

**Dickinson Wind Energy Center
Dickinson Wind, LLC
Stark County, North Dakota**

**Application to the North Dakota Public Service Commission
for a Certificate of Site Compatibility**



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1. INTRODUCTION

Dickinson Wind, LLC (Dickinson Wind), a subsidiary of NextEra Energy Resources, LLC (NEER), is submitting this application for a Certificate of Site Compatibility (Certificate) to construct the Dickinson Wind Energy Center (the Project). The proposed Project is located in Stark County, North Dakota, (**Figures 1-3**) and will have a nameplate capacity of approximately 150 megawatts (MW), consisting of 80 General Electric (GE) 1.715 MW Xle wind turbine generators and 7 GE 1.79 MW Xle wind turbine generators. Additional facilities include access roads, electrical collection systems and cabling, a collection substation, an operation and maintenance (O&M) building, and a construction laydown area. The Project also includes an approximately 31-mile, 230-kilovolt (kV) overhead transmission line to connect the Project to the Belfield to Rhame 230-kV transmission line, in Section 20 of Township 139 North, Range 98 West, approximately 10 miles southwest of the city of Dickinson and will transmit power into Basin's transmission system. The transmission line must be permitted separately and Dickinson Wind will submit a separate application for a Certificate of Corridor Compatibility and Route Permit for the line and associated switchyard and construction laydown area by the end of March 2015.

The collection substation will include a power transformer to step up the voltage from 34.5 kV to 230 kV, enabling the interconnection to the Belfield to Rhame transmission line. The Project collection substation will be located on the south side of 37th Street SW in the northeast corner of the northwest quarter of Section 12 in Township 139 North, Range 94 West.

NEER is a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC ("NEER"). NEER develops renewable projects throughout the United States. NEER is the largest generator of wind-powered electricity in North America, with more than 10,000 MW of capacity at 100 facilities in 19 states and four provinces in Canada as of December 2013. In North Dakota specifically, NEER, through its affiliates, has developed, constructed, and currently operates 990 MW of generation while owning over 850 MW.

1.1 Compliance with the Energy Conversion and Transmission Facility Siting Act Chapter 49-22

The North Dakota Energy Conversion and Transmission Facility Siting Act (the Act) requires an application for a Certificate to meet the criteria set forth in North Dakota Century Code (NDCC) Chapter 49-22 and North Dakota Administrative Code (NDAC) Article 69-06. The siting of an energy conversion facility is to be made in an orderly manner compatible with environmental preservation and the efficient use of resources (NDCC 49-22-02).

Dickinson Wind considered the exclusion and avoidance areas and selection and policy criteria set forth in NDAC Section 69-06-08-01 in the design of the Project and has provided information on such areas in this application to the extent available. In addition, sufficient Project design, wind resource, and technical information have been provided for a thorough evaluation of the proposed Project. **Table 1** outlines the information required to fulfill the requirements for a Certificate with the North Dakota Public Service Commission (PSC; 1979) and where these requirements are addressed in this document.

Table 1. Certificate Completion Checklist

State Authority	Description	Section
NDCC 49-22-08 and NDAC 69-06-04-01	PSC Guidelines: Energy Conversion and Transmission Facility Siting	1.1
Section A	Description	1.0, 4.0, 6.0
1.	Type: Describe the type of energy conversion facility proposed and provide a diagram of the major process system or a flow diagram.	1.0, 4.1, Figures 7 and 8
2.	Product: Describe in general terms and technical terms the products to be produced by the proposed facility.	1.3.2, 6.1, 6.3, Figure 6
3.	Size and Design: Provide the following description of the production capacity and design	1.3.2, 4.1, 4.2, 4.3, 6.0
a.	Gross design capacity;	1.3.2
b.	Net design capacity;	1.3.2
c.	Estimated thermal efficiency of the energy conversion process and the assumptions upon which the estimate is based;	N/A
d.	The number of acres that the proposed facility will occupy; and	1.3.1, 5.1
e.	One (1) copy of all design data reports separate from the application.	N/A; design information is included in Section 6.0
4.	Time Schedule: Provide the anticipated time schedule for the accomplishment of the following:	1.4
a.	Certificate of Site Compatibility;	1.4
b.	Land acquisition complete;	1.4
c.	Construction start date;	1.4
d.	Construction complete;	1.4
e.	Test operations;	1.4
f.	Commercial production date;	1.4
g.	100 percent capacity factor; and	1.4
h.	Any expansion or additions.	1.4
Section B	Studies	
	Provide a copy of any evaluative studies or assessments of the environmental impact of the proposed facility submitted to any Local, State or Federal agency.	Appendix A
Section C	Need for Facility	2.0
1.	An analysis of the need for the proposed facility based on present and projected demand for the product or products to be produced by the proposed facility, including the most recent system studies supporting the analysis of the need.	2.1
2.	A description of any feasible alternative methods of serving the need.	2.2
3.	A statement justifying any deviations from the most recent Ten-Year Plan which the proposed facility may present.	2.3
Section D	Location	1.3.1, Table 2
1.	Select a study area, which includes the proposed facility site, of sufficient size to enable the PSC to evaluate the factors addressed in Section 49-22-09, NDCC.	1.3.1, 3.0, 10.0-10.12, Figures 1-3
2.	Discuss the utility's policies and commitments to limit the environmental impact of its facilities, including copies of board resolutions and management directives.	1.0
3.	Identify and map the criteria that led to the proposed facility location within the study area.	Figures 4 and 5, 1.2, 3.0

State Authority	Description	Section
4.	Discuss present and future natural resource development in the area.	7.3.1
5.	Discuss in detail the relative value of each criteria and how the proposed facility location was selected giving consideration to all criteria.	3.0, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6
6.	The criteria to be evaluated shall include at a minimum all of the following which are within the study area:	3.0
	Exclusion areas;	3.1, Table 6, Figure 5
	Avoidance areas;	3.2, Table 7, Figure 5
	Selection criteria;	3.3, Table 8
	Policy criteria;	3.4, Table 9
	Design and construction limitations; and	3.5
	Economic considerations.	3.6
7.	Discuss the mitigative measures that will be taken to minimize adverse impacts which result from the location, construction, and operation of the proposed facility.	7.2.3, 7.3.3, 7.4.3, 7.5.3, 7.6.3, 7.7.3, 7.8.3, 7.9.3, 7.10.3, 7.11.3, 7.12.3, 7.13.3, 7.14.3, 7.15.3, 7.16.3, 7.17
8.	List the qualifications of the people in the various disciplines that contributed to the facility site location study	11.0
9.	Maps	Figures
	Map the criteria within the study area showing the proposed facility location. Several different criteria may be shown on each map, depending on the map scale and the density and nature of the criteria. Minimum map scale shall be ½ inch = 1 mile. All maps shall be at the same scale unless otherwise specified.	Figures 5, 8, 9, 10, 11, 13, 14, 15
	Furnish one Mylar map, separate from the application, of the same scale as the criteria maps and showing the same basic features as the criteria maps, including the study area, but not the proposed facility location.	(PSC Staff supports not providing a Mylar map)
NDCC 49-22-09	Factors to be considered in evaluating applications and designation of sites, corridors, and routes.	10.0
1.	Available research and investigations relating to the effects of the location, construction, and operation of the proposed facility on public health and welfare, natural resources, and the environment.	10.1
2.	The effects of new energy conversion and transmission technologies and systems designed to minimize adverse environmental effects.	10.2
3.	The potential for beneficial uses of waste energy from a proposed energy conversion facility.	10.3
4.	Adverse direct and indirect environmental effects which cannot be avoided should the proposed site or route be designated.	10.4
5.	Alternatives to the proposed site, corridor or route which are developed during the hearing process and which minimize adverse effects.	10.5
6.	Irreversible and irremediable commitments of natural resources should the proposed site, corridor, or route be designated.	10.6
7.	The direct and indirect economic impacts of the proposed facility.	10.7
8.	Existing plans of the state, local government, and private entities for other developments at or in the vicinity of the proposed site, corridor, or route.	10.8
9.	The effect of the proposed site or route on existing scenic areas, historic sites and structures, and paleontological or archaeological sites.	10.9
10.	The effect of the proposed site or route on areas which are unique because of biological wealth or because they are habitats for rare and endangered species.	10.10

State Authority	Description	Section
11.	Problems raised by federal agencies, other state agencies, and local entities.	10.12

1.2 Flexibility in Siting

Wind facility siting is a process through which input is considered from several different entities. When considering where to locate this wind farm in North Dakota, Dickinson Wind identified the Project Area (see **Figures 1-3**) for further investigation as outlined in Section 1.3 below. Dickinson Wind then conducted environmental desktop and field studies in the Project Area, the results of which are incorporated in the appropriate sections of this application, and further assessed wind resource and transmission availability and interconnection points. The identified Project Area is considered optimal from a wind resource perspective.

Dickinson Wind has entered into agreements with landowners that are interested in having wind turbines and associated facilities placed on their property. Simultaneously, Dickinson Wind has identified preliminary turbine locations based on initial site inspection, topographic maps, known environmentally sensitive areas, review of North Dakota’s power plant siting exclusion and avoidance areas, and communications with local, state and federal agencies. Dickinson Wind is not seeking a permit for each wind turbine indicated on **Figure 1** through **Figure 3**; rather, the preliminary layout indicates areas of the site with good wind resource and where there are no known environmental or regulatory siting issues or any such issues can be mitigated.

Dickinson Wind seeks a Certificate of Site Compatibility for the Project Area, as opposed to specific turbine locations. Dickinson Wind suggests that the Certificate define the Project Area, number of turbines, and structures related to wind generation to be located within the Project Area based on the information presented in this Application. Within the permitted Project Area, Dickinson Wind proposes that conditions be included specifying that final turbine placement be subject to required setbacks from environmentally sensitive areas, and sufficient to meet required noise levels.

Dickinson Wind is currently completing additional studies required by the Certificate and Dickinson Wind’s siting process, including geotechnical studies and final cultural resource surveys and wetland delineations. Dickinson Wind will also further evaluate the Project Area based on efficient construction of the Project. In addition, Dickinson Wind will seek further input from landowners regarding the location of wind turbines and associated facilities. Once these additional studies and communications are completed, preliminary turbine locations will be re-evaluated for their appropriateness with the Certificate conditions and buffers. A final site plan for the Project will be submitted to the PSC prior to construction and a pre-construction conference call will be held with PSC staff to ensure that the site plan conforms to the Certificate requirements.

Dickinson Wind believes that the aforementioned siting process is consistent with North Dakota siting rules and provides Dickinson Wind with the flexibility necessary to develop a timely, cost-effective project in an environmentally responsible manner.

1.3 Project Summary

Dickinson Wind evaluated wind resources in North Dakota for siting a 150 MW wind generation facility. Based on this review, Dickinson Wind selected a Project Area approximately 75 miles west of the city of Bismarck and 12 miles east of the city Dickinson for additional study and preparation of an application for a Certificate to the PSC. No other areas were considered for development of the Project. The proposed Project Area was identified as optimal from wind resource, transmission interconnection, environmental, and economic perspectives. The proposed Project Area was selected considering the exclusion and avoidance criteria outlined in NDAC 69-06-08-01.

1.3.1 Proposed Project Area

The Project Area is the location within which Dickinson Wind is pursuing leases from landowners. The Project Area was selected to include all areas necessary for Dickinson Wind to optimize the wind resource while avoiding and minimizing impacts to environmental resources. Dickinson Wind currently has leases in Stark County (**Table 2**).

Table 2. Project Area Location

County	Township	Range	Sections
Stark County	138 N	93 W	33
	139 N	92 W	14-19
	139 N	93 W	2-11, 13-24, 26-30
	139 N	94 W	1, 2, 10-15, 23-25
	149 N	93 W	16, 19-23, 26-35
	149 N	94 W	25-28, 33-36

The Project Area encompasses approximately 39,182 acres (61 square miles) in eastern Stark County. Although the turbines will be placed throughout the Project Area, the Project structures will occupy approximately 80 acres during operation (See **Tables 3 and 4 below**), or less than one percent of the total Project Area. **Table 3** summarizes the assumptions used to calculate impacts by Project facility. Permanent impacts are considered to be the Project footprint during operation. Temporary impacts are considered those impacts that result during construction to accommodate equipment and temporary activities outside of the areas that will remain as the Project footprint during operation. **Table 4** summarizes the estimated impact for each Project component for both construction (temporary) and operation (permanent). The Project Area and Project layout are shown on **Figures 1-3**. The impact assumptions are shown on **Figure 4**.

Table 3. Project Impact Assumptions

Project Component	Temporary Disturbance (Construction Only)	Permanent Disturbance (Operation)	Total Disturbance (Temporary and Permanent)
Wind Turbines <u>a/</u>	3.5 acres per turbine	0.2 acres per turbine	3.7 acres per turbine
Access Roads <u>b/</u>	22 feet wide per linear foot of road	16 feet wide per linear foot of road	38 feet wide per linear foot of road
Collection Lines <u>c/</u>	50 feet wide per linear foot	12 feet x 8 feet for each junction box	50 feet wide per linear foot, inclusive of permanent disturbance
O&M facility	0 acres	5 acres	5 acres
Collection Substation	0 acres	5 acres	5 acres
Construction Laydown Areas <u>d/</u>	15 acres	0 acres	15 acres
Meteorological towers <u>e/</u>	1.25 acres per tower	5 sq. feet per tower	1.25 acres per tower

a/ Impacts during operation account for a 40-foot x 100-foot gravel pad with a 15-foot buffer. Impacts per turbine during construction can be up to 3.7 acres (400-foot x 400-foot), so net construction impact is $3.7 - 0.2 = 3.5$ acres. For the purposes of the impact analysis using GIS software, a radius of 226.6 feet and 53.82 feet was used to approximate the 3.7 acres and 0.2 acres, respectively.

b/ Easement width necessary for construction based on turbine types. Temporary and permanent impacts represent a conservative estimate of disturbance. Roads required to support crane access to turbines during operation would remain up to 38 feet wide; other access roads may be built at 16 feet or reduced later to 16 feet. Access road impacts also assume all proposed roads are new access roads and do not consider improvements to existing roads separately.

c/ Assuming up to four (4) circuits and that collection lines are not co-located with access roads. Where collection lines run parallel to access roads, the centerlines in the layout design include a separation distance of 150 feet, and as a result, impact buffers generally do not overlap.

d/ Assumes one 15-acre laydown areas.

e/ Area of impact is 1.25 acres per guyed tower during installation. Once installed, each tower has a 1 square-foot base plate and four 1 square-foot anchor points.

Table 4. Project Impacts

Project Component	Temporary Impact (Construction Only)	Permanent Impact (Operation)	Total Impact (Temporary and Permanent)
Wind Turbines <u>a/</u> (87 planned turbines, not including alternates)	302.4 acres	17.9 acres	320.3 acres
Access Roads <u>b/</u>	79.2 acres	57.5 acres	136.7 acres
Collection Lines <u>c/</u>	309.4 acres	Less than 0.1 acre	309.4 acres
Collection Substation	0 acres	5 acres	5 acres
Construction Laydown Area	15 acres	0 acres	15 acres
Meteorological towers <u>d/</u>	7.5 acres	5 sq. feet	7.5 acres
Total	713.5 acres	80.4 acres	793.9 acres

a/ Assumes 87 turbines x 3.7 acres of ground disturbance during construction, 0.2 acre/turbine of that remaining as permanent. The 8 alternate turbines were not included in the calculation.

b/ Assumes a 38-foot wide easement for roads during construction, 16 feet of that remaining during operation. Assumes total of approximately 42 linear miles of service roads. The overlapping area for turbines and substation were excluded from the impact calculations.

c/ The overlapping areas between the collection line corridor buffer and the access road corridor buffer were removed from impact calculation. Approximately 15.2 miles of collection lines run parallel to the access roads, with a 150-foot distance designed between the collection line and access road centerlines. The impacts also include approximately 62 miles of collection lines not co-located with access roads. Junction boxes will be located on the ground throughout the Project Area and will each require approximately 12 feet x 8 feet.

d/ 6 temporary met towers x 1.25 acres = 7.5 acres; 1 permanent met tower, assuming unguyed, 5 square feet.

1.3.2 Projected Output

The Project will have a nameplate (gross) capacity of approximately 150 MW. Assuming a net capacity factor of 53 percent, the projected average annual output is estimated at 695,027 MW hours per year. As with all wind projects, output is dependent upon wind resource, final design, site-specific features, and equipment.

1.4 Project Schedule

The commercial operation date is dependent upon permitting, equipment deliveries, and other development activities. Dickinson Wind is targeting site construction to begin in June 2015 provided all pre-construction permits and approvals have been obtained.

1. Certificate of Site Compatibility: Dickinson Wind anticipates and has requested with this filing that the Certificate be issued in June 2015.
2. Land Acquisition: All land easement agreements for the wind generation facility will be completed by April 2015.
3. Permits: Dickinson Wind is responsible for undertaking all required environmental studies, and will obtain all permits and licenses that are required following issuance of

the Certificate. Completing permits is on the “critical path” for the Project and will allow Dickinson Wind to move forward with other commitments on the Project.

4. Equipment Procurement, Manufacture and Delivery: Dickinson Wind will order the wind turbine components as soon as practicable.
5. Construction: Construction is scheduled to begin as early as June 2015, subject to road restrictions and weather. The engineering, procurement, and construction (EPC) contractor will be responsible for completing all project construction, including roads, wind turbine assembly, electrical, and communications work. Construction will take approximately six months to complete.
6. Testing Operations: Dickinson Wind anticipates testing to begin in October 2015.
7. Commercial Operation: Dickinson Wind anticipates commercial operation of the Project to begin producing energy in December 2015.
8. Expansions or Additions: Due to the good wind resource and growth in the area, expansion of this Project is a possibility, although no specific schedule has been set at this time.

1.5 Project Ownership

Dickinson Wind will own the entire Project and, as a result, will manage the construction of all equipment and associated facilities related to the Project. Dickinson Wind will likely select a third-party EPC contractor to perform the majority of the engineering and construction of the wind farm. Dickinson Wind will procure the turbine/tower package directly from a manufacturer.

2. NEED FOR FACILITY

2.1 Need Analysis

Due partly to high heating demand in winter, North Dakota's per capita energy consumption is among the highest in the nation. Nearly three-tenths of North Dakota households use electricity as their primary energy source for home heating. Most of the coal used for power generation is supplied by several large surface mines in the central part of the state. Energy sources such as coal are finite and their combustion has environmental consequences.

In March 2007, North Dakota enacted legislation (H.B. 1506) adopting a voluntary renewable portfolio objective that aims to have ten percent of electricity used in the state generated from renewable sources by 2015. According to the Energy Information Administration (EIA 2014), in 2010, 79 percent of North Dakota's net electricity generation came from coal, 16 percent came from wind energy, and 5 percent came from conventional hydroelectric power sources. Consequently, the ten percent renewable portfolio objective is being met. However, other goals for renewable energy have been established. According to a March 2010 report prepared by the EmPower ND Commission, one of the state energy goals is to increase installed wind energy capacity to 5,000 MW by 2020 (EmPower ND 2010). North Dakota's energy-related goals include the following:

- general economic development and help the nation achieve greater energy independence,
- derive 25 percent of all energy produced in America from renewable sources by 2025, and
- provide a fair and responsible regulatory environment that promotes energy development.

A regional need exists for renewable energy produced in North Dakota. Eleven of the Midwest Independent System Operator (MISO) states currently have renewable portfolio standards (MISO 2012). According to the MISO Transmission Expansion Plan for 2012, the MISO region needs to add between 4,484 and 11,290 MW of new capacity or 3,865 and 9,733 MW of demand reduction to meet the minimum Planning Reserve Margins in 2022 (MISO 2012). From 2015 onward, 9,912 MW of retirements of fossil-fueled power plants are assumed to occur due to Environmental Protection Agency regulations. Depending on the projection scenario, MISO assumes anywhere from 13 to 60 gigawatts (GW) of incremental wind penetration. Seventeen multi-value transmission projects have been integrated into the MISO planning models, which will relieve a major part of MISO's internal future congestion and deliver wind energy more efficiently.

