

U.S. Department of Energy, Energy Efficiency and Renewable Energy. "Wind Powering America: Utility-Scale Land-Based 80 Meter Wind Maps." *Wind Program: Wind Powering America*. September 12, 2012. http://www.windpoweringamerica.gov/wind_maps.asp (accessed April 23, 2013).

USFWS. 2009. Final environmental assessment - proposal to permit take as provided under the Bald and Golden Eagle Protection Act. Division of Migratory Bird Management.

USFWS. 2012. Bald Eagle breeding pairs 1990-2006. http://www.fws.gov/Midwest/eagle/population/nos_state_tbl.html (Accessed 2013).

USFWS. 2013. Eagle conservation plan guidance. Module 1 – land based wind energy. Version 2. http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf (Accessed 2013).

Wires, L.R. and F.J. Cuthbert. 2001. Prioritization of waterbird colony sites for conservation in the U.S. Great Lakes: Final report to Us Fish and Wildlife Service, Nov 2001.

Wires, L., K. Haws and F. Cuthbert. 2005. The Double-crested Cormorant and American White Pelican in Minnesota: A Statewide Status Assessment. MNDNR. http://files.dnr.state.mn.us/eco/nongame/projects/consgrant_reports/2005/swg_2005_wires_etal.pdf (Accessed 2013).

Westwood Professional Services. 2013. 2012 avian and bat fatality monitoring Lakefield Wind Project Jackson County, Minnesota. https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={0975A27A-BF4E-4C0A-A687-13921C2B58EF}