Apart from renewable energy goals, in recent years, the Mid-Continent Area Power Pool (MAPP) has consistently reinforced the regional need for increased generating capacity in the coming decade. The most recent MAPP report available (2009) indicates that deficits are now expected by 2017 (Table 5).

Table 5. MAPP (US) Summer Season Surplus/Deficit

Year	MW
2008	2,377.3
2009	1,522.2
2010	1,044.8
2011	939.5
2012	785.7
2013	502.8
2014	657.8
2015	524.4
2016	227.5
2017	-19.3
2018	-367.3

Source: Page III-5 of the MAPP 2009 Load and Capability Report (MAPP 2009).

In December 2014, Dickinson Wind signed a 30-year power purchase agreement with Basin Electric Power Cooperative (Basin) for the Project. Pursuant to this agreement, Basin will purchase all of the electrical output generated by the Project for 30 years. The Project will help to increase the renewable portion of Basin’s generating portfolio to more than 1,400 MW when combined with additional wind generation commitments made by Basin in 2013. The Project will help meet Basin member’s energy needs while keeping member electricity rates low (Basin 2014).

The Project will allow North Dakota to continue to provide capacity to meet those forecasted deficits with clean, efficient, renewable energy for at least the projected 30-year life of the Project.

2.2 Alternatives

Feasible technology alternatives to wind include electricity generation using coal, natural gas, or biomass. None of these alternatives were considered because these technologies do not meet the state’s goal of adding new wind energy.

Although the Project will include 87 planned turbines, an additional 11 alternate turbine locations have been included in the Project layout in order to provide siting flexibility based on on-going environmental studies and landowner preferences.

2.3 Ten-Year Plan

Dickinson Wind will file a Ten-Year Plan with the PSC and the Stark County Auditor by July 1, 2015.

3. SITE SELECTION CRITERIA

Dickinson Wind is evaluating the proposed 39,182-acre (61 square-mile) Project Area to determine the best locations for up to 80 GE 1.715 MW and 7 GE 1.79 MW Xle wind turbines. Siting turbines is a process through which input from several different entities is considered. The Project Area was identified as an optimal site from environmental, wind resource, transmission, and economic perspectives.

Dickinson Wind has secured voluntary wind option agreements with landowners and identified preliminary turbine locations based on site inspection, topographic maps, known environmentally sensitive areas, review of North Dakota's power plant siting exclusion and avoidance areas, review of Stark County and state wind siting requirements, and communications with local, state, and federal agencies. NEEDR has used this siting process in developing recent wind turbine projects, including projects in North Dakota. Through this process, NEER addresses environmental issues that commonly arise during project development and works within the parameters of State rules. North Dakota has several site selection criteria that are considered by the PSC to determine suitability of the site. Dickinson Wind has reviewed the criteria in Chapter 69-06-08 and has considered these criteria in Project design. These criteria are discussed in this section.

3.1 Exclusion Areas

In accordance with NDAC Section 69-06-08-01(1) and (2), the geographical areas listed in **Table 6** shall be excluded in the consideration of a site for an energy conversion facility. The area of exclusion shall include a buffer zone of a reasonable width to protect the integrity of the area. Exclusion areas are mapped for the Project Area on **Figure 5**.

3.2 Avoidance Areas

The Project complies with the requirement in NDCC 49-22-05.1 that areas within 500 feet of occupied rural residences be considered avoidance areas. In accordance with NDAC Section 69-06-08-01(3) and (4), the geographical areas listed in **Table 7** shall not be approved as a site for an energy conversion facility unless the applicant shows that, under the circumstances, there is no reasonable alternative. In determining whether an avoidance area should be designated for a facility, the PSC may consider, among other things: the proposed management of adverse impacts; the orderly siting of facilities; system reliability and integrity; the efficient use of resources; and alternative sites. Avoidance areas are also mapped for the Project Area on **Figure 5**.

Table 6. Exclusion Areas

Exclusion Area	Present within Project Area?	Description	Section Addressed
Designated or registered national areas: parks; memorial parks; historic sites and landmarks; natural landmarks; historic districts; monuments; wilderness areas; wildlife areas; wild, scenic, or recreational rivers; wildlife refuges; and grasslands.	None	N/A	3.5, 7.3, Figures 5 and 10
Designated or registered state areas: parks; forests; forest management lands; historic sites; monuments; historical markers; archaeological sites; grasslands; wild, scenic, or recreational rivers; game refuges; game management areas; management areas; and nature preserves.	Present	Archaeological sites have been identified through a file search and field survey, but the Project layout will avoid all newly documented sites. The sites are not shown on Figure 5 due to confidentiality. The field survey will be completed in spring 2015.	7.7, 7.8, 7.9, 7.15, 7.17
County parks and recreational areas; municipal parks; parks owned or administered by other governmental subdivisions; hardwood draws; and enrolled woodlands.	None	N/A	7.8, 7.17
Prime farmland and unique farmland, as defined by the land inventory and monitoring division of the soil conservation service, United States department of agriculture, in 7 C.F.R. part 657; provided, however, that if the Commission finds that the prime farmland and unique farmland that will be removed from use for the life of the facility is of such small acreage as to be of negligible impact on agricultural productions, such exclusion shall not apply.	Present	14,765 acres (38%) of soils of statewide importance and 3,171 (8%) of prime farmland soils in the Project Area. Prime farmland has been avoided to the extent practical. Permanent impacts to prime farmland soils and soils of statewide importance from turbine placement and access roads are expected to be up to 28 acres and 151 acres, respectively, which is less than 1% of the Project Area.	7.9, 7.10, Figure 14
Irrigated land	None	N/A	7.9
Areas critical to threatened or endangered animal or plant species	None	Although the Project Area is within the whooping crane migration corridor, there is no designated critical habitat within the Project Area.	7.16, 7.17
Areas where animal or plant species that are unique or rare to this state would be irreversibly damaged.	None	N/A	7.13, 7.14, 7.15, 7.16, 7.17
Wind-energy specific exclusion areas	N/A	The Project complies with the following exclusion areas: <ul style="list-style-type: none"> ▪ 1.1 x height of turbine from interstate and state road rights-of-way ▪ 1.1 x height of turbine plus 75 feet from centerline of county or township roadways ▪ 1.1 x height of turbine from railroad right-of-way ▪ 1.1 x height from 115kV or higher transmission lines ▪ 1.1 x height from property line of non-participating landowners 	4.1.1

Table 7. Avoidance Areas

Avoidance Areas	Present within Project Area?	Description and Proposed Buffer	Section Addressed
Areas within 500 feet (152.4 meters) of an inhabited residence	Present	All occupied residences are at least 2,000 feet from the nearest turbine.	4.1.1
Historical resources which are not designated as exclusion areas	None	N/A	7.7, 7.17
Areas within the city limits of a city or the boundaries of a military installation	Present	The city of Taylor is within the Project Area, but no Project facilities are within the city limits.	7.3, Figures 1-3
Areas within known floodplains as defined by the geographical boundaries of the 100-year flood	Present	2 percent of the Project Area is within the 100-year floodplain. These areas occur primarily within creek beds and will be avoided or permitted as required by Stark County.	7.12, 7.17
Areas that are geologically unstable	None	N/A	7.11, 7.17
Woodlands and wetlands	Present	Permanent impacts to jurisdictional wetlands will be avoided and minimized as practicable. Few woodland impacts are anticipated, and all trees that are removed will be replaced at a 2 to 1 ratio as required by the PSC.	7.13, 7.14, 7.17, Figures 13 and 15
Areas of recreational significance which are not designated as exclusion areas	Present	2,321 acres enrolled in Private Lands Open to Sportsmen (PLOTS). These lands will remain open to hunters after Project is constructed, if landowner wishes, so there would be no impacts. The Old Red/old Ten Scenic Byway runs through Project Area roughly parallel to Interstate-94. The Scenic Byways Program is a tourism designation.	7.3
Geographic area where, due to operation of the facility, the sound levels within 100 feet of an inhabited residence or a community building will exceed 50 dBA.	None	Noise modeling results indicated that received sound levels are all 50 dBA within 100 feet of an inhabited residence.	7.6.2, Appendix A

3.3 Selection Criteria

In accordance with NDAC Section 69-06-08-01(5), a site shall be approved in an area only when it is demonstrated to the PSC by the applicant that any significant adverse effects resulting from the location, construction, and operation of the facility in that area, as they relate to the criteria listed in **Table 8**, will be at an acceptable minimum, or that those effects will be managed and maintained at an acceptable minimum.

Table 8. Selection Criteria

Selection Criteria	Potential Adverse Effects	Section Addressed
The impact upon agriculture:		
Agricultural production	Approximately 80 acres of land will be affected by 87 turbines, associated access roads, and other infrastructure during operation. Additional temporary impacts during construction for turbine installation, road construction, cable trenching, and laydown and construction staging would be approximately 714 acres. These impacts represent a minor portion of the land area available for agricultural production. Landowner agreements include compensation for crop damage, if any, during surveys and construction. As a result, the Project will not result in significant impacts to agricultural production.	7.3, 7.9
Family farms and ranches	The Project will comply with state and county setbacks. Although some land area will be converted to wind turbine foundations and pads, access roads, and a substation, wind lease payments to farmers will provide a supplemental source of income. As stated above, landowner agreements also include compensation for crop damage, if any, during surveys and construction.	4.1.1, 7.2, 7.3, 7.10, Table 10, Figure 5
Land which the owner demonstrates has soil, topography, drainage, and an available water supply that cause the land to be economically suitable for irrigation	Participating landowners have not expressed concerns related to economically suitable irrigation on their land. Currently no irrigation is occurring within the Project Area.	7.9, 7.10, Figures 14 and 15
Surface drainage patterns and ground water flow patterns	No impacts to surface drainage patterns or groundwater flow patterns will occur.	7.11, 7.12, 7.13, Figure 15
The agricultural quality of the cropland	No impacts to the agricultural quality of the cropland are anticipated. If compaction of soils occurs during construction, Dickinson Wind will work with the landowners to alleviate the compaction.	7.9, 7.10
The impact upon the availability and adequacy of:		
Law enforcement	No impacts are anticipated.	7.4
School systems and education programs	No adverse effects are expected.	7.4
Governmental services and facilities	Governmental services and facilities will not be negatively affected.	7.4
General and mental health care facilities	General and mental health care facilities will not be negatively affected.	7.4
Recreational programs and facilities	No impacts are anticipated.	7.4, 7.8, 7.17
Transportation facilities and networks	During construction, an increase in vehicle trips per day is anticipated for the duration of Project construction. During facility operation, no significant impacts are anticipated.	7.4, Figure 11
Retail service facilities	No adverse impacts are anticipated. Local services such as motels, restaurants, and convenience stores are likely to experience an increase in business during Project construction.	7.4
Utility services	The Project will utilize station service from Roughrider Electric Cooperative, Inc., which will suggest appropriate configurations for the electrical system, and Dickinson Wind will abide by the recommendations to prevent impacts to the transmission system.	1.0, 2.0, 6.0, 7.4
The impact upon:		
Local institutions	No impacts are anticipated.	7.4

Selection Criteria	Potential Adverse Effects	Section Addressed
Noise sensitive land uses	The noise sensitive land uses within the Project Area are the residences near turbine locations. The noise impacts from the Project turbines will not exceed nuisance thresholds at occupied residences.	7.6, 7.17
Rural residences and businesses	The Project will comply with state and local setbacks.	7.2, 7.3, Figure 5
Aquifers	No impacts will occur.	7.11
The impact upon:		
Human health and safety	No impacts to human health and safety are anticipated based on the implementation of the mitigative measures discussed in Section 7.5.3 and maintenance schedules.	6.3, 6.5.27.5
Animal health and safety	No impacts to livestock are anticipated from construction or operation of the facility. Based on avian surveys performed to date, mean raptor use was generally low compared to other wind facilities. For other avian species, fatalities from the Project, if any, are not anticipated to have population-level effects. Dickinson Wind will implement measures to avoid and minimize effects to wildlife by siting facilities away from active raptor nests and wetlands to the extent practicable. In addition, Dickinson Wind will implement a post-construction Wildlife Response and Reporting System (WRRS) and one year of post-construction bird and bat mortality monitoring for the Project in order to monitor avian/turbine interaction.	7.15, 7.16, Appendix A
Plant life	The Project will result in approximately 80 acres of permanent impact. Land where the turbines will be sited is primarily undeveloped cropland and grassland.	7.14, Figure 13
Temporary and permanent housing	Existing temporary housing, such as hotels, will be utilized during construction. No adverse impacts are anticipated.	7.2
Temporary and permanent skilled and unskilled labor	No adverse effects are anticipated. Local contractors employed for construction will result in increased wages.	7.2
The cumulative effect of the location of the facility in relation to existing and planned facilities and other industrial development	Wind energy development is anticipated to have a positive cumulative impact on air quality and minimal impacts to geology, soils, water, noise, safety and health issues, and cultural resources. Socioeconomic impacts are anticipated to be positive, as the rural economy and energy production is diversified. Wind energy development removes less total land from agricultural use than other forms of energy generation development.	10.11

3.4 Policy Criteria

In accordance with NDAC Section 69-06-08-01(6), the PSC may give preference to an applicant that will maximize benefits that result from the adoption of the policies and practices listed in **Table 9**, and in a proper case may require the adoption of such policies and practices.

Table 9. Policy Criteria

Policy Criteria	Suitable Policy or Practice of Applicant	Section Addressed
Recycling of the conversion byproducts and effluents	Not applicable.	N/A

Policy Criteria	Suitable Policy or Practice of Applicant	Section Addressed
Energy conservation through location, process, and design	Dickinson Wind is developing the site to maximize energy output and will develop a site layout that optimizes wind resources while minimizing the impact on land resources and any potentially sensitive areas. Wind-powered electric generation is entirely dependent on the availability of the wind resource at a specific location. The energy available from the wind increases at the third power of the wind speed. In other words, a doubling of the wind speed will increase the available energy by a factor of eight times.	4.2
Training and utilization of available labor in this state for the general and specialized skills required	Dickinson Wind will use local labor to the extent practicable.	7.2
Use of a primary energy source or raw material located within the state	The energy generated at the site will utilize the wind resources of the State of North Dakota.	5.2
Non-relocation of residents	No residents will be relocated as a result of the Project.	7.2.2
The dedication of an area adjacent to the facility to land uses such as recreation, agriculture, or wildlife management	The Project will not interfere with adjacent land uses. As such, it is not anticipated that areas adjacent will be dedicated to recreation, agriculture, or wildlife management.	7.3, 7.8, 7.9, 7.15, Figures 5 and 10
Economies of construction and operation	Dickinson Wind will utilize local contractors to the extent practicable.	7.2
Secondary uses of appropriate associated facilities for recreation and enhancement of wildlife	None.	N/A
Use of citizen coordinating committees	Dickinson Wind will continue to work with landowners of properties for the Project.	8.0
A commitment of a portion of the energy produced for use in this state	Energy transmitted will be injected into the Belfield to Rhame Transmission Line and will be delivered to Basin's grid system. Basin's service area includes North Dakota, and a portion of the energy produced will be used in-state.	6.3
Labor relations	Some trades may be part of unions. No labor relations will be affected.	6.5, 7.2
The coordination of facilities	Existing facilities and facility corridors were considered in the location of the wind farm and associated facilities.	3.0, 3.6
Monitoring of impacts	Dickinson Wind and the EPC contractor will employ best management practices during construction to monitor soil impacts and segregate topsoil. A storm water prevention plan will be prepared for the Project.	7.10, 7.11, 7.12, 7.15, 7.16

3.5 Design and Construction Limitations

Two key design and construction limitations when building any wind farm are wind resources and landowner easements. The wind resource is essential to selecting and designing a wind farm. Dickinson Wind has conducted an analysis of the proposed Project Area to ensure that the site has ample wind energy to generate revenue for the wind farm. Easements allowing construction of turbine towers and transmission facilities are also critical to the Project. Dickinson Wind is in the process of securing voluntary land agreements with landowners necessary to develop the Project.

3.6 Economic Considerations

Economics were considered when selecting a location for the Project. As discussed above, it is important to select a site with a wind resource capable of generating energy. The proposed Project Area takes advantage of the wind resource in the area. Information on the wind resource at the site is discussed in **Sections 5.2-5.3**.

One of the most important economic considerations related to the Project is the need to qualify for the Federal Production Tax Credit (PTC). The PTC is an income tax credit of 2.3 cents/kilowatt-hour allowed for the production of electricity from utility-scale wind turbines. This incentive was created under the Energy Policy Act of 1992, and has been renewed and expanded many times, most recently by the Tax Increase Prevention Act of 2014. This December 2014 legislation revised the credit by extending the deadline for wind energy facilities by one year, from December 31, 2013 to December 31, 2014. In order to qualify for the PTC, projects must have begun construction prior to January 1, 2015, including spending at least five percent of the total cost of the facility and making continuous efforts to complete the facility (USDOE 2015). Early approval of a Certificate is not only consistent with circumstances unique to wind project siting, but it is also essential to timing, given the uncertainty and limited duration of the Federal PTC available for wind project development.

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4. GENERAL DESCRIPTION OF THE PROPOSED FACILITY

4.1 Wind Power Technology

As the wind passes over the blades of a wind turbine, it creates lift and causes the rotor to turn. The rotor is connected by a hub and main shaft to a system of gears, which are connected to a generator. Exact turbine models are subject to change to ensure selection of a turbine that is both cost effective and optimizes land and wind resources. Dickinson Wind is proposing to install up to 80 GE 1.715 MW and 7 GE 1.79 MW Xle turbines.

The GE 1.715 MW Xle utility-grade wind turbine has a nominal nameplate rating of 1.715 MW. Each turbine will have an 80-meter (262 feet) hub height and a 103-meter (338 feet) rotor diameter (**Figure 6**). The GE 1.79 MW Xle turbine has a nominal nameplate rating of 1.79 MW, an 80-meter hub height, and a 100-meter (328 feet) rotor diameter. Both turbines begin operation in wind speeds of 3.5 meters per second (m/s), or 7.8 miles per hour (mph), and reach their rated capacity at a wind speed of 11.5 m/s (25.7 mph). The turbine is designed to operate in wind speeds of up to 25 m/s (56 mph).

Each tower will be secured by a concrete foundation that can vary in design depending on soil conditions. A control panel inside the base of each turbine tower houses communication and electronic circuitry. Each turbine is equipped with a wind speed and direction sensor that communicates to the turbine's control system to signal when sufficient winds are present for operation. Turbines feature variable-speed control and independent blade pitch to assure aerodynamic efficiency.

The electricity generated by each turbine is brought to a pad-mounted transformer where the voltage is raised (stepped up) to power collection line voltage of 34.5 kV. The electricity is collected by a system of underground power collection lines within the Project Area (**Figure 7**). Both power collection lines and communication cables will be buried on private property or public right-of-way. Typically, this infrastructure is run adjacent to the Project access roads or along public rights-of-way or easements. In cases where such infrastructure must be sited on property that is not governed by the existing wind easement and land lease options, Dickinson Wind is in the process of obtaining easements for the necessary property.

Each wind turbine will be accessible via all-weather, aggregate-surfaced roads between 16 and 38 feet in width which will connect with public roads. At the point where the access and public roads meet, the communication and power lines will continue as underground feeder lines. The feeder system distributes power to the Project substation. **Figure 7** is a diagram of the path of energy from the wind farm to energy users and **Figure 8** shows a typical wind farm facility layout. The power will be transformed to 230 kV at a collection substation that will be constructed on Section 12 of Township 139 North, Range 94 West (**Figures 2 and 3**). The substation will be located along 37th Street SW (**Figure 9**) and will be connected to the Belfield to Rhame Transmission Line via an approximately 31-mile overhead transmission line that will be permitted separately.

4.1.1 Wind Energy Center Layout

Dickinson Wind will develop a wind farm layout that optimizes wind resource while minimizing the impact on land resources and any potentially sensitive areas. Wind-powered electric generation is entirely dependent on the availability of the wind resource at a specific location. The energy available from the wind increases at the third power of the wind speed. In other words, a doubling of the wind speed will increase the available energy by a factor of eight times. Analysis of wind direction data suggests that the optimal turbine string alignments are generally from southwest to northeast. Design of the turbine array and collection system will minimize energy loss due to wind turbine wakes and turbulence, and electrical line losses.

Table 10 lists the setbacks utilized in designing the Project layout. The Project complies with the requirement in NDCC 49-22-05.1 that areas within 500 feet of occupied rural residences be considered avoidance areas. The Project also complies with the following wind energy-specific exclusion areas provided in Section 69-06-08-01 (2), as well as setbacks required by Stark County (**Table 10**):

- 1.1 x height of turbine from interstate and state road rights-of-way
- 1.1 x height of turbine plus 75 feet from centerline of county or township roadways
- 1.1 x height of turbine from railroad right-of-way
- 1.1 x height from 115kV or higher transmission lines
- 1.1 x height from property line of non-participating landowners

The distances are based on the GE 1.715 MW turbine, which has a larger rotor diameter than the GE 1.79 MW turbine model and has a total turbine height (from the bottom of the turbine tower to the top of the blade when vertical) of 475 feet. The Conditional Use Permit (CUP) from Stark County specifies that the Project turbines must not be located within 200 feet of a public road or within 2,000 feet of any existing residence. Dickinson Wind will comply with all applicable county setbacks.

Table 10. Setback Distances for Wind Turbines

Setback Type	Distance
PSC Exclusion Areas	
Interstate and state road rights-of-way	1.1 x turbine height (475 feet)
Centerline of county or maintained township roadways	1.1 x turbine height plus 75 feet (550 feet)
Railroad rights-of-way	1.1 x turbine height (475 feet)
115kV or higher transmission lines	1.1 x turbine height (475 feet)
Property line of non-participating landowners	1.1 x turbine height (475 feet)
Stark County Setbacks	
Occupied structures and Facilities (residence, commercial building or publicly-used structure)	2,000 feet
Public roads	200 feet (from center of right-of-way)
Above ground communication and electrical lines	200 feet (from center of right-of-way)

Setback Type	Distance
Wind Energy Facility Perimeter	2.5 x the rotor diameter of the wind turbine (845 feet for the 1.715 MW turbines and 820 feet for the 1.79MW turbines)
Other	
GE-provided setback from roads (more conservative than PSC setback)	1.5 x turbine height (900 feet)

4.2 Associated Facilities

The electricity generated by each turbine is stepped up to a power collection line voltage of 34.5 kV via a pad-mounted transformer at the base of each turbine. The electricity generated at each turbine will be collected by a system of underground power collection lines within the Project Area and brought to the Project collection substation, where it will be further raised to 230 kV and transmitted via an approximately 31-mile overhead transmission line to the Belfield to Rhome Transmission Line. A separate application for the transmission line will be submitted to the PSC for a Certificate of Corridor Compatibility and Route Permit. The Project also includes access roads. An O&M building and a temporary 15-acre laydown yard are also required.

A total of six temporary meteorological towers have been and will be installed for the Project, and one additional permanent meteorological tower will be installed.

4.3 Land Rights

Dickinson Wind has secured easements in Stark County for the proposed 150 MW Project. Land rights will encompass the proposed wind farm and all associated facilities, including but not limited to wind and buffer easements, wind turbines, access roads, underground collection lines, meteorological towers, and overhead transmission line. The land for the Project substation and O&M building will be purchased.

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5. PROPOSED SITE

5.1 Identification of Project Area

Dickinson Wind selected the Project Area based on its wind resource, land-use patterns, and presence of environmentally sensitive features. The Project Area boundary encompasses an area of 39,182 acres (61 square miles). However, the land occupied by turbines and other wind farm infrastructure during operation will be less than 1 percent of this area. It is anticipated that the area of direct land use during operation will be approximately 80 acres for the turbines, aggregate-surfaced access or service roads 16 feet wide, electrical junction boxes, one permanent meteorological tower, a collection substation, and O&M building. Total land disturbance for the wind farm and infrastructure is expected to be up to approximately 714 acres, including temporary disturbance due to turbine installation, road construction of roads up to 38 feet wide, collection line trenching, up to six temporary meteorological towers, and the laydown/construction staging areas. See **Table 4** in **Section 1.3.1** and **Section 7.0** for a detailed description of the Project Area impacts. **Figures 2-3** show proposed turbine locations, which are subject to shifts during micro-siting.

5.2 Wind Resource Areas – General

The U.S. Department of Energy's Wind Program and the National Renewable Energy Laboratory published a wind resource map for the state of North Dakota. This resource map shows wind speed estimates at 50 meters above the ground and depicts the resource that could be used for utility-scale wind development. As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). In general, at 50 meters, wind power Class 4 or higher can be useful for generating wind power with large turbines. The map indicates that North Dakota has wind resources consistent with utility-scale production. Good-to-excellent wind resource areas are located throughout North Dakota. Winds within the Project vicinity generally consist of Class 4 and 5 winds (USDOE 2014).

5.3 Wind Characteristics in Project Area

NEER has utilized wind data from meteorological towers in the Project Area to characterize the wind resource. NEER has secured information from other long-term references to aid in correlating the wind data on-site, including 30-year re-analysis data processed by the National Aeronautics and Space Administration (NASA) and processed by NEER. Industry standard software, such as Windographer, Openwind, WRF, and ArcGIS as well as internal NEER tools were used to analyze the available wind data and make corrections for site effects (topography, surface roughness, and obstacles) to produce a site independent characterization of the local wind climate. The resulting local wind climate was applied in conjunction with the Project Area effects to predict the spatial wind variations in the Project Area. Various site layouts and wind turbine generator parameters can be tested to predict energy production and array efficiency in order to optimize the site layout and turbine selection. Project site data have been compared to regional wind measurements using a parallel time period. There is good correlation between the long-term wind measurements and the short-term Project-specific wind measurements.

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6. ENGINEERING AND OPERATIONAL DESIGN ANALYSIS

This section provides a summary description of the Project, which includes a description of the Project layout, turbines, electrical system, and associated facilities. Additional design components addressed in this section are Project construction, schedule, operation, and decommissioning of the site. There are other turbines that are feasible choices for the Project Area that are available from various manufacturers and Dickinson Wind wishes to reserve the right to select alternative turbines representative of the 1.715 MW and 1.79 MW class of machines. Turbine type may affect the number and configuration of the turbine array. Details for the GE 1.715 MW and 1.79 MW Xle turbines are presented below.

6.1 Project Layout and Associated Facilities

The Project will consist of an array of wind turbines and transformers. The turbines will be interconnected by fiber optic communication cables and 34.5 kV power collection cables within the wind farm.

Land will be graded on-site for the turbine pads. Drainage systems, access roads, storage areas, and construction/laydown areas will be installed as necessary to fully accommodate all aspects of Project construction, operation, and maintenance.

Electrical system design and interconnection details will be determined as a result of studies and discussions with Basin. The Project includes a computer-controlled communications system that permits automatic independent operation, and remote supervision, thus allowing the simultaneous control of many wind turbines. Dickinson Wind will be responsible for operation and maintenance for the life of the Project and will contract with the most appropriate supplier of O&M services at the time of operation, to assure timely and efficient operations.

6.2 Description of Wind Turbines

The Project is currently designed to include 80 GE 1.715 MW and 7 GE 1.79 MW Xle turbines. Dickinson Wind reserves the right to select the most appropriate technology for the Project at the time of construction to ensure optimization of wind and land resources and cost efficiency.

6.2.1 Turbine

Both turbine models would have a hub height of 262 feet (80 meters); the 1.715 MW turbines would measure 431 feet from the base of the tower to the tip of the upright blade (**Figure 6**), and the 1.79 MW turbines would measure 427 feet. Both turbine models begin operation in wind speeds of 3.5 m/s (7.8 mph) and reach the rated capacity at a wind speed of 11.5 m/s (25.7 mph). The turbines are designed to operate in wind speeds of up to 25 m/s (56 mph).

The turbines 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.

The turbines have Supervisory Control and Data Acquisitions (SCADA) communication technology to allow control and monitoring of the wind farm. The SCADA communications

system permits automatic, independent operation and remote supervision, thus allowing the simultaneous control of many wind turbines. Operations, maintenance, and service for the Project will be structured so as to provide for timely and efficient operations. The computerized data network will provide detailed operating and performance information for each wind turbine. Dickinson Wind will maintain a computer program and database for tracking each wind turbine's operational history.

Other specifications of the turbines include:

- Rotor blade pitch regulation;
- Gearbox with three-stage planetary/helical system;
- Double fed three-phase asynchronous generator and an asynchronous 4-pole generator with a wound rotor;
- A braking system for each blade (three self-contained systems) and a fail-safe disc brake; and
- Yaw systems are electromechanically driven.

6.2.2 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. The 1.715 MW turbines have a 103-meter (338 feet) rotor diameter, with a swept area of 8,332 square meters (89,685 square feet) and a rotor speed of 17.14 revolutions per minute (rpm). The 1.79 MW turbines have a 100-meter (328 feet) rotor diameter, with a swept area of 5,346 square meters (57,544 square feet) and a rotor speed of 16.8 rpm.

6.2.3 Tower

The towers will all be conical tubular steel with a hub height of up to 80 meters (262 feet). The turbine towers, on which the nacelle is mounted, consist of three to four sections manufactured from certified steel plates. All welds are made by automatically controlled power welding machines and 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.

6.2.4 Lightning Protection

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

6.3 Description of Electrical System

At the base of each turbine, a step-up transformer will be installed to step up the voltage to the power collection line voltage of 34.5 kV. The power from these transformers will be run through an underground collection system consisting of various sized buried cables that are generally located alongside the Project access roads. At the point where the access and public roads meet, the collection system will continue as underground lines. All the collection system cables will terminate at an on-site Project collector substation, which steps up the Project voltage to 230 kV and provides the necessary protection and control for interconnection to the transmission grid. The Project substation (**Figure 9**) will be located in the northeast corner of the northwest quarter of Section 12 in Township 139 North, Range 94 West. The Project substation will be connected to the Belfield to Rhame Transmission Line via an approximately 31-mile 230-kV overhead transmission line.

All utility protection and metering equipment will meet Dickinson Wind and National Electric Safety Code standards for parallel operations. The construction manager will ensure that proper interconnection protection is established.

6.4 Project Construction

Several activities must be completed prior to the proposed commercial production date. The majority of the activity relates 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. Pre-construction, construction, and post-construction activities for the Project include:

- Ordering of all necessary components including towers, nacelles, blades, foundations, and transformers;
- Final turbine micrositing;
- Complete survey to microsite locations of structures and roadways;
- Soil borings, testing, and analysis for proper foundation design and materials;
- Complete construction of access roads, to be used for construction and maintenance;
- Construction of underground feeder lines;
- Design and construction of the Project substation;
- Installation of tower foundations;
- Installation of underground and aboveground cables;
- Tower placement and wind turbine setting;
- Acceptance testing of facility; and
- Commencement of commercial production date.

Private turbine access roads will be built adjacent to the towers, allowing access to the turbines during and after construction. Access roads will be 16 feet wide¹ and will have an aggregate surface as cover, and will be adequate to support the size and weight of maintenance vehicles. The specific turbine placement will determine the amount of private roadway that will be constructed for the Project.

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 the construction personnel. Dickinson Wind estimates that there will be approximately 50 additional trips per day in the area during peak construction periods. That volume will occur during the peak time when the majority of the road, foundation and tower assembly are taking place. At the completion of each construction phase, this equipment will be removed from the site or reduced in number.

6.4.1 Construction Management

An EPC contractor will be primarily responsible for the construction management of the Project. The EPC contractor will use the services of local contractors, where possible, to assist in Project construction. The EPC contractor, in coordination with local contractors, will undertake the following activities:

- Securing building, electrical, grading, road, and utility permits;
- Perform detailed civil, structural and electrical engineering;
- Schedule execution of construction activities; and
- Forecast Project labor requirements and budgeting.

The EPC contractor also serves as key contact and interface for subcontractor coordination. The EPC contractor will oversee the installation of communication and power collection lines as well as the substation. The EPC contractor will also oversee the installation of roads, concrete foundations, towers, machines, and blades, as well as the coordination of materials receiving, inventory, and distribution. The Project will be constructed under the direct supervision of an on-site construction manager with the assistance of local contractors. The construction consists of the following tasks:

- Site development, including roads;
- Foundation excavation;
- Concrete foundations;
- All electrical and communications installation;
- Tower assembly and machine erection; and

¹ Roads required to support crane access to turbines during operation will remain up to 38 feet wide; all other roads may be built at 16 feet wide or reduced later to 16 feet.

- System testing.

The construction team will be on site to handle materials purchasing, construction, quality control, testing, and start-up. The EPC contractor will manage local subcontractors to complete all aspects of construction. Throughout the construction phase, ongoing coordination will occur between the Project development and the construction teams. The on-site Project construction manager will help to coordinate all aspects of the Project, including ongoing communication with local officials, citizens groups and landowners. Even before the Project becomes fully operational, the O&M staff is integrated into the construction phase of the Project. The construction manager and the O&M staff manager will work together continuously to ensure a smooth transition from construction through wind farm commissioning and, finally, operations.

6.4.2 Foundation Design

The wind turbines' freestanding 80-meter (262-foot) tubular towers will be connected by anchor bolts to an underground concrete foundation. Geotechnical surveys, turbine tower load specifications and cost considerations will dictate final design parameters of the foundations. Foundations for similar sized turbines are generally octagonal, approximately 40 to 60 feet across at the base, and extend seven to 10 feet below grade. The wind turbine foundation design shall be prepared by a registered professional engineer licensed to practice in the State of North Dakota.

6.4.3 Civil Works

Completion of the Project will require various types of civil works and physical improvements to the land. These civil works may include the following:

- Improvement of existing public access roads to the Project Area;
- Construction of roads adjacent to the wind turbine strings (turbine access roads) to allow construction and continued servicing of the wind turbines;
- Clearing and grading for wind turbine tower foundation installations;
- Installation of underground cabling for connecting the individual wind turbines;
- Installation of an on-site feeder system for connecting wind turbine strings for delivery to the electricity collection/metering location;
- Installation of any site fencing and security; and
- Restoration and re-vegetation of disturbed land when construction activities are completed.

Any improvements to existing public access roads will consist of re-grading and filling of the surface to allow access in inclement weather. No asphalt or other paving is anticipated. Turbine access roads will be constructed along turbine strings or arrays. These roads will be sited in consultation with local landowners and completed in accordance with local building requirements where these roads intersect with public roads. They will be located to facilitate

both construction (cranes) and continued operation and maintenance. Siting roads in areas with unstable soil will be avoided wherever possible. All roads will include appropriate drainage and culverts while still allowing for the crossing of farm equipment. The roads will be 16 to 38 feet wide and will be covered with road base designed to allow passage under inclement weather conditions. The roads will consist of graded dirt and will be covered with an aggregate surface. Once construction is completed, the roads will be re-graded, filled, and dressed as needed.

6.4.4 Commissioning

The Project will be commissioned after completion of the construction phase. The Project will undergo detailed inspection and testing procedures prior to final turbine commissioning. Inspection and testing will occur for each component of the wind turbines, as well as the communication system, meteorological system, obstruction lighting, high voltage collection and feeder system, and the SCADA system.

6.5 Project Operation and Maintenance

In addition to regularly-scheduled on-site visits, Dickinson Wind and the appropriate supplier will control, monitor, operate, and maintain the Project by means of a SCADA computer software program. The operation of the entire wind farm, including discrete settings for individual turbines, is managed by the centralized SCADA system. The Project will be operated and maintained by NextEra Energy Operating Services.

The SCADA system offers access to wind turbine generation or production data, availability, meteorological, and communications data, as well as alarms and communication error information. Performance data and parameters for each machine (generator speed, wind speed, power output, etc.) can also 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 troubleshooting of problems.

The primary functions of the SCADA system are to:

- Monitor wind farm status;
- Allow for autonomous turbine operation;
- Alert operations personnel to wind farm conditions requiring resolution;
- Provide a user/operator interface for controlling and monitoring wind turbines;
- Collect meteorological performance data from turbines;
- Monitor field communications;
- Provide diagnostic capabilities of wind turbine performance for operators and maintenance personnel;
- Collect wind turbine and wind farm material and labor resource information;

- Provide information archive capabilities;
- Provide inventory control capabilities; and
- Provide information reporting on a regular basis.

6.5.1 Maintenance Schedule

Dickinson Wind will remotely monitor the Project on a daily basis. This monitoring will be accompanied by visual inspections by the on-site operating staff. Several daily checks will be made in the first three months of commercial operation to verify that the Project is operating within expected parameters. Once installed, the Project service and maintenance is carefully planned and divided into 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 tightening all bolts by 100 percent, a full greasing, and filtering of gear oil.

B. Semi-Annual Service Inspection. Regular service inspections commence six months after the first inspection. The semi-annual inspection consists of lubrication and a safety test of the turbine.

C. Annual Service Inspection. The annual 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 every bolt assembly. If any bolts are found to be loose, all bolts in that assembly are tightened 100 percent and the finding is recorded.

D. Two-Year Service Inspection. The two-year service inspection consists of the annual inspection, plus checking and tightening of 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.

6.5.2 General Maintenance Duties

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 of the wind turbines and of 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 Project structures, access roads, drainage systems and other facilities necessary for the operation;

- Maintenance of all O&M field maintenance manuals, service bulletins, revisions, and documentation for the Project;
- Maintenance of all parts, price lists, and computer software;
- Maintenance and operation of Project substation;
- Provision of all labor, services, consumables, and parts required to perform scheduled and unscheduled maintenance on the wind farm, including repairs and replacement of parts and removal of failed parts;
- Cooperation with avian and other wildlife studies as may be required, to include reporting and monitoring;
- Management of lubricants, solvents, and other hazardous materials as required by local and/or state regulations;
- Maintenance of appropriate levels of spare parts in order to maintain equipment. Order and maintain spare parts inventory;
- Provision of all necessary equipment including industrial cranes for removal and reinstallation of turbines;
- Hiring, training, and supervision of a work force necessary to meet the general maintenance requirements; and
- Implementation of appropriate security methods.

6.5.3 Operations and Maintenance Facility

The O&M facility will be constructed adjacent to the substation in the northwest corner of the northeast quarter of Section 12, Township 139 North, Range 94 West, and will occupy approximately 5 acres.

6.6 Decommissioning and Restoration

Dickinson Wind will develop a Decommissioning Plan in accordance with NDCC 49-02-27 and NDAC 69-09-09. Additionally, Dickinson Wind has a contractual obligation to the landowners to remove the wind facilities, including foundations to a depth of three feet below ground, when the wind easement expires and to restore the area to the same physical condition that existed immediately before the construction of the turbines. Dickinson Wind also reserves the right to explore alternatives regarding Project decommissioning at the end of the Project Certificate term. For example, retrofitting the turbines and power system with upgrades based on new technology may allow the wind farm to produce efficiently and successfully for many more years. Based on estimated costs of decommissioning and the salvage value of decommissioned equipment, the salvage value of the wind farm is expected to exceed the cost of decommissioning.

7. ENVIRONMENTAL ANALYSIS

This section provides a description of the environmental conditions that exist within the Project Area. Consistent with the North Dakota Energy Conversion and Transmission Facility Siting Act, exclusion and avoidance criteria, as well as selection and policy criteria, were considered in the selection and design of the site. To support this siting process, maps of the Project Area were generated that indicate the presence or absence of many of the criteria highlighted in NDCC 69-06-08-01.

7.1 Description of Environmental Setting

The Project Area is located in Stark County in western North Dakota, a primarily rural agricultural area located approximately 12 miles east of Dickinson, North Dakota.

7.2 Demographics

7.2.1 Description of Resources

The proposed Project is located in Stark County, North Dakota, a primarily rural agricultural region in the eastern portion of the county. The Project Area is located west of State Highway 8, with Interstate 94 crossing through the center of the Project Area and U.S. Highway 10 roughly parallels Interstate 94 approximately 0.5 mile to 1.5 miles to the north. The Project Area lies between the small communities of Gladstone (2010 population 239) and Richardton (2010 population 529). The community of Taylor (2010 population 148) is located within the northeastern portion of the Project Area (U.S. Census Bureau 2015). There are a few homes, businesses, and services, and there is no indication of any new residential construction.

Stark County had a population of 24,199 persons in 2010, a 6.9 percent increase from the 2000 population (U.S. Census Bureau 2014). The county contains 1,335 square miles of land, with a density of approximately 18 persons per square mile. The majority of the county population (73 percent) resides in Dickinson, located approximately 8 miles west of the Project (U.S. Census Bureau 2014). The population density within the rural area surrounding the Project Area is therefore much lower than the county average. Approximately 91 percent of the population is composed of white persons who are not of Hispanic or Latino origin. As of 2013, it is estimated that 14 percent of the county population is 65 years or older, while only approximately 7 percent of the population is under five years of age (U.S. Census Bureau 2014).

According to the 2010 U.S. Census Bureau American Community Survey (U.S. Census Bureau 2015) over a quarter of the workforce worked in education, health, and social services, and another nine percent worked in public administration. Retail trade accounts for approximately 13 percent of the jobs in the county. Per capita income estimated in 2012 was \$29,209; median household income 2008-2012 was \$58,793. Approximately 7.7 percent of the county population lived below the poverty level (U.S. Census Bureau 2014), compared to 12.1 percent nationwide (U.S. Census Bureau 2014).

Agriculture continues to play a significant role in the county's land use and economy. In 2012, there were 837 farms in Stark County, comprising approximately 97 percent of the land area. According to the 2012 Census of Agriculture (USDA 2012), total market value of agricultural

products produced in Stark County was \$152,583,000, 78 percent of which was from crops and 22 percent from livestock sales. The primary livestock is cattle and the principal crops include wheat and spring wheat. Winter and durum wheat are also grown.

7.2.2 Impacts

No residents would be displaced due to the Project. The proposed Project would have positive economic impacts for the local population, including lease and royalty payments for participating landowners, employment, and property and sales tax revenue. A previous case study evaluated the socioeconomic impacts of a wind energy facility constructed in 2007 and 2008 in Cavalier County, northeastern North Dakota (Leistriz and Coon 2009). The study authors felt that the project area was typical of Great Plains communities where many similar wind energy projects are being constructed. Leistriz and Coon (2009) found that the 159 MW project resulted in a peak workforce of 269 workers during construction, 10 permanent jobs, and \$1.4 million in annual expenditures to local businesses and households. This includes payments to landowners totaling \$413,000 the first year, annual local property taxes to the County and school district, and direct payments for wages and materials in Cavalier County and adjacent counties. **Table 11** summarizes the economic impacts from the construction and operation of the project.

Table 11. Economic Impacts of Wind Project in Cavalier County, ND

Impact	Construction (one-time) in millions of dollars	Operation (annual) in millions of dollars
Direct	\$56.4	\$1.4
Secondary (indirect and induced)	\$169.3	\$3.0
Total	\$225.7	\$4.4

During construction, temporary housing in Cavalier County was full, and local service businesses (hotels, restaurants, etc.) experienced a short-term increase. An increase in traffic on local roadways during shift changes was noticeable. There were little or no impacts to public services, as only five percent of the construction workers brought their families and most of the long-term jobs were filled locally. There were no added costs to the County, school district, or state. The increase in property taxes to the school district and the County were largely due to payments from the project, but also due to an anticipated increase in residential and property values (Leistriz and Coon 2009).

On a per-MW basis, the project's economic impacts were: \$8,900 in local expenditures during construction; \$2,600 per year in landowner payments; and \$2,900 per year in property taxes. Project-specific impacts would vary based on the local availability of materials, services, and labor. Assuming comparable economic impacts for the 150 MW Project, the Project would result in approximately \$1,335,000 being spent locally during construction and a total of \$825,000 per year in landowner payments and property taxes during operation.

Up to 80 acres of the total Project Area will be permanently affected due to conversion to turbine sites, access roads, a collector substation, O&M building, and meteorological towers. Landowner compensation will be established under individual lease agreements, and includes

compensation for crop damage during surveys and construction. In general, agricultural areas surrounding each turbine can still be farmed. In addition, in an environment of uncertain and often declining agricultural prices and yields, the supplemental income provided to farmers from wind energy leases is expected to provide stability to farm incomes and thus will help assure the continued viability of farming in the Project Area. Project construction will not cause additional impacts to leading industries within the Project Area. 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 any minority group.

To the extent that local contractors are used for portions of the construction, total wages and salaries paid to contractors and workers in Stark County will contribute to the total personal income of the region. Additional personal income will be generated for residents in the county as well as the state by circulation and recirculation of dollars paid out by the applicant as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies and other products and services will benefit businesses in the county and the state.

It is likely that general skilled labor is available either in the county or the state to serve the basic infrastructure and site development needs of the Project. Specialized labor will be required for certain components of wind farm development. It is likely that this labor will be imported from other areas of the state or from other states, as the relatively short duration of construction does not warrant special training of local or regional labor. Balancing the use of local contractors and imported specialized contractors will likely alleviate any labor relations issues.

No effects on permanent housing are anticipated. During construction, out-of-town laborers will likely use lodging facilities in and around the cities of Dickinson and Bismarck. Operation and maintenance of the facility will require few laborers. Sufficient permanent housing is available within the county to accommodate these laborers.

Long-term beneficial impacts to the county's tax base as a result of the construction and operation of the wind farm will contribute to improving the local economy in this area of North Dakota. The development of wind energy in this region has been important in diversifying and strengthening the economic base of southeast North Dakota. In addition, establishing the central region of North Dakota as an important producer of renewable energy, such as wind, has spurred the development of wind-related businesses in the area and in turn contribute to the economic growth in the region; there are at least four wind energy-related manufacturing facilities in North Dakota (AWEA 2014).

7.2.3 Mitigative Measures

Socioeconomic impacts associated with the Project will be primarily positive, with an influx of wages and expenditures made at local businesses during the Project construction and an increase in the county's tax base due to construction and operation of the wind turbines and associated infrastructure. In addition, the lease payments paid to landowners will offset potential financial losses associated with removing land from agricultural production.

7.3 Land Use

7.3.1 Description of Resources

The land in Stark County within the Project Area boundary is primarily agricultural with scattered farmstead residences. The Project will be located on privately-owned land in eastern Stark County, 12 miles east of Dickinson. Dickinson Wind proposes to install a 150 MW wind generating facility, consisting of up to 87 wind turbines within a 61-square mile (39,182-acre) Project Area. Current land use within the Project Area is primarily agricultural, supporting both crops and livestock grazing. The city of Taylor is located entirely within the northeastern portion of the Project Area. No other city limits are within the Project Area. The Project Area is not within any known military installation.

Natural resource development in the Project Area consists primarily of agriculture. There are two active oil wells, associated pipelines, and a gas metering site. There are historic sand and gravel mines, but no coal mines within the Project Area. Agricultural production and limited oil/gas production are anticipated to continue in the future.

Table 12 and **Figure 13** identify current land use in the Project Area based on 2011 US Geological Survey (USGS) National Land Cover data. Land use in the Project Area is dominated by cultivated crops (45 percent), followed by grasslands (37 percent). Developed, open space and pasture/hay land are also present but limited, accounting for 10 and 4 percent of the Project Area, respectively. Forest, wetland, and water categories were each one percent or less of the Project Area.

Table 12. Land Cover within the Project Area

Land Cover	Acreage	Percent of Project Area
Cultivated Crops	17,601	45
Grassland/Herbaceous	14,535	37
Pasture/Hay	3,860	10
Developed, Open Space	1,728	4
Woody Wetlands	395	1
Developed, Low Intensity	388	Less than 1
Deciduous Forest	336	Less than 1
Shrub/Scrub	190	Less than 1
Emergent Herbaceous Wetlands	55	Less than 1
Open Water	47	Less than 1
Developed, Medium Intensity	41	Less than 1
Barren Land	5	Less than 1
Evergreen Forest	3	Less than 1
Mixed Forest	1	Less than 1

Source: Yang et al. 2013.

The US Fish and Wildlife Service (USFWS) has been purchasing wetland easements in the Prairie Pothole Region since 1989. Easement wetlands are part of the National Wildlife Refuge System. A wetland easement is a legal agreement that pays landowners to permanently protect wetlands. Wetlands covered by an easement cannot be drained, filled, leveled, or burned. When

these wetlands dry up naturally, they can be farmed, grazed, or hayed. No signs are placed on the property and the easement does not affect hunting or mineral rights (USFWS 2009). Based on easement data provided by the USFWS to Tetra Tech on December 19, 2014, there are no wetland or grassland easements within the Project Area.

The National Resource Conservation Service (NRCS) administers a number of conservation-based programs for private landowners. The Conservation Reserve Program (CRP) conserves soil and water resources and provides wildlife habitat by removing enrolled tracts from agricultural production, generally for a period of 10 years. These tracts cannot be hayed, tilled, seeded, or otherwise disturbed without the authorization of the NRCS. Based on NCED data, there are no lands within the Project Area enrolled in CRP or other NRCS easements, although this must be confirmed with participating landowners.

The Project Area includes approximately 2,321 acres that participate in the PLOTS program. The North Dakota Game and Fish Department (NDGF) administers and regulates the PLOTS program to allow hunting access on private lands through lease agreements with landowners. PLOTS allow for walk-in hunting during the legal hunting season. Properties within the Project Area that participate in PLOTS occur throughout the Project Area (**Figure 10**).

7.3.2 Impacts

The development of the Project will not result in a significant change in land use. The development of the Project will not displace any residents or existing or planned industrial facilities. Wind turbines will be sited a minimum of 2,000 feet from occupied residences. The area will retain the rural sense and remote characteristics of the vicinity. At other wind developments in the North Dakota, landowners frequently plant crops and/or graze livestock to the edge of the access roads and turbine pads. The access roads will be between 16 and 38 feet wide² and low profile to allow cross-travel by farm equipment. Dickinson Wind will work closely with landowners in locating access roads to minimize land use disruptions to the extent possible. Consideration will be taken in locating access roads to minimize impact on current or future row crop agriculture and environmentally sensitive areas. During the construction of the wind power facilities, additional areas may be temporarily disturbed for contractor staging areas and underground power lines. These areas will be graded to original contour and, if necessary, reseeded with appropriate vegetation.

It is estimated that installation of up to 87 turbines and the associated access roads, collection substation, O&M building, and meteorological towers will result in the conversion of approximately 80 acres of land. An additional 714 acres are estimated to be disturbed during the construction phase of the Project, primarily for installation of the turbines, road construction, collection line trenching, a 15-acre laydown/staging areas, and six temporary meteorological towers.

PLOTS lands will remain available for hunting if landowners maintain enrollment in the PLOTS program. The Project will not affect the existing oil and gas development.

² Roads required to support crane access to turbines during operation will remain up to 38 feet wide; all other roads may be built at 16 feet wide or reduced later to 16 feet.

At other wind farms, the public has expressed concerns over potential devaluation of property in and adjacent to proposed wind projects. A study published in October 2002, *“Economic Impacts of Wind Power in Kittitas County, Final Report,”* conducted by Dr. Stephen Grover of ECONorthwest of Portland, OR, summarized survey results as follows:

Views of wind turbines will not negatively impact property values. Based on a nationwide survey conducted of tax assessors in other areas with wind power projects, we found no evidence supporting the claim that views of wind farms decrease property values (Grover 2002, p.20).

More recently, the Lawrence Berkeley National Laboratory conducted a study on the impact of wind power projects on residential property values in the U.S. (Hoen et al. 2013). The study found that neither the view of wind facilities nor the distance of homes to those facilities is found to have any consistent, measurable, or statistically significant effect on sales prices. The study consisted of a comprehensive analysis of transaction data from areas across nine states and 27 counties, and within 10 miles of 67 different wind facilities. The total study sample consisted of over 51,200 sales transactions that were evaluated with various models and using data subsets based on distance to turbines, timing of sale in relation to timing of wind project announcement and construction, and view of turbines from the site. Visibility of turbines, existing amenities, and other information was also collected during field visits to the residences over the course of the three-year study period.

The results of the study indicate that while the possibility exists that individual homes have been or could be impacted, if these impacts do exist, they are either too small and/or too infrequent to result in widespread, statistically observable impacts (Hoen et al. 2013). The study did not find evidence that prices of sales occurring after construction of the facility for homes within a mile of the nearest wind turbine are affected and found some evidence that sales occurring prior to construction are slightly negatively affected. Notably, the study was not able to obtain information on whether turbine easement payments or neighbor agreements were in place at any of the projects in the study sample. Such mitigation measures have become more common and create a socioeconomic benefit that is not factored into the study results.

7.3.3 Mitigative Measures

Dickinson Wind is working closely with landowners and seeking input from local, state, and federal agencies in locating wind turbines and access roads to minimize land use disruptions and impacts to environmentally sensitive areas to the extent possible. Operation of the wind farm will not change the land use in the Project Area. The proposed land use will not involve any ongoing industrial use of non-renewable resources or emissions into the environment.

7.4 Public Services

7.4.1 Description of Resources

Local Services

The Project is located in a lightly populated, rural area in western North Dakota. There is an established transportation and utility network that provides access and necessary services to the small cities, homesteads, and farms existing near the Project. The community of Taylor is located within the Project Area, the next closest communities are Gladstone and Richardton,

located approximately 1.75 miles west and 2.5 miles east, respectively. Dickinson, the county seat, is located approximately 8 miles west of the Project Area. Dickinson provides sanitary sewer, water, utility services, educational facilities, and recreational facilities and parks to its residents and visitors. Dickinson’s local services include emergency services, ambulance service, a hospital, clinics, a landfill, and a police department.

Electrical Service

Electrical service is provided by Montana-Dakota Utilities Company, and rural service by Roughrider Electric Cooperative Inc. (Stark County 2010a).

Roads

County and township (section line) roads characterize the existing roadway infrastructure in and around the Project. The Project Area is accessed via I-94, U.S. Highway 10, State Highway 8, and other local two-lane paved and gravel county roads.

Traffic

Existing traffic volumes on the area’s major roadways are documented in **Table 13** and **Figure 11**. Determining the specific capacity of any highway is a complex process. However, general estimates are used for planning purposes. For purposes of comparison, the functional capacity of a two-lane paved rural highway is approximately 5,000 vehicles per day, or Average Annual Daily Traffic (AADT).

Additional county and township roads run through the Project Area, but no vehicle count data are available for them. In general, the North Dakota Department of Transportation (NDDOT) indicated that roads with vehicle counts under 100 AADT are rarely counted. According to NDDOT, vehicle counts on routes with no count data are likely lower than those with count data.

Table 13. Existing Daily Traffic Levels

Roadway Segment	Existing AADT/Commercial Truck Traffic
Interstate 94 west of State Highway 8	8,000/2,130
Interstate 94 east of State Highway 8	7,725/2,120
State Highway 8 north of Interstate 94	965/845
State Highway 8 south of Interstate 94	940/325
State Highway 8 through Richardton	2,905/400

Source: 2013 Traffic Volumes (NDDOT 2013).

Water Supply

Townships have limited public infrastructure services. Homes typically utilize septic systems and water wells for their household needs.

Communications

In February 2015, Dickinson Wind conducted a preliminary telecommunications study to identify all non-federal microwave telecommunication systems within the Project Area. There are several beam paths crossing the Project Area (**Appendix A**).

With the switch to digital television in 2009 throughout the United States, the concern of ghost images and flickering that may be caused by wind turbine interference with analogue signals is no longer an issue.

Federally operated communications systems can be identified through consultation with the National Telecommunications and Information Administration (NTIA). The NTIA was contacted in November 2014.

7.4.2 Impacts

The Project is expected to have a minimal effect on the existing services and infrastructure. The following is a brief description of the impacts that may occur during construction and operation of the Project.

Local Services

No impact is expected to local services.

Electrical Service

The Project will require station service from the local electric provider when the Project is not generating electricity.

Roads

Construction of the Project will require approximately 42 miles of new aggregate-surfaced access roads. During operation of the Project, the access roads will be used by operation and maintenance crews while inspecting and servicing the wind turbines. The access roads will be between towers, offset as necessary to allow for adequate crane access. One road will be required for each string of turbines. Although a 38-foot wide disturbance area is likely during construction, the permanent access roads will primarily be 16 feet wide and low profile to allow cross-travel by farm equipment.

Traffic

The maximum construction workforce is expected to generate approximately 50 additional vehicle trips per day. Using any combination of state and county highways and other township roads throughout the Project Area, the traffic impacts are considered negligible. The capacity of any route and level-of-service to the traveling public will not be affected.

Truck access to the Project site is provided by Interstate 94, which runs east and west through the center of the Project Area, U.S. Highway 10 which roughly parallels Interstate 94 approximately 0.5 mile to 1.5 miles to the north. Specific additional truck routes will be dictated by delivery location. Additional operating permits will be issued by the State or County for over-sized truck movements.

Water Supply

Construction and operation of the Project will not significantly impact the water supply. The abandonment of any wells is not required for the Project. The Project will not require appropriation of surface water or permanent dewatering. Temporary dewatering of groundwater may be required during construction of turbine foundations.

Communications

Telephone and fiber optic cables within the Project Area will be located in the field by the respective utility companies prior to construction and will not be negatively affected during construction.

The NTIA concluded that no harmful impacts on federal communication systems are anticipated from the Project (Appendix B).

No impacts to FCC-licensed microwave beams are anticipated from the Project turbines because a setback of blade length (51.5 meters) plus 10 meters (total 61.5 meters, or 202 feet) has been incorporated in the turbine layout.

The extent of the interference created by wind turbines on AM and FM radio and television has been gradually diminished over the past decade due to advances in turbine manufacturing and transmitter/receiver antenna design. This has reduced the impact on AM and FM radio systems to the point where only small degradation of signal is noticed a few meters from a turbine location. Coverage of AM and FM radio services are not expected to be impacted by the wind farm because there are no transmitter towers located within the Project Area and turbines will be constructed a sufficient distance from each dwelling. With the switch to digital television in 2009, the concern of ghost images and flickering caused by wind turbine interference with analogue signals is no longer an issue.

7.4.3 Mitigative Measures

Construction and operation of the Project will be in accordance with all associated local, state, and federal permits and laws, as well as industry construction and operation standards. Due to the minor impacts expected on the existing communications infrastructure during project construction and operation, additional mitigation measures are not required.

Local Services

With the addition of substation and transmission capacity, no impact to local services is anticipated, and no mitigation is required.

Electrical Service

Dickinson Wind will purchase station service from Roughrider Electric Cooperative, which will suggest appropriate configurations for the electrical system that Dickinson Wind will abide by to prevent impacts to the transmission system. Dickinson Wind has established a setback of 475 feet (110 percent the turbine height) from existing transmission lines. No additional mitigation is necessary.

Roads

Dickinson Wind is working closely with the landowners to locate access roads in order to minimize land-use disruptions to the extent possible. The preliminary layout of the turbines and access roads is shown in **Figures 2-3**.

Traffic

The capacity of any route and level-of-service to the traveling public will not be affected and as such, no mitigation is necessary.

Water Supply

The abandonment of any wells is not required for the Project. However, in the event wells are abandoned, they will be sealed as required by North Dakota law. If temporary dewatering of groundwater is required during construction activities, discharge of dewatering fluid will be conducted under the requirements of the National Pollutant Discharge Elimination System (NPDES) permit and Storm Water Pollution Prevention Plan (SWPPP).

Communications

Collection and telecommunication lines will be buried underground to avoid collisions, to the extent practicable. An underground utilities locator company will be contacted prior to construction to locate and avoid underground facilities. To the extent Project facilities cross or otherwise affect existing communications systems, Dickinson Wind will enter into agreements with service providers as necessary to avoid interference with their facilities.

7.5 Human Health and Safety

7.5.1 Description of Resources

Air Traffic

There are two private airports within the Project Area and one public airport within 6 nautical miles of the Project Area. Nautical miles are the standard measure for aviation; 1 nautical mile is equal to 1.15 statute miles. The Richardton Airport (FAA ID 4E8) is public airport located approximately 0.4 mile east of the Project Area. The Brands Airport (FAA ID ND62) is a privately-owned facility located in the south central portion of the Project Area, (AirNav 2014), and Jurgens Airstrip Airport (75ND) is a privately-owned facility located in the northwest portion of the Project Area (SkyVector 2014). The nearest airport certified for commercial carrier operations is the Dickinson – Theodore Roosevelt Regional Airport (FAA ID KDIK), located 3.5 miles south of Dickinson and approximately 11 nautical miles southwest of the Project Area.

Federal Radar Interference

Wind turbines may interfere with radar systems and airspace navigation. Tetra Tech queried the online Department of Defense (DoD) Preliminary Screening Tool to obtain a preliminary review of potential impacts to Long Range Radar (FAA 2012). The latitude and longitude of four points encompassing the Project Area were submitted for review.

The Federal Aviation Administration (FAA) reviews potential impacts to DoD radar as part of its aviation hazard review of structures that file a Notice of Proposed Construction or Alteration (FAA Form 7460-1). The FAA will request that the DoD and the U.S. Department of Homeland Security (DHS) review the filing and may issue a Notice of Presumed Hazard if the DoD and DHS determine that impacts to radar are considered significant. The impact of a wind energy project on radar systems primarily depends on the distance to the radar, the number and configuration of the turbines.

The results of the Preliminary Screening Tool indicate that the entire Project Area appears as green on the map produced by the screening tool (**Appendix A**) and the Project is not anticipated to impact Air Defense and Homeland Security radars.

National Weather Service Radar

The results of the Preliminary Screening Tool indicate that no impacts are to Weather Surveillance Radar—1988 Doppler (WSR-88D) weather radar operations. The National Oceanic and Atmospheric Administration would not perform a detailed analysis, but that agency requested that they be made aware of the Project. The entire search area appears as green on the map produced by the screening tool (**Appendix A**).

Military Training Routes and Special Use Airspace

From the results of the Preliminary Screening Tool it was determined that impacts to military airspace are unlikely (**Appendix A**).

Electromagnetic Fields

Use of electricity in our everyday lives creates electric and magnetic fields (EMF). Electric and magnetic fields occur both naturally and from man-made sources. Power lines and utility facilities are not the only sources of EMFs. People are exposed to EMF from many sources at many different levels and durations throughout their daily environments. These sources include appliances, wiring in buildings, power lines and utility facilities, and electrical equipment and devices we use at work. Examples of natural sources of EMF include static electricity and the earth's static magnetic field which guides a compass needle.

Shadow Flicker

A wind turbine's moving blades can cast a moving shadow on locations within a certain distance of a turbine. These moving shadows are called shadow flicker, and can be a temporary phenomenon experienced by people at nearby residences or public gathering places. The impact area depends on the time of year and day (which determines the sun's azimuth and altitude angles) and the wind turbine's physical characteristics (height, rotor diameter, blade width, and orientation of the rotor blades). Shadow flicker generally occurs during low angle sunlight conditions, typical during sunrise and sunset times of the day.

Hazardous Materials / Hazardous Waste

The site is located in a relatively rural area of North Dakota. Hazardous wastes from large industrial or commercial activities are not likely. Potential hazards may exist in rural areas from farm dumps and agricultural chemicals. A Phase I Environmental Site Assessment will be conducted in the Project Area in prior to construction to identify any recognized environmental conditions that may exist.

Potentially hazardous materials associated with the Project include fluids found in association with turbines and substation/transformer equipment. There will be three types of fluids used in the operation of the wind turbines, all of which are petroleum products. These fluids are necessary for the operation of each turbine and include gear box oil, hydraulic fluid, and gear grease. The transformers contain mineral oil.

Security

The Project Area is located in an area that has a low population density. Construction and operation of the Project will have minimal impacts on the security and safety of the local communities.

7.5.2 Impacts

Air Traffic

The installation of wind turbines creates a potential for air traffic collision. The wind turbines and meteorological towers will have lighting and markings that comply with FAA requirements and the FAA's review will include the evaluation of any potential interference with air traffic.

Dickinson Wind has submitted Notices of Proposed Construction or Alteration to the FAA for the Project turbines.

Electromagnetic Fields

There have been thousands of scientific studies related to EMF. One of the largest EMF research and evaluation programs (\$45 million) was established by the U.S. Congress in 1992 and was completed by the U.S. National Institute of Environmental Health Sciences (NIEHS) in 1999. None of these organizations has found that exposure to power frequency EMF causes or contributes to cancer or any other disease or illness. Low-level power frequency EMF will occur around the wind turbine generators (in the nacelles), around the GSU transformers, along the collector lines and at the Project substation. All Project facilities would be set back from residences as required by state and county regulation. At these distances EMF levels would not be above background levels. The only exposure will be brief exposure to maintenance workers, primarily at the substation. Based on the above, no significant adverse impacts are anticipated.

Shadow Flicker

An analysis of potential shadow flicker impacts from the Project turbine layout dated January 29, 2015 was conducted using the WindPro software package (Tetra Tech 2015a; **Appendix A**). The WindPro analysis was conducted to determine shadow flicker impacts under realistic impact conditions (actual expected shadow flicker, which accounts for historical sunshine probability, wind speed, and wind direction). This analysis calculated the total amount of time (hours and minutes per year) that shadow flicker could occur at receptors out to 2,500 meters (8,202 feet). The analysis assumes that the receptors all have a direct in line view of the incoming shadow flicker sunlight and does not account for trees or other obstructions which may block sunlight. In reality, the windows of many houses will not face the sun directly to be affected by the key shadow flicker impact times.

A total of 79 structures were identified within a minimum buffer of approximately 1 mile of the proposed Project turbines; of these, 44 were determined to be occupied residences and are considered potential shadow-flicker receptors for the purpose of this analysis. The predicted shadow flicker impacts are less than 30 hours per year at all 44 identified occupied residence receptors. The maximum predicted shadow flicker impact at any occupied residence receptor is 29 hours 7 minutes per year at a residence owned by a landowner that is participating in the Project. As a result of the analysis, no significant shadow flicker impacts are anticipated to sensitive receptors.

Hazardous Materials / Hazardous Waste

An assessment will be conducted and results will be used to minimize risk associated with potential recognized environmental conditions that may pose a threat to human health and safety. Significant findings are not anticipated due to the known historic uses of the property.

As with any construction activity, there is the possibility of accidentally spilling fuel, hydraulic fluid, or other hazardous substances during construction of the Project. The potential of such events would be minimized through implementation of a Spill Prevention, Control, and Countermeasures (SPCC) plan, which would include the following:

- Construction equipment will be equipped with spill cleanup kits.
- Equipment refueling will take place at secure areas, away from wetlands or drainages.
- Workers will be trained in spill clean-up and the use of the spill cleanup kits.

These measures would ensure that surface and groundwater quality would not be degraded through inadvertent spillage of contaminants.

Security

Project construction and operation will have minimal impacts to the security and safety of the local communities.

7.5.3 Mitigative Measures

Air Traffic

Dickinson Wind has submitted Form 7460-1 to FAA for each turbine to determine whether the Project layout and lighting will impact navigable airspace or communications technology used in aviation operations. The response from FAA will be submitted to the PSC when received. Wind turbines and meteorological towers will have lighting and markings according to FAA requirements that minimize any potential for air traffic impacts.

Electromagnetic Fields

Since no significant adverse impacts are anticipated, no mitigative measures are proposed at this time.

Shadow Flicker

The primary mitigation measure used for wind turbines is setback distance. Dickinson Wind is committed to a 2,000-foot setback distance from all existing occupied residential structures. Because no significant impacts are anticipated, no additional mitigation is proposed at this time.

Hazardous Materials / Hazardous Waste

Since no significant findings are anticipated, no mitigation is proposed at this time. All petroleum fluids will be contained within the wind turbines and electrical equipment. Any petroleum wastes generated will be handled and disposed of in accordance with local, state, and federal regulations.

Security

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

- The towers will be placed at least 200 feet from road right-of-way and 2,000 feet from occupied homes. These distances are considered to be safe based on developer experience, and are consistent with the required local setbacks.
- Security measures will be taken during the construction and operation of the project, including temporary and permanent (safety) fencing, warning signs, and locks on equipment and wind power facilities.
- Turbines will sit on solid steel-enclosed tubular towers in which all electrical equipment will be located, except for the pad-mounted transformer. Access to the tower is only through a solid steel door that will be locked when not in use.
- Where necessary or requested by landowners, Dickinson Wind will construct gates or fences such as those around the collection substation.
- Dickinson Wind will provide educational materials to landowners within the site boundaries and upon, request, to interested persons about the Project.

7.6 Noise

7.6.1 Description of Resources

The Project Area is primarily rural and agricultural. The small community of Taylor is located near proposed turbine locations, and the communities of Gladstone and Richardton are also nearby. The acoustic environment is defined primarily by the Burlington Northern Railroad and Interstate 94, which runs through the Project Area east to west, as well as aircraft flyover events, farming equipment and local traffic. In addition to anthropogenic noise sources, the windy conditions of this site define a somewhat elevated ambient sound level, which increases with wind speed. Windy conditions can generate noise caused by the rustling of grass and tree leaves.

7.6.2 Impacts

According to Article VI Section 6.7 of the Stark County Zoning Ordinance, sustained noises over eighty (80) decibels (dB) during the day and seventy (70) decibels (dB) at night is prohibited. At the State level, the NDAC (Article 69-06-08-01 (4) specifies that areas within 100 feet of an inhabited residence may not exceed 50 dBA.

Wind turbine generators produce noise through a number of different mechanisms roughly grouped into mechanical and aerodynamic sources. Modern wind turbines include design features that minimize mechanical sound sources. The interaction of air and the turbine blades produces aerodynamic noise through a variety of processes as air passes over and past the blades. Unlike other sound sources, wind turbines generally radiate more noise as wind speed increases. However, at elevated wind speeds the wind tends to generate significant background

noise by moving trees and grasses, which can create a masking effect and may aid in reducing the audibility of wind turbine sound.

In February 2015, an acoustic engineering analysis was developed to address sound levels resulting from wind turbine operations, as well as the consideration of sound from the electrical substation and sound generated during Project construction and maintenance activities (Tetra Tech 2015b; **Appendix A**).

Wind turbine operation was analyzed for the Project employing the GE 1.715 MW and 1.79 MW turbine models and the substation located in the northeast corner of the northwest quarter of Section 12, Township 139 North, Range 94 West. The GE 1.715 MW and 1.79 MW turbine noise specifications were used for their respective proposed turbine locations according to the turbine layout dated January 29, 2015. Acoustic modeling was completed at both wind turbine cut-in and maximum rotational conditions, inclusive of the entire range of future Project operational conditions. Project compliance was assessed at a total of 56 receptors near the Project turbines, 12 of which were determined to be not currently in use for residential purposes. Non-noise sensitive buildings, such as barns and commercial structures, were excluded from the analysis.

The noise modeling results indicate that the received sound levels are all below the North Dakota noise requirement (Chapter 69-06-08-01(4)), which prescribes a limit of 50 dBA within 100 feet of an inhabited residence. The highest modeled sound level for an occupied residence was 47 dBA (Tetra Tech 2015b; **Appendix A**).

Project construction may cause short-term but unavoidable noise impacts. The sound levels resulting from construction activities vary significantly depending on several factors such as the type and age of equipment, the specific equipment manufacturer and model, the operations being performed, and the overall condition of the equipment and exhaust system mufflers. Sounds generated by construction activities are typically exempt from state and local noise oversight provided that they occur within weekday, daytime periods as may be specified under local zoning or legal codes. All reasonable efforts will be made to minimize the impact of noise resulting from construction activities.

Construction activity will generate traffic having potential noise effects, such as trucks traveling to and from the site on public roads. At the early stage of the construction phase, equipment and materials will be delivered to the site, such as hydraulic excavators and associated spreading and compacting equipment needed to form access roads and foundation platforms for each turbine. Once the access roads are constructed, equipment for lifting the towers and turbine components will arrive. Traffic noise is categorized into two categories: (1) the noise that will occur during the initial temporary traffic movements related to turbine delivery, haulage of components and remaining construction; and (2) maintenance and ongoing traffic from staff and contractors, which is expected to be minor.

7.6.3 Mitigative Measures

The primary mitigation measure used for wind turbines is setback distance. Dickinson Wind is committed to a minimum 2,000-foot setback distance from all existing occupied residential

structures, as required by the Stark County Zoning Ordinance. This setback distance has proven sufficient and the resulting relatively low sound levels have been found to be generally acceptable, at several permitted and operational NEER wind farms located throughout the state of North Dakota.

Special conditions can occur which are difficult to predict, such as high wind shear events where there is little masking wind noise at surface level but at hub-height there is sufficient wind for energy generation. In addition, residents in homes which are poorly insulated or highly exposed in the environment with limited nearby vegetation may be subject to a higher perceptibility. If a complaint is registered and sound is measured above the 50 dBA level, Dickinson Wind can provide improved insulation, landscaping, or other appropriate candidate mitigation measures. It should be noted that the acoustic model conservatively predicts outdoor sound levels and assumes no shielding or attenuation by trees or other vegetation.

7.7 Cultural and Archaeological Impacts

7.7.1 Description of Resources

Tetra Tech performed a Class I Literature Review for the area of potential effects for direct effects (direct effects APE) and a 1-mile buffer around the direct effects APE.

Architectural Resources

The Class I Literature Review identified one National Register of Historic Places property (the Gerhardt Octagonal Pig House – 32SK0092) within the direct effects APE of a collection line east of Turbine 33. However, the archaeological field survey (see below) revealed that property 32SK0092 is an abandoned farmstead with no standing structures. The collection line layout will be shifted south to avoid this site.

A Class III Intensive Cultural Resources Inventory for historic structures will be conducted in spring 2015. Dickinson Wind and Tetra Tech are currently coordinating with North Dakota State Historic Preservation Office (SHPO) on the appropriate scope and level of survey for the Project. The survey report will be submitted to SHPO for review and concurrence once complete, and will also be provided to the PSC.

Archaeological Resources

The literature review identified 6 cultural resources and 20 cultural resource leads within the 1-mile buffer around the direct effects APE. A Class III Cultural Resources Inventory for archaeological resources is underway within the direct effects APE.

From December 2014 to February 2015, Tetra Tech conducted reconnaissance and pedestrian surveys of the direct effects APE. The majority of the direct effects APE were located in cultivated fields with smaller areas in grasslands. The pedestrian surveys will be completed as weather permits in spring 2015. Shovel probing may be utilized in areas where a pedestrian survey could not adequately assess the presence or absence of cultural materials. During the surveys to date, Tetra Tech documented 12 new cultural resources within the direct effects APE. These resources included one prehistoric lithic scatter and four isolated finds, as well as 7 historic sites including water wells, foundations, agricultural equipment, and a railroad bed. Based on preliminary field data, Tetra Tech would not consider these sites to be eligible for

listing on the National Register of Historic Places. However, shovel probing would be necessary to confirm the presence or absence of intact cultural material deposits at these sites and help determined the National Register eligibility of these sites.

Native American Consultation

In December 2014, Dickinson Wind sent a letter to the North Dakota Indian Affairs Commission notifying the agency and interested tribes about the Project and the preparation of this application for a Certificate. In addition, although there are no reservations or Bureau of Indian Affairs trust lands in Stark County, in February 2015 Dickinson Wind contacted the following 12 Tribal Historic Preservation Officers or Tribal Cultural Preservation Officers to introduce the Project and provide an opportunity for input:

- Cheyenne River Sioux Tribe
- Crow Creek Sioux Tribe
- Fort Peck Assiniboine and Sioux Tribes
- Lower Brule Sioux Tribe
- MHA Nation
- Oglala Lakota Nation
- Rosebud Sioux Tribe
- Santee Sioux Nation
- Spirit Lake Tribe
- Standing Rock Sioux Tribe
- Sisseton-Wahpeton Oyate Nation
- Turtle Mountain Band of Chippewa

No responses have been received to date.

7.7.2 Impacts

Architectural Resources

The Project will not directly impact any architectural resources, and a survey of architectural resources will be conducted in spring 2015 to evaluate potential visual effects on historic properties, should any be identified. This report will be submitted to the SHPO when complete for review and concurrence, and will also be submitted to the PSC.

Archaeological Resources

Although the primary field data suggests the 12 newly-documented site are not eligible for listing on the National Register of Historic Places, Dickinson Wind will avoid these sites and the

previously-documented cultural resources within the direct effects APE. Avoidance buffers will be created for these sites and the buffers will be delineated prior to construction to ensure that historic properties are avoided. The pedestrian survey and shovel probing, if necessary, will be completed as weather permits in spring 2015 and the cultural resources inventory report will be submitted to the SHPO for review and concurrence in the once it is complete.

An Unanticipated Discovery Plan will be prepared for the proposed Project outlining the procedure that would be followed to prepare for and address any unanticipated discoveries of cultural resources, including previously undiscovered archaeological sites and possible human remains. It will provide direction to on-site personnel and their consultants as to the proper procedure to follow in the event that unanticipated discoveries were to be made during construction of the Project. No significant impacts to cultural resources would, therefore, be anticipated from the proposed Project.

In the event that burials or cultural sites with Native American religious values are identified during construction of the proposed Project, work would immediately halt within 200 feet of the site and the site would be protected until SHPO and the North Dakota Indian Affairs Commission (NDIAC) are consulted, in addition to any involved Tribes that express interest in the Project and identify a potential impact.

If the skeletal remains are possibly human, the Stark County Sheriff's office will be contacted. The Sheriff will call the North Dakota State Forensic Examiner to determine if the remains are associated with a crime scene. If the remains are historic or prehistoric, the North Dakota Chief Archaeologist will be contacted.

7.7.3 Mitigative Measures

The sites that will be avoided during construction will be fenced to reduce the potential that they will be inadvertently disturbed.

7.8 Recreational Resources

7.8.1 Description of Resources

Recreational opportunities in Stark County include hunting and wildlife observation. As discussed in Section 7.3, recreational areas include 2,321 acres of private land within the Project Area enrolled in NDGF's PLOTS program, which allows public access to hunting on private lands (**Figure 10**). The Old Red/Old Ten Scenic Byway runs through the Project Area parallel to Interstate 94 (**Figure 10**). The North Dakota Scenic Byway Program is a tourism program managed by the North Dakota Parks and Recreation Department and the North Dakota Transportation Department.

7.8.2 Impacts

No recreational resources will be directly affected by the Project. Recreational impacts will be auditory and visual in nature and limited to individuals using public or private property in and near the Project Area for hunting, fishing, or nature observation, and to travelers along the Old Red/Old Ten Scenic Byway. PLOTS lands will remain available for hunting if landowners maintain enrollment in the PLOTS program. The turbines would introduce a new visual element into the landscape, but the area already has transportation and utility infrastructure such as

transmission lines, railroads, and Interstate 94. There are also two existing (non-utility scale) wind turbines along the byway owned by the Sacred Heart Monastery near Richardton.

7.8.3 Mitigative Measures

Since the Project is not anticipated to result in significant adverse impacts to recreational resources, no mitigative measures are proposed.

7.9 Effects on Land-Based Economies

7.9.1 Description of Resources

Agriculture/Farming

The majority of the Project Area is either grazing land or cropland (**Figure 13**). Most crop fields within the Project Area are wheat fields, although some corn, sunflower, and safflower crops are also present.

Agriculture has historically played a dominant role in the local economy, and continues to play a significant role in the county's land use and economy (Stark County 2010b). In 2012, there were 837 farms in Stark County, comprising approximately 97 percent of the land area; approximately 60 percent of the land in farms is cropland, and 36 percent is pasture. According to the 2012 Census of Agriculture (USDA 2012), total market value of agricultural products produced in Stark County was \$152,583,000, 78 percent of which was from crops and 22 percent from livestock sales. The primary livestock is cattle and the principal crop is wheat.

Prime farmland is the land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops. The NRCS also identifies farmland of statewide and local importance, which is land that is important for the production of food, feed, fiber, forage, and oilseed crops. Generally, additional farmlands of statewide or local importance include those that are nearly prime and that produce high yields of crops in an economic manner when treated and managed according to acceptable farming methods. Some may produce a yield as high as prime farmland if conditions are favorable. **Table 14** lists the soils within the Project Area, including those considered prime farmland and soils of statewide or local importance. **Figure 14** shows the prime farmland soil distribution in the Project Area.

Three prime farmland soils occur within the Project Area, comprising 3,171 acres or 8 percent of the Project Area; 20 soil types are considered farmland of statewide importance, totaling 14,765 acres or approximately 38 percent of the Project Area.

Woodlands

Economically important forestry resources are not found in the Project Area. Trees and shrubs in the Project Area are limited to mostly windbreaks around residential properties and between fields, or are found in drainageways or wetlands. Trees observed onsite include plains cottonwood (*Populus deltoids*), green ash (*Fraxinus pensylvanica*), bur oak (*Quercus macrocarpa*), peach-leaved willow (*Salix amygdaloides*), quaking aspen (*Populus tremuloides*), Siberian elm (*Ulmus pumila*), wild plum (*Prunus Americana*), and boxelder (*Acer negundo*).

7.9.2 Impacts

Agriculture/Farming

Wind energy development removes less total land from agricultural use than other forms of development. No impacts are anticipated to animal health and safety due to the construction or operation of the wind farm and associated facilities. Except for the physical locations of the turbines, access roads, and substation, all the land surrounding the Project facilities will be available for grazing.

Actual impacts to agricultural production will be determined once turbine and road locations are finalized. Exact impact acreages will not be known until turbine siting is finalized, but expected permanent impacts will be approximately 80 acres, including turbine foundations, access roads, and the Project collection substation. It is possible that some of this land is not used for agricultural purposes, thus the actual impacts to agricultural production cannot be determined until turbine and road locations are finalized.

The Project will permanently disturb approximately 28 acres of soils classified as prime farmland and approximately 151 acres in farmland soils of statewide importance, not including the collection lines, which will be buried and would be a temporary disturbance of soil. This would be a negligible impact to agricultural production in the county. As noted earlier, wind lease payments will provide farmers with a supplemental source of income, helping assure that farmers can continue to operate financially viable farms, and thus helping to assure the continuation of farming in Stark County.

No turbines will be placed within 2,000 feet of occupied homes. Other impacts to homes are discussed throughout **Section 7.0**. Family farms will be affected due to the loss of land associated with the construction of the turbines and access roads. The extent of impacts will not be known until final turbine locations are determined in conjunction with the landowners.

Woodlands

No significant impacts are anticipated to woodlands.

7.9.3 Mitigative Measures

Agriculture/Farming

The wind turbines and access roads will be located so that the most productive farmland (prime farmland) will be avoided as much as practicable. Only land for the turbines, substation, and access roads will be unavailable for crop production. Dickinson Wind will work with landowners to minimize impacts to their land. Once the wind turbines are constructed, all land surrounding the turbines can still be farmed or grazed. All construction areas will be separated from grazing animals by temporary or permanent fencing.

Woodlands

If trees are removed as part of the Project, they will be replaced per PSC's Tree and Shrub Mitigation Specifications.

7.10 Soils

7.10.1 Description of Resources

The U.S. Department of Agriculture (USDA) has mapped over 70 soil map units within the Project Area (USDA 2014). These soils are primarily well-drained loams, silt loams, and to a lesser extent fine sandy, and sandy loams. These soils are primarily derived from the underlying bedrock that consist of sandy and clayey unconsolidated materials and, to a lesser extent, sandstones and siltstones. Thirteen soil types comprise approximately 72 percent of the Project Area. The most extensive of these are Amor-Shambo loams (13.5 percent of the Project Area), Amor-Cabba loams (12.3 percent), Vebar-Parshall fine sandy loams (9 percent), Vebar-Flasher-Tally complex (6.8 percent), Arnegard loam (5.8 percent), and “Vebar-Flasher complex (5.1 percent). **Table 14** provides a summary of the soil map units within the Project Area, including their acreages and percentages of the Project Area.

Table 14. Soil Map Units Within the Project Area

Map Unit Name	Area (acres)	Percentage of Project Area	Farmland Classification
Amor-Arnegard loams	1,342	3.5	Farmland of statewide importance
Amor-Cabba loams	4,838	12.3	Not prime farmland
Amor-Shambo loams	5,283	13.5	Farmland of statewide importance
Arikara-Shambo-Cabba loams	1,177	3.1	Not prime farmland
Arnegard loam	2,254	5.8	All areas are prime farmland
Arnegard loam, saline	70	0.2	Not prime farmland
Beisigl-Flasher-Telfer loamy fine sands	507	1.3	Not prime farmland
Belfield-Daglum silt loams	986	2.5	Not prime farmland
Belfield-Grail silty clay loams	1,059	2.7	Farmland of statewide importance
Belfield-Grail silty clay loams, saline	37	0.1	Not prime farmland
Belfield-Savage silty clay loams	75	0.2	Farmland of statewide importance
Cabba-Amor loams	1,057	2.7	Not prime farmland
Cabba-Badland outcrop complex	127	0.4	Not prime farmland
Cabba-Chama-Sen silt loams	408	1.0	Not prime farmland
Chama-Sen-Cabba silt loams	118	0.3	Farmland of statewide importance
Cherry silt loam	14	<0.1	Farmland of statewide importance
Daglum-Rhoades complex	339	0.9	Not prime farmland
Dimmick silty clay	5.8	<0.1	Not prime farmland
Dogtooth-Janesburg-Cabba complex	50	0.1	Not prime farmland
Dogtooth-Janesburg silt loams	27	0.1	Not prime farmland
Farfeld-Cedarpan loams	31	0.1	Not prime farmland
Farnuf loam	3	<0.1	Farmland of statewide importance
Farnuf loam, golden valley	51	0.1	Farmland of statewide importance
Flasher-Rock outcrop-Vebar complex	498	1.2	Not prime farmland
Flasher-Vebar-Parshall complex	61	0.2	Not prime farmland
Grail silty clay loam	805	2.0	All areas are prime farmland
Grail silty clay loam, saline	198	0.5	Not prime farmland
Harriet silt loam	64	0.2	Not prime farmland
Havrelon silt loam	42	0.1	Farmland of statewide importance

Map Unit Name	Area (acres)	Percentage of Project Area	Farmland Classification
Havrelon silt loam, channeled	123	0.3	Not prime farmland
Havrelon silt loam, channeled, wooded	50	0.1	Not prime farmland
Heil silt loam	43	0.1	Not prime farmland
Janesburg fine sandy loam	17	<0.1	Not prime farmland
Lallie silty clay	1	0.0	Not prime farmland
Lawther-Daglum complex	85	0.2	Not prime farmland
Lawther silty clay	196	0.6	Farmland of statewide importance
Lefor-Cohagen fine sandy loam	140	0.4	Not prime farmland
Lefor fine sandy loam	475	1.2	Farmland of statewide importance
Lihen-Parshall complex	23	0.1	Not prime farmland
Manning-Schaller-Wabek complex	260	0.7	Not prime farmland
Manning fine sandy loam	863	2.3	Not prime farmland
Miscellaneous water	4	<0.1	Not prime farmland
Moreau-Janesburg complex	184	0.5	Not prime farmland
Moreau-Wayden silty clays	10	<0.1	Not prime farmland
Moreau silty clay	428	1.1	Farmland of statewide importance
Moreau silty clay, golden valley	13	<0.1	Not prime farmland
Morton-Farland silt loams	68	0.2	Farmland of statewide importance
Orthents-Highway complex	430	1.1	Not prime farmland
Parshall fine sandy loam	404	1.0	Farmland of statewide importance
Reeder-Farnuf loams	105	0.3	Farmland of statewide importance
Regan silt loam	250	0.6	Not prime farmland
Regent-Janesburg complex	383	1.0	Not prime farmland
Regent-Savage silty clay loams	375	1.0	Farmland of statewide importance
Rhoades-Daglum complex	297	0.8	Not prime farmland
Savage-Daglum silt loams	75	0.2	Not prime farmland
Savage silty clay loam	96	0.2	Farmland of statewide importance
Sen-Janesburg silt loams	1,046	2.8	Not prime farmland
Seroco fine sand, golden valley	15	<0.1	Not prime farmland
Shambo loam	940	2.4	Farmland of statewide importance
Stady loam	274	0.7	Farmland of statewide importance
Straw-Daglum complex, channeled	203	0.5	Not prime farmland
Straw-Rhoades-Daglum silt loams	68	0.2	Not prime farmland
Straw loam	112	0.3	All areas are prime farmland
Straw loam, channeled	264	0.7	Not prime farmland
Trembles fine sandy loam	7	<0.1	Farmland of statewide importance
Vebar-Arikara-Flasher complex	281	0.7	Not prime farmland
Vebar-Cohagen fine sandy loams, golden valley	120	0.3	Not prime farmland
Vebar-Flasher-Tally complex	2,677	6.8	Not prime farmland
Vebar-Flasher complex	1,978	5.1	Not prime farmland
Vebar-Parshall fine sandy loams	3,515	9.0	Farmland of statewide importance
Vebar-Tally fine sandy loams	736	1.9	Not prime farmland
Water	18	0.1	Not prime farmland

Source: USDA 2014.

Forty-six percent of the soils within the Project Area are prime farmland or farmland of statewide importance. Approximately 47 percent of the soils in the Project Area (with the exception of areas mapped as "Water", which are unrated) have high susceptibility to erosion by water (i.e., K-factors greater than 0.37). Forty percent of the soils also have high susceptibility to wind erosion (i.e., USDA Wind Erosion Groups of less than 6) (USDA 2014).

7.10.2 Impacts

The impact to soils within the Project Area will be limited to areas removed from agricultural production by occupancy of Project components, including turbines, roads, collection lines, and a Project substation. Construction disturbance activities including grading for roads and turbine footprints, excavation for turbine foundations and underground lines and other infrastructure has the potential to contribute to soil erosion through exposure of soils that were previously vegetated or stable. Access roads will be 16- to 38-foot wide³ aggregate-surfaced roadways. Impacts include permanent operations disturbance to soils due to turbine placement, access road construction, and a Project substation.

7.10.3 Mitigative Measures

Wind and water erosion are potential hazards for the soils found in the Project Area. To minimize erosion during and after construction, best management practices (BMPs) for erosion and sediment control will be utilized. Construction sites will maintain sediment control practices in accordance with the SWPPP. A Project-specific erosion control protocol based on the SWPPP will be developed to treat disturbed and exposed soil surfaces and prevent erosion and contamination of natural water resources. Since towers will not be located on significant slopes, only non-structural practices should be required. These practices include temporary seeding, permanent seeding, mulching, filter strips, erosion blankets, and sod stabilization. If cuts are made during construction, top soil will be segregated and reapplied after final contours have been graded. In addition, during construction and operation, vehicle speed will be limited to 25 mph on Project roads to minimize dust.

7.11 Geologic and Groundwater Resources

7.11.1 Description of Resources

Southwestern North Dakota and the area of the Project lie within the Unglaciaded Missouri Plateau section of the Great Plains physiographic province and on the south-central flank of the Williston Basin, a broad structural depression underlying parts of North and South Dakota, Montana, Manitoba, and Saskatchewan (USGS 1975). Stark County and the Project Area are located southwest of the glaciaded area of North Dakota, and within the Rolling Soft Shale Plain major land resource area (MLRA) which is an old, moderately dissected, rolling plain with local badlands, buttes, and isolated hills (NRCS 2006). Gentle slopes characterize 50 to 80 percent of the area and local relief ranges from 300 to 500 feet (NDGS 1977). The rolling plateau surface of Stark County is highly dissected by erosion. Scattered buttes, capped by resistant

³ Roads required to support crane access to turbines during operation will remain up to 38 feet wide; all other roads may be built at 16 feet wide or reduced later to 16 feet.

sandstone, limestone, or scoria beds, are remnants of sedimentary strata that once covered the area more extensively (USGS 1975).

Unconsolidated surface deposits include alluvium and terrace deposits of the Oahe Formation of Pleistocene age. These surficial sediments are underlain by the Tertiary Age bedrock Sentinel Butte and Golden Valley Formations (USGS 1975, NDGS 2005a, NDGS 2005b, NDGS 2005c, NDGS 2006, NDGS 2007). The Sentinel Butte formation consists of layers of silt, clay and sand with interbedded sandstone, lignite, baked clay, and limestone. The formation forms rolling topography over broad areas and has been eroded to badlands near rivers. The Golden Valley Formation is younger and generally occurs at high elevations in the Area of Taylor, North Dakota and in a strip westward in the Project Areas. The Golden Valley formation consists of clayey and sandy layers that are commonly found on hills, along the sides of buttes, and over upland areas (USGS 1975). Recent/Pleistocene landslide and mass movement deposits from the Sentinel Butte and Golden Valley formations are mapped along the Heart and Green rivers in the vicinity of the Project Area (NDGS 2007, NDGS 2005a).

The most important mineral resource in Stark County is sand and gravel. North Dakota Geological Survey (NDGS) maps (Anderson 2010) indicate numerous potential viable sand and gravel resource areas (approximately 20 areas) within the Project Area, as well as inactive and historical sand and gravel mining operations (approximately 13 in the area). These sand and gravel deposits are primarily associated with alluvial and terrace deposits.

Desktop data from the North Dakota Department of Mineral Resources oil and gas database (NDDMR 2014) lists 12 exploration wells in the vicinity of the Project Area; all of these wells are listed as “dry, abandoned, or abandoned and plugged.” However, field surveys documented two active oil wells, associated pipelines, and a gas metering site is in the Project Area.

Lignite (coal) is known to occur in the Sentinel Butte Formation, but there are no economically viable mapped lignite reserves or historic mining operations within or surrounding the Project Area based on a review of available North Dakota Geological Survey maps (NDGS 2014). No coal mines were observed in site visits to the Project Area.

According to the USGS, North Dakota is located in an area of very low seismic risk (USGS 2008). There are no known active tectonic features or faults known to generate earthquakes with magnitudes of 6 or greater in North Dakota (USGS 2014). Related geologic hazards, such as soil liquefaction, are therefore also unlikely.

Thick beds of sandstone in the lower part of the Sentinel Butte formation are important sources of groundwater in the Project Area (USGS 1975). These beds are also referred to as the Sentinel-Tongue River aquifer. The Tongue River formation is approximately 500 feet below ground surface in the Project Area and has a thickness from less than 50 to 200 feet. The Sentinel Butte sandstone aquifer can reach as much as 245 feet in thickness (USGS 1975). Water levels below ground surface are about 20 feet in the Sentinel Butte aquifer and yields can reach up to 100 gallons per minute (gpm). The Golden Valley aquifer system and Quaternary deposits are also sources of shallow water in Stark County. Well yields are generally 25 to 75 gpm.

Review of driller logs available from the North Dakota State Water Commission database (NDSWC 2014) indicates that 9 wells have been drilled within the Project Area. Most of these wells did not have depth information but the two well logs indicate depths of 720 and 800 feet that tap the Sentinel-Tongue River aquifer. The wells are indicated for domestic, stock, municipal, and observation uses. The municipal well is located in the southeast quarter of Section 26 of Township 140 North, Range 93 West.

7.11.2 Impacts

Impacts of the Project to available mineral resources are likely to be highly limited. No coal resources are known to be actively or historically mined in the Project Area, and economic deposits of lignite coal are not present within or surrounding the Project Area. Dickinson Wind is coordinating with participating land owners to prevent impacts to oil/gas facilities. Although viable sand and gravel resources do occur within the Project Area, these resources are generally found along river valleys and terraces and the Project is not likely to interfere with the development of these resources. Even if the Project affects any of these sand and gravel deposits, the resource would not incur adverse effects, because the regional supply of these materials is abundant in the area. Landslide areas are located along the Heart River valley and mass movement areas are located along the Green River valley. Project development would avoid these landslide areas. Consequently, geologic hazards are unlikely to impact the proposed Project, and the proposed Project would not affect geologic hazards. No significant impacts to geology would, therefore, be anticipated.

Impacts to groundwater resources in the Project Area are anticipated to be minimal. Major withdrawals of groundwater will not be necessary due to the limited water supply needs of the Project. A new well will be drilled to provide water for the O&M building, and a well may be necessary during construction. Based on the small amount of increased impervious surface area that would be created by Project components relative to the separation of these components and the size of the entire Project Area, the Project will likely have minimal impacts to regional groundwater recharge. Based on the generally deep well depths recorded in well logs in the area, Project construction activities such as excavation and construction of foundations are unlikely to affect groundwater quality or flow patterns. If impacts were to occur, they would likely be minor and highly localized, and unlikely to adversely affect local water supply wells. In addition, each turbine would be located a minimal distance of 2,000 feet away from existing residential structures, thereby minimizing the risk of impacts to private wells in the area, which are assumed to be located in proximity to the structures they serve. It is also noted that turbine locations are located over 2,000 feet from the municipal well identified in the southeast quarter of Section 26 of Township 140 North, Range 93 West.

Development of the turbine foundations may require subsurface blasting, which could potentially fracture bedrock and affect groundwater flow in the immediate vicinity of the disturbance. In the event that subsurface blasting is required, a blasting plan would be developed and implemented to keep the impacts localized and fracture the least amount of bedrock necessary for construction. Potential disturbances due to blasting would be localized and temporary, with groundwater likely to resume its natural course of flow down gradient of the foundation. Although it is not anticipated, if dewatering of excavations is necessary, water would be

discharged to the surrounding surface, allowing it to infiltrate back into the ground to minimize potential impacts.

7.11.3 Mitigative Measures

Wind turbines will be sited so as to avoid any sand and gravel resources identified in the Project Area wherever possible. However, as previously discussed, sand and gravel resources are abundant in the area of the Project and mitigation measures would not be necessary to protect these resources.

Wind turbine locations will not impact the use of existing water wells because the turbines will not be sited within 2,000 feet of occupied structures. In the event that subsurface blasting is required, a blasting plan would be developed and implemented to keep the impacts localized and fracture the least amount of bedrock necessary for construction. It may be necessary to pump out any accumulated groundwater in the excavation during construction. All dewatering of the excavation would be discharged to the surrounding surface, thereby allowing it to infiltrate back into the ground to minimize potential impacts.

7.12 Surface Water and Floodplain Resources

7.12.1 Description of Resources

Surface water and floodplain resources for the Project Area were identified by reviewing U.S. Geological Survey topographic maps, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, and USFWS National Wetlands Inventory (NWI) data, and surface water features were surveyed for Project facilities. There are numerous intermittent, unnamed tributaries within the Project Area. The majority of the Project Area is drained by the small intermittent streams into Beaver Creek, Government Creek, or the Heart River while intermittent streams in a small portion of the north and northwest section of Project Area drain towards Deep Creek. The Heart River is a major river that flows through the southwest portion of the Project Area and is a tributary of the Missouri River.

According to electronic data from FEMA, approximately 2 percent of the Project Area is within 100-year floodplain. These areas occur primarily within creek beds of the major tributaries to the Heart River such as Beaver Creek and Government Creek. The 100-year floodplain is defined as the area that will be inundated by a flood event having a 1-percent chance of occurring in any given year.

7.12.2 Impacts

Construction of the wind turbines, transformer pads, and access roads will disturb land within the Project Area. The wind turbines will be built on uplands in order to avoid intermittent streams located in the lower elevations of the landscape. Access roads to the turbines will be built to avoid impacts to surface waters.

Assuming that the proposed wind turbines and associated structures are not placed in potential flooding areas, it is reasonable to assume that floodplains will not be affected by the Project.

7.12.3 Mitigative Measures

Access roads constructed adjacent to intermittent streams and drainageways will be designed in such a manner that runoff from the upper portions of the watershed can flow unrestricted to the lower portion of the watershed. An application (Notice of Intent) to obtain coverage under the NPDES general permit for storm water discharges associated with construction activity will be submitted to the North Dakota DOH prior to construction of the Project.

7.13 Wetlands

7.13.1 Description of Resources

Wetlands are an important natural resource providing a number of critical ecosystem functions. Some of these functions include flood flow attenuation, streambank stabilization, discharge and recharge of ground water, detention and removal of sediments, and the detention, removal and transformation of nutrients and contaminants. Wetlands also may provide habitat for wildlife and sites for human recreation, education, and aesthetic enjoyment.

Desktop analysis was employed to identify probable locations of wetlands and waterbodies prior to field work. Desktop analysis included review of NWI maps (USFWS 2014a), aerial photo imagery (NAIP 2014), web soil survey maps (NRCS 2013), and national hydrography dataset (USGS 2010).

The initial desktop analysis was followed by three wetland field reconnaissance trips conducted between November 2014 and January 2015. Field reconnaissance surveys were conducted in order to verify findings of wetland and surface water resources from the desktop analysis, and to document the presence of other wetlands and waters not found in the initial desktop evaluation. The field reconnaissance efforts were not formal wetland delineations, but they did gather important data with which to verify presence/absence of wetlands and water resources and allow for avoidance and/or minimization of potential impacts by critical micro-siting while in the field. A second desktop analysis was conducted following the field reconnaissance efforts and following the latest changes to the Project layout.

The following Project infrastructure buffers were employed to allow for an evaluation of potential wetland and water resource impacts:

- Turbines: 500-foot radius
- Access Roads: 500-foot-wide area (250 feet on either side of centerline)
- Electrical Collection Lines: 100-foot-wide area (50 feet on either side of centerline)
- Substation: 5 acres
- O&M facility: 5 acres
- Laydown area: 15 acres

Dickinson Wind conducted a preliminary evaluation of U.S. Army Corps of Engineers (USACE) jurisdiction using the methodologies cited in the USACE Jurisdictional Determination Form

Instruction Guidebook (USACE and EPA 2007), including the December 2, 2008 revised Rapanos guidance (EPA and USACE 2008). Wetlands will be delineated and flagged prior to construction when in close proximity to Project features. It is important to note that only the USACE may make formal jurisdictional determinations for a wetland or other “water of the United States” (WoUS), hence the terminology “potentially jurisdictional” is used here to reference those wetlands or WOUS that appear to meet USACE criteria.

A total of 73 locations have been identified where there are intersections between planned Project infrastructure buffers and potentially jurisdictional wetlands or WoUS resources. The majority of these intersections are electrical collection lines and access roads. Minor shifts to the Project layout have already been made in order to avoid many potential impacts to wetlands and WoUS resources.

7.13.2 Impacts

Dickinson Wind has committed to minimizing impacts to jurisdictional wetlands or other WoUS to the extent practicable. Based on extensive desktop analysis and field reconnaissance, the Project is not expected to have any “single and complete project” that will meet or exceed the 0.10-acre impact threshold that would require a preconstruction notification (PCN) to the USACE Bismarck Regulatory Office. By “single and complete project,” we are referring to each discrete intersection between planned Project infrastructure and jurisdictional wetlands and other WoUS. Major components of Project infrastructure and features that were identified during desktop analysis and field reconnaissance are summarized below.

Turbines – Turbine pads are all currently sited to avoid jurisdictional wetlands/WoUS. However, based on the current Project layout, there are eight locations where the 500-foot radius turbine survey buffers intersect potentially jurisdictional wetlands and/or other WoUS. Wetland delineation and flagging during the beginning of the growing season in spring 2015 will allow for avoidance of impact for the vehicle turnaround and construction footprints in these locations.

Access Roads – Site access roads will avoid potentially jurisdictional wetlands/WoUS to the extent practicable. Based on the current Project layout, there are 13 locations where access road buffers intersect potentially jurisdictional wetlands/WoUS. Nine of these intersections are places where the access road will approximately parallel a wetland or other WoUS, but the feature boundaries are uncertain. These nine features can be avoided by wetland delineation and flagging in the spring of 2015. The remaining four sites will be crossed by planned access roads, potentially yielding temporary and/or permanent impacts to wetlands/WoUS, none of which are currently estimated to exceed the 0.10-acre threshold requiring a PCN. It is recommended that these sites be formally delineated in the spring of 2015, and if avoidance is not possible, then the minor impact acreages can be calculated to ensure that no PCN will need to be undertaken.

Electrical Collection Lines – Based on the current Project layout, there are 52 locations where electrical collection lines would intersect potentially jurisdictional wetlands/WoUS. Where it is not practical for electrical collection lines to be shifted to avoid jurisdictional wetlands/WoUS, the collection lines will be bored using horizontal directional drilling (HDD). The HDD will be initiated and terminated beyond the delineated boundaries of the wetlands/WoUS, and a SWPPP will be

implemented to assure no construction fill would be discharged into jurisdictional wetlands/waters. This process will avoid potential impacts from this infrastructure type. Wetland delineation can assist in establishing areas from which to bore that are situated in uplands.

Construction Laydown Areas – Desktop analysis and field reconnaissance have established that there are no wetland or other WoUS resources within the currently planned construction laydown area, thus no impacts are anticipated.

Substation – Desktop analysis and field reconnaissance have established that there are no wetland or other WoUS resources within the currently planned substation site and no impacts are anticipated to these resources.

No Section 404 written permit is anticipated to be required as a result of construction of this Project because it is not anticipated that the Project will exceed the 0.10-acre threshold for PCN. Nevertheless, if the Project does cause minor impacts less than 0.10-acre in jurisdictional wetlands/WoUS, then general and state of North Dakota nationwide permit requirements will be adhered to. These requirements are included in the USACE response letter in Appendix B.

Dickinson Wind will obtain a stormwater runoff permit from NDDoH prior to construction. Compliance with the conditions of this permit and those of the associated stormwater pollution prevention plan would ensure that surface water would not be adversely affected by runoff from areas disturbed by Project construction activities.

7.13.3 Mitigative Measures

Dickinson Wind has committed to avoiding and minimizing impacts to potentially jurisdictional wetlands and other WoUS, as practicable. Wetlands will be delineated and flagged prior to construction when in close proximity to Project features. Horizontal directional drilling will be used where necessary to avoid impacts to wetlands from collection line trenching during construction.

7.14 Vegetation

7.14.1 Description of Resources

The Project Area is a rural location with farming and livestock grazing and related agricultural operations dominating the land use. According to the NLCD data, 92 percent of the Project Area land use is either agricultural crops (45 percent) or grasslands/herbaceous or hay/pasture (47 percent; Fry et al. 2006). There is potential for areas of native prairie to occur within the Project Area, although it was not possible to conduct field surveys for native prairie due to the timing of the surveys and the Project schedule.

7.14.2 Impacts

Access road construction will result in the greatest effects to native vegetation resulting in permanent loss of these habitats where they occur along selected routes. Installation of the proposed buried collector system will result in some temporary effects to native and non-native grasslands.

7.14.3 Mitigative Measures

Dickinson Wind will work to avoid and to minimize impacts to existing trees and shrubs. Trees and shrubs anticipated to be cleared will be inventoried for replacement. Tree replacement will be on a 2 to 1 basis with 2-year-old saplings; shrub replacement will be on a 2 to 1 basis with stem cuttings. Trees and shrubs will be replaced by the same species or similar species, according to the PSC Tree and Shrub Mitigation Specifications.

Impacts to grassland vegetation will be mitigated by reseeding the construction areas with native grasses following completion of construction activities, if approved by the landowner. Areas currently in crop will be replaced with crop in coordination with landowner preferences.

7.15 Wildlife

7.15.1 Description of Resources

Based on issues identified at wind generation sites throughout the U.S., wildlife species of concern to the wind industry are federally or state-protected avian and bat species that may occur in the Project Area. A site visit was conducted in September 2013 (Tetra Tech 2013) and desktop likelihood assessments for whooping crane (*Grus Americana*) and bats were conducted (Tetra Tech 2015c, Tetra Tech 2015d; **Appendix A**). Avian surveys, raptor nest surveys, and bat acoustic monitoring will be conducted in spring 2015.

Avian Species

In accordance with the voluntary USFWS Land-Based Wind Energy Guidelines (USFWS 2013a), Dickinson Wind has conducted a preliminary site evaluation and will conduct field studies to document wildlife and habitat within the Project Area. Based on the location of the Project Area and the habitat present (Tetra Tech 2013), it is expected that the majority of avian species present within the Project Area will be those typically associated with prairie pothole wetlands, agriculture, and grassland habitats. Additionally, birds migrating between breeding and wintering grounds may also pass through the Project Area given its position within the Central Flyway (USFWS 2011).

Bats

Ten bat species are found in North Dakota and potentially occur within the Project Area based on currently known distribution ranges: little brown bat, big brown bat, silver-haired bat, eastern red bat, hoary bat, fringed bat, long-eared bat, long-legged bat, western small footed bat, and northern long-eared bat (Gullickson *no date*, ASM 2014, NatureServe 2014, BCI 2014). Three of the species that could potentially occur within the Project Area (hoary bat, silver-haired bat, and eastern red bat) are long-distance migrants and are found in the greatest abundance in North Dakota during the migratory period of late May through early September (Cryan 2003). The likelihood of migratory bats passing through the Project Area is low (Tetra Tech 2015b; Appendix A). The Project Area contains small forested riparian corridors that bats could follow or utilize as day roosting sites, although these are not significant features from a regional perspective. The limited roosting habitat within the Project Area is a major limiting factor for use of the Project Area by migrating bats. Therefore, bat migration through the Project Area is likely low in magnitude.

Bat acoustic monitoring will be conducted in the Project Area from April to June 2015.

7.15.2 Impacts

Potential impacts from the Project to avian and bat species include collisions with wind turbines, transmission lines, and guyed meteorological towers as well as loss of habitat. The collision risk for birds at the Project will likely be low based on records of fatalities at other wind energy facilities in the Great Plains, which average 2.03 birds/MW/year (2.49 birds/turbine/year) and range from 0.15 to 9.31 birds/MW/year. Rates of bird fatalities in the Great Plains are typically lower than the national average (2.57 birds/MW/year; Tetra Tech, unpublished data).

The collision risk for bats at the Project will likely be low is based on records of fatalities at other wind energy facilities in the Great Plains which average 4.80 bats/MW/year (6.64 bats/turbine/year) and range from 1.06 to 8.90 bats/MW/year. Rates of bat fatalities in the Great Plains are typically lower than the national average (7.04 bats/MW/year; Tetra Tech, unpublished data).

A voluntary Bird and Bat Conservation Strategy (BBCS) for the Project will be developed which will incorporate avoidance and minimization measures (see 7.15.3 below) to minimize collision fatalities to the extent practicable, as well as fatality monitoring and adaptive management strategies. No take of bald or golden eagle is anticipated.

As stated in the USFWS voluntary wind energy guidelines, a species of habitat fragmentation concern is a "species of concern for which a relevant federal, state, tribal, and/or local agency has found that separation of their habitats into smaller blocks reduces connectivity such that the individuals in the remaining habitat segments may suffer from effects such as decreased survival, reproduction, distribution, or use of the area" (USFWS 2013a). The USFWS North Dakota field office has defined a list of species in the state which are considered to be species of habitat fragmentation concern (USFWS 2013b). Of the eleven designated species, the primary range for seven cover the Project Area – Baird's sparrow, chestnut-collared longspur, grasshopper sparrow, northern harrier, sharp-tailed grouse, Sprague's pipit, and upland sandpiper (USFWS 2013b). Habitat fragmentation from the construction of a wind energy project may create significant barriers for such species, particularly wildlife that inhabits wetlands, wet meadows, and riparian corridors. However, because the proposed Project will be largely located in already disturbed agricultural areas which are generally considered suboptimal habitat for most wildlife species, habitat fragmentation is likely to be minimal to most species. Some wildlife displacement in grassland areas would be expected from construction activities, but the effects would be mostly limited to the short construction period, and individuals would be expected to return after construction activities cease (Pearce-Higgins et al. 2012). Because Project construction is anticipated to begin in June 2015, the Project will avoid the primary breeding season for grassland birds.

Potential impacts to sensitive species are discussed in more detail in **Section 7.16.2** below.

7.15.3 Mitigative Measures

Dickinson Wind is conducting environmental studies of the Project Area to aid in the final placement of turbines, roads, and associated facilities to avoid and minimize impacts to wildlife and habitat. The following measures will be used, to the extent practicable, by Dickinson Wind

to help avoid potential impacts to wildlife in the Project Area during selection of the turbine locations and subsequent development and operation:

- Siting access roads and turbines away from wetlands and waterbodies to the greatest extent practicable.
- Designing the layout of the proposed Project so that no permanent impacts to potentially jurisdictional wetland areas would occur. Avoiding wetland impacts would generally reduce potential impacts to migratory birds and bats and sensitive habitat.
- Minimizing the use of lights on turbines when practicable in accordance with state, federal, and local requirements.
- Reseeding or planting disturbed areas with native material, if approved by landowner.
- Developing a management plan to prevent the spread of noxious weeds throughout the Project Area or adjacent areas during construction and ongoing operations.
- Implementing a WRRS once turbine construction is completed. The WRRS will include protocols for field technicians to report and document bird and bat mortalities during routine maintenance operations.
- Conducting post-construction mortality monitoring surveys for 1 year following construction of the Project.
- Developing a BBCCS, which includes an adaptive management approach, so that information gathered and experience gained from post-construction monitoring can be used to inform future management decisions at the Project.
- Proposing in its lighting plan to use the minimum number of aviation hazard lights acceptable to the FAA to avoid attracting migrating birds and bats to the turbines. Dickinson Wind will also install motion-activated lighting or down-shielded lighting on other Project facilities that require lighting at night (i.e., the collection substation) to avoid the potential to draw birds and bats toward the facility.
- During construction and operation, limiting vehicle speed limited to 25 mph on Project roads to minimize wildlife collisions.

7.16 Rare and Unique Natural Resources

7.16.1 Description of Resources

The Endangered Species Act (ESA), as administered by the USFWS, mandates protection of species federally listed as threatened or endangered and their associated habitats. The ESA makes it unlawful to knowingly violate the “take” provisions of the ESA. Take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to engage in any such conduct.” Significant modification or degradation of listed species’ habitats where the modification actually kills or injures wildlife by significantly impairing essential behavioral

patterns is considered “harm” under ESA regulations. Candidate species receive no statutory protection from the USFWS unless they are formally listed.

Based upon USFWS data for Stark County, North Dakota, the following listed species have potential to occur within the county and potentially the Project Area: the endangered - whooping crane (*Grus americana*), black-footed ferret (*Mustela nigripes*), and gray wolf (*Canis lupus*). Additionally, there is potential for bald and golden eagles to occur within the Project Area that are both protected under the Bald and Golden Eagle Protection Act (BGEPA).

Whooping Crane (Federal Endangered)

The whooping crane was considered endangered in the United States in 1970 and the endangered listing was ‘grandfathered’ into the ESA of 1973 (CWS and USFWS 2007). The whooping crane population was reduced to 16 individuals in 1941, but with conservation efforts the Aransas-Wood Buffalo National Park population, the single self-sustaining wild population, has been steadily rising with the population estimate at 304 individuals (with a 95% probability of actual flock size being between 260-354 birds) during the 2013-2014 winter census (USFWS 2014c). A 200-mile wide migration corridor has been delineated for this population that contains 95 percent of all verified sightings. The population breeds in Wood Buffalo National Park in Canada and winters at the Aransas National Wildlife Refuge (ANWR, designated a critical habitat) along the Gulf Coast of Texas (Lewis 1995). Spring migration occurs primarily in April and May whereas fall migration occurs primarily in October and November (Lewis 1995). Stopover habitat during migration includes a variety of croplands with roosting occurring in shallow, freshwater inland wetlands (Lewis 1995). Four additional areas associated with major stopover areas are designated as critical habitat: Quivira National Wildlife Refuge and Cheyenne Bottoms State Wildlife Management Area in Kansas; a section of the Platte River in Nebraska; and the Salt Plains National Wildlife Refuge in Oklahoma (USFWS 2012a). Wind energy development has been identified as a threat to the species due to the potential for displacement due to the presence of the turbines, and potential for collisions with operational wind turbines, and new power lines (USFWS 2012a).

A whooping crane likelihood assessment was conducted for the Project (Tetra Tech 2015a). Although there is foraging and roosting habitat within the Project Area, the landscape-scale analysis concluded that the likelihood of whooping cranes occurring within the Project Area is low based on the location of the Project Area on the edge of the migration corridor.

Black-footed Ferret (Federal Endangered)

The black-footed ferret, a medium-sized member of the weasel family, was listed as endangered in 1967 (USFWS 2014d). The black-footed ferret is an obligate predator of prairie dogs and occurs exclusively in prairie dog colonies which it depends upon for food and shelter (USFWS 2014d). Previously believed extinct, 18 individuals were discovered in 1986 and were then used to create a breeding and reintroduction program (USFWS 2010). It is estimated that over 1,000 black-footed ferrets occur in the wild with another 300 within breeding facilities (USFWS 2014d). No reintroductions of black-footed ferrets have been made in North Dakota (USFWS 2014d), and it is thought to be extirpated from the state (NDGF 2012). Although there is potential for prairie dog colonies to occur with the Project Area, the habitat within the Project Area is highly fragmented. Black-footed ferrets only occur in large, unfragmented prairie dog

colonies. Based on the range, known introduction locations of black-footed ferrets, and habitat within the Project Area, it is unlikely the black-footed ferret would occur within the Project Area.

Gray Wolf (Federal Endangered)

The gray wolf was listed as endangered in 1974 (USFWS 2014e, USFWS 2014f). Gray wolves previously inhabited a large portion of the United States in a variety of habitats including tundra, forests, grasslands and deserts. There is potential for the gray wolf to occur within the Project Area based upon movement of the species from other known populations (Western Great Lakes and Northern Rocky Mountains). The Project Area lacks forested areas known to support wolf pack establishment and persistence (NatureServe 2014; USFWS 2012b); therefore it is unlikely that the gray wolf would occur within the Project Area.

Bald Eagle (Federal Protected under BGEPA)

Bald eagles in North America occur throughout the contiguous United States, Alaska, and Canada (Buehler 2000). Individuals may occur as breeders, winter residents, migrants or year-round residents (Buehler 2000). Bald eagles can nest in large trees or cliffs. Breeding areas are closely associated with aquatic habitats with forested shorelines or cliffs (Buehler 2000). The nesting period varies by latitude; in the northern Great Plains it begins with courtship and nest building in mid-January through March and ends when the young fledge. The majority of wintering populations are present within the lower 48 states, Alaska and coastal Canada. Wintering locations are associated with aquatic areas that contain some open water for foraging on fish, with wintering bald eagles roosting anywhere between 6 miles and 20 miles from foraging sites depending on abundance of prey. The wintering or non-nesting period is from September through mid-January (USFWS 2013c). Bald eagles are opportunistic foragers that prey primarily on fish but also feed on other aquatic and terrestrial vertebrates as well as on carrion (Buehler 2000). The number of bald eagle nests has increased in North Dakota over the last 20 years, and nests are found primarily on the Missouri River and Red River (Johnson 2010). Based on the habitat within the Project Area, it is unlikely that bald eagles will nest in the vicinity. Bald eagles congregate along larger waterways in the winter; therefore, the Project Area should not attract bald eagles in winter because of the absence of these larger rivers. Based on the distribution of bald eagles, known nesting areas, and the lack of large waterbodies within 10 miles of the Project Area, the likelihood of occurrence is expected to be low, although bald eagles may occur as transients across the Project Area.

Golden Eagle (Federal Protected under BGEPA)

Golden eagles are common in western North America west of the 100th meridian with small populations also present in the eastern portions of Canada and the United States (Kochert et al. 2002). Western golden eagle populations may be migratory or resident year-round; however, southern populations tend to be residential, with individuals from northern populations migrating south to over-winter in the region (Kochert et al. 2002). Golden eagles in the western U.S. are most commonly associated with open and semi-open habitats such as shrublands, grasslands, woodland-brushlands, and coniferous forests as well as in farmland and riparian habitats (Kochert 1986, Kochert et al. 2002). Golden eagles nests on cliff faces or in large trees and breeding areas vary by region, but are generally associated with mountainous canyon land, rimrock terrain of open desert, grassland areas, riparian habitats, and occasionally in forested areas (Kochert et al. 2002). The species feeds upon a wide variety of prey species but tends to

hunt small to medium-sized mammals such as hares, rabbits, ground squirrels, and prairie dogs depending upon local availability (Kochert et al. 2002). Golden eagles are uncommon permanent residents in southwestern North Dakota with known nesting occurring on the Little Missouri National Grasslands approximately 30 miles west of the Project Area (Hagen et al. 2005). The closest known golden eagle nest is approximately 20 miles west of the Project Area (NDPR 2015). Based upon the distance from the known eagle nest and the habitat of the Project Area, the likelihood of regular use and occurrence is expected to be low.

7.16.2 Impacts

According to the WRRS data generated for other operating wind farms in North Dakota, there have been a limited number of detected bird and bat fatalities. Per the WRRS protocol, if an injured bird is found, it must be left undisturbed and reported to USFWS. No listed species or eagles have been WRRS-recorded as injuries or fatalities at other operating wind farms in North Dakota to date.

Whooping Crane

Collisions with turbines, meteorological towers, or transmission lines are a potential impact from the Project. However, cranes have been documented altering flight direction in response to turbines at a wind facility in South Dakota (Nagy et al. 2012), and multiple studies have documented sandhill cranes gradually climbing as they approach marked power lines (Morkill and Anderson 1991, Murphy et al. 2009). Therefore, this avoidance behavior may minimize the potential for Project-related collisions. Furthermore, no whooping cranes have been detected as a fatality at wind facilities to date, suggesting that likelihood of collision may be low.

The potential for indirect impacts resulting from habitat loss is likely to be low. This is because the potential roosting habitat within the Project Area is minimal and is of marginal quality. Approximately 2 percent of the Project Area is categorized as riverine or wetland habitat. Wetlands surrounded by trees or with nearby structures, such as are found in the Project Area, are generally considered unsuitable roosting habitat for cranes because as cranes primarily use sites with unobstructed visibility (Austin and Richert 2001). Less than 1 percent of the Project Area is categorized as open water or emergent herbaceous wetlands that would be favorable for wetlands for cranes.

Based on the limited presence of suitable wetland habitat, the low probability of site usage, and the avoidance and minimization measures discussed in Section 7.16.13 (e.g., buried collection systems, and marking the transmission line within 0.5 miles of suitable stopover habitat), the proposed Project is not likely to impact the whooping crane.

Black-footed Ferret

Given that NDGF believes that the black-footed ferret is extirpated from the state (NDGF 2012), it is unlikely that the Project will affect the black-footed ferret.

Gray Wolf

As gray wolves are unlikely to occur within the Project area, it is unlikely the Project will impact the gray wolf.

Bald Eagle

There are no known bald eagle nests that occur within the vicinity of the Project Area. The landscape within the Project Area does not support any large waterbodies or an abundance of smaller waterbodies that would be attract bald eagles for nesting or foraging. Bald eagles are unlikely to occur during the breeding season but may occur in the Project Area during the migratory periods. Based on the distance from the Project Area to the known nesting areas, lack of large waterbodies, and bald eagle occurrence within the region, the development of the proposed Project is not likely to adversely affect the bald eagle.

Golden Eagle

Known golden eagle nests occur within 20 miles of the Project Area in bluffs of the surrounding grasslands and agricultural fields. The landscape within the Project Area does not support cliff nesting sites and trees within the Project Area seem unlikely to meet the preferred tree nest site characteristics (Menkens and Anderson 1987); therefore, it is unlikely that golden eagles will nest within the Project Area. Golden eagles may use the rangelands within the Project Area for foraging during the breeding season; however, golden eagles are rare in the eastern portion of the breeding range and concentrate foraging over home ranges during the breeding season (average 20–33 km² [7.7–12.7 sq. mi]; Kochert et al. 2002). Golden eagles may occur during migration and winter seasons; however, there are no known features that would concentrate golden eagles within the Project Area compared to the surrounding area. Based on the distance from the Project Area to the known nesting areas and golden eagle occurrence within the region, the development of the proposed Project is not likely to adversely affect the golden eagle.

7.16.3 Mitigative Measures

General avoidance and minimization practices for vegetation and wildlife are discussed in **Sections 7.14.3** and **7.15.3**, respectively. Dickinson Wind has committed to the following additional avoidance and minimization measures which are specific to potential impacts to federally threatened and endangered species:

- Dickinson will bury collection lines from the turbines to the collection substation to avoid collision risk, if practicable.
- The proposed associated overhead transmission line within 0.5 miles of wetlands that may provide stopover habitat for whooping cranes will be outfitted with bird flight diverters.
- Dickinson Wind will implement a WRRS, whereby if any dead or injured birds or bats are found within the Project boundaries by Project personnel, its location will be marked and reported promptly to the on-duty Plant Lead/Site Supervisor. The injured migratory bird or bat carcasses will not be moved by any unpermitted individual. In addition, if an endangered or threatened animal fatality is found in the Project Area, Dickinson Wind employees will immediately notify the USFWS after completing the WRRS documentation process (photographs and GPS locations).

- In addition to the training provided via the WRRS, Dickinson would provide all construction and maintenance staff with training in federally listed species identification and would provide identification guides for whooping cranes to be kept in all vehicles.
- Dickinson Wind will conduct bird and bat post-construction fatality surveys for 1 year following construction of the Project.

7.17 Summary of Impacts

Table 15 summarizes the resources that will be affected as a result of the Project and the appropriate mitigation.

Table 15. Summary of Impacts and Mitigation

Resource	Impact	Mitigation
Socioeconomics	Primarily positive due to increased expenditures during construction and the long term benefits of lease payments and an increased tax base of the county due to property taxes.	N/A
Land Use	Approximately 80 acres of land will be affected by 87 turbines, associated access roads, and a substation during operation. Temporary impacts during construction for turbine installation, road construction, cable trenching, and laydown and contractor staging would be approximately 714 acres.	Dickinson Wind will work with landowners and regulatory agencies to minimize impacts of the Project.
Public Services	No impacts are anticipated.	The Project will utilize station service from the local electrical utility and will abide by the recommendations to prevent impacts to the transmission system.
Human Health and Safety	No impacts are anticipated. No occupied residences are predicted to have more than 30 hours per year of shadow flicker.	Turbines will be lighted to comply with FAA requirements. A variety of security measures will be implemented to reduce the chance of physical and property damage.
Noise	No impacts are anticipated to noise-sensitive resources (occupied residences).	Noise modeling results indicated that received sound levels are all below the North Dakota noise requirement (Chapter 69-06-08-01(4)), which prescribes a limit of 50 dBA within 100 feet of an inhabited residence.
Cultural and Archaeological	No impacts to previously identified cultural resources are anticipated.	Dickinson Wind has conducted a Class I file search for the Project. A Class III Intensive Cultural Resources Inventory for archaeological resources is underway. Turbines and other Project facilities will be microsited to avoid impacts to archaeological sites. A Class III Intensive Cultural Resources Inventory for architectural resources will be conducted in spring 2015.
Recreational Resources	No direct impacts to recreational resources are anticipated.	No mitigation measures are proposed at this time.
Land Based Economies	Approximately 80 acres of land will be permanently affected. Temporary impacts include 714 acres for turbine installation, road construction, cable trenching, and laydown and contractor staging.	Dickinson Wind has worked with landowners to minimize impact to their land.

Resource	Impact	Mitigation
Soils	Same as above.	BMPs for erosion and sediment control will be utilized to minimize wind and water erosion at the site. Only land needed for the facility will be permanently affected. Temporarily disturbed areas will be restored.
Geologic and Groundwater Resources	No impacts to groundwater resources are anticipated.	N/A
Surface Water and Floodplain Resources	Access roads, turbines, and other Project facilities will be located and constructed in such a manner that no impacts are anticipated.	Impacts to surface waters will be avoided. Dickinson Wind will implement BMPs to minimize erosion and sedimentation at the site.
Wetlands	Impacts to wetlands and WoUS will be avoided and minimized to the extent practicable.	Wetlands will be delineated and flagged prior to construction. Horizontal directional drilling will be used where necessary to avoid impacts to wetlands from collection line trenching during construction.
Vegetation	Approximately 80 acres of land will be permanently affected; an additional 714 acres will be temporarily disturbed during construction.	Dickinson Wind will avoid existing trees and shrubs as practicable and will use BMPs during construction and operation to minimize impacts. If impacts to trees or shrubs cannot be avoided, the individual trees or shrubs will be replaced. Temporarily disturbed areas will be reseeded per USFWS and NRCS recommendations. Native prairie will be avoided to the extent practicable and will be reseeded using native prairie mix.
Wildlife	Potential avian and bat collisions may occur, but are anticipated to be relatively few.	A variety of mitigative measures will be implemented, as discussed in Section 7.15.3. The Project's WRRS will be implemented after construction of the Project as described in Section 7.15.3.
Rare and Unique Natural Resources	The Project Area is on the western edge of the whooping crane migration corridor, and the likelihood of whooping cranes occurring within the Project Area is low. No other federally listed species are expected to be affected by the Project.	Dickinson Wind has committed to burying collection lines as feasible, marking portions of the associated overhead transmission line within 0.5 mile of suitable crane habitat, and avoiding permanent impacts to jurisdictional wetlands.

8. PUBLIC AND AGENCY COORDINATION

Per Section 69-06-01-05 of the PSC’s administrative rules, Dickinson Wind and its representatives have contacted key local, state and federal agencies in December 2014 to inform them of the Project and for assistance in identifying concerns or issues within the Project Area. Agency correspondence and responses received as of March 2, 2015 are included in **Appendix B; Table 16** summarizes the responses received from agencies to date.

Principal stakeholders in the Project are landowners that have entered or will be entering into agreements with Dickinson Wind to provide wind rights for the Project. Dickinson Wind will continue to meet with county officials as the Project moves forward and Dickinson Wind seeks any necessary local permits (e.g. building permit).

Table 16. Summary of Agency Responses

Agency	Response Date	Response Summary
USFWS	12/19/14	There are no USFWS lands or easements in or adjacent to the Project Area.
SHPO	01/02/15	Recommends Class I file search and Class III Intensive Cultural Resources Inventories for archaeological sites and historic structures.
USACE	01/07/15	If a Section 10 and/or Section 404 permit is required, a permit application must be submitted to USACE. NWP 12 requirements and general conditions were provided.
NDSWC	01/12/15	There are floodplains in the Project Area. A surface drain permit is required for filling wetlands. The online link for well locations was provided.
NDPRD	01/21/15	No state park lands are in the Project Area. There are some Land and Water Conservation Fund lands in the Project Area. The Old Red/Old Ten Scenic Byway is in the Project Area and the least amount of visual impacts is recommended. There are several significant ecological communities documented in the Project Area.
NDGF	01/22/15	Suggests use of USFWS Land-Based Wind Energy Guidelines; recommends avoidance of wetland impacts and maintaining existing drainage patterns, and replacing wetlands that are affected. Requests burying of collection lines, marking overhead lines near streams or wetlands; recommends monitoring for avian and bat mortality, and requests GPS coordinates of turbines once Project is constructed.
ND Department of Trust Lands	01/29/15	The Project Area does not contain school trust land surface acres, but the agency holds the mineral rights to several parcels in the Project Area. The agency recommends consultation with the North Dakota Oil and Gas Commission.
ND Department of Health	01/30/15	The agency believes the environmental impacts of the Project will be minor. Fugitive dust emissions should be minimized during construction. Aggregate to be used for road construction should be tested for erionite. Impacts to streams should be avoided and disturbed areas should be revegetated. Projects disturbing one or more acres must have a permit to discharge storm water runoff.

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9. POTENTIAL PERMITS/APPROVALS

The federal and state permits or approvals that have been identified as potentially required for the construction and operation of the Project are shown in **Table 17**. Permits dependent on the final site layout will be applied for after receiving PSC approval, but prior to construction.

Table 17. Potential Permits and Approvals Required for Construction and Operation of the Proposed Facility

Agency	Type of Approval	Status*	Need
Federal Approvals			
USACE	Nationwide Permit	3	A wetland survey completed in December 2014; additional surveys will be completed as necessary in spring 2015.
FAA	Form 7460-1, Notice of Proposed Construction	1	Notice and approval are required for structures over 200 feet in height. FAA approval of lighting and marking of turbines is required.
EPA	SPCC	2	Required if more than 1,320 gallons of oil are stored onsite.
State of North Dakota			
PSC	Certificate of Site Compatibility	1	Required for construction of generation facility over 0.5 MW in size.
	Certificate of Corridor Compatibility and Route Permit	1	Required for transmission lines over 115kV.
SHPO	Concurrence with effect determinations	1	Class I File Search is complete and a Class III Intensive Cultural Resources Inventory for archaeology is underway; the report will be submitted to SHPO for review in spring 2015. A Class III Cultural Resources Inventory for historic structures is scheduled for spring 2015.
North Dakota Department of Health	NPDES Permit: General Construction Storm Water	2	Required for disturbance of over 1 acre of land. Must prepare a SWPPP.
North Dakota Highway Patrol	Overheight/Overweight Permit	2	Permit required for hauling construction equipment and materials on State Highways.
NDDOT	Road Approach/Access Permit	2	Permit required for construction of access roads from State Highways.
	Utility Permit/Risk Management Documents	2	Permit required for utility crossings on State Highway right-of-way
Local Permits			
Stark County	Wind Energy Facility Siting Permit	1	Dickinson Wind will apply after submittal of this permit application.

* Status Explanation:

- 1 Applied and/or Decision Pending
- 2 Will Apply Prior to Construction
- 3 Final Layout will Determine Whether Permit/Approval is Needed

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10. FACTORS CONSIDERED

The North Dakota Energy Conversion and Transmission Facility Siting Act lists 11 factors to guide the Commission in the evaluation and designation of the site of the facility.

10.1 Public Health and Welfare, Natural Resources, and the Environment

The preceding sections discuss the research and investigations relating to the effects of the proposed facility on public health and welfare, natural resources, and the environment. These effects and the proposed mitigation to minimize these effects are summarized in **Section 7.17**.

10.2 Technologies to Minimize Adverse Environmental Effects

Dickinson Wind will utilize the most current technologies that minimize impacts to the environment. Current wind turbine technologies, including the equipment and siting tools, optimize the wind and land resources.

10.3 Potential for Beneficial Uses of Waste Energy

This factor is not applicable to this Project. No waste energy is created using wind energy.

10.4 Unavoidable Adverse Environmental Effects

Unavoidable adverse environmental effects are described for each resource area in Section 7. The Project is expected to impact approximately 80 acres of land during operation, which will not be available for other uses. Approximately 714 acres of land will be temporarily affected due to turbine pad construction, road construction, collection line trenching, laydown and contractor staging areas, and temporary meteorological towers.

10.5 Alternatives to the Proposed Site

Dickinson Wind believes that the proposed site is the most viable alternative. Dickinson Wind is committed to being flexible on the preliminary site layout and will work closely with landowners and to examine all reasonable alternatives to the preliminary site layout.

10.6 Irreversible and Irretrievable Commitment of Natural Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource that cannot be replaced within a reasonable timeframe. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action. There are few commitments of resources associated with this Project that are irreversible and irretrievable, but these include those resources primarily related to construction. Construction of the Project will necessitate a one-time expenditure of funds, which is not retrievable.

Labor and natural resources will be used in the fabrication and preparation of construction materials. These materials are usually not retrievable. Construction resources that will be used include aggregate resources, concrete, steel, and hydrocarbon fuel. Each steel turbine requires the construction of a concrete base 40 to 60 feet across and 7 to 10 feet thick. Access roads will

require aggregate resources for their construction and maintenance. During construction, vehicles will be traveling to and from the site, utilizing hydrocarbon fuels. These resources are not in short supply, and their use will not have an adverse effect on the availability of these resources. In addition, the anticipated economic benefits of the Project will balance the irretrievable commitment of resources resulting from the construction of the Project (see **Section 10.7**).

10.7 Direct and Indirect Economic Impacts

Economic impacts include impacts associated with the temporary disturbance of up to 714 acres of land during construction. Permanent impacts will be lower, at approximately 80 acres. In general, agricultural areas surrounding each turbine can still be farmed, and landowner compensation will be established by individual lease agreements

The remaining direct and indirect economic impacts are primarily positive. Wind energy development removes less total land from agricultural use than other forms of development. The rural economy and energy production in the county and state is diversified. To the extent that local contractors are used for portions of the construction, total wages and salaries paid to contractors and workers in Stark County will contribute to the total personal income of the region. Additional personal income will be generated for residents in the county and the state by circulation and recirculation of dollars paid out by the Applicant as business expenditures and state and local taxes. Expenditures made for equipment, energy, fuel, operating supplies, and other products and services benefit businesses in the county and the state.

Long-term beneficial impacts to the county's tax base as a result of the construction and operation of the wind farm will contribute to improving the local economy in this area of North Dakota. The development of wind energy in this region will be important in diversifying and strengthening the economic base of western North Dakota. Additional revenues are expected from property and income taxes.

Continuing to establish the central region of North Dakota as an important producer of alternative energy sources may spur the development of wind-related businesses in the area, in turn contributing to economic growth in the region.

10.8 Existing Development Plans of the State, Local, Government and Private Entities at or in the Vicinity of the Site

No conflicts are anticipated with existing state and local government and private entities' development plans.

10.9 Effect of Site on Cultural Resources

As described in **Section 7.7**, a literature review was conducted and a Class III Cultural Resources Inventory for archaeology in the APE for direct effects is underway. The literature review identified 6 cultural resources and 20 cultural resource leads within the 1-mile buffer around the direct effects APE. One National Register of Historic Places property (the Gerhardt Octagonal Pig House – 32SK0092) was reported within the direct effects APE west of Turbine 33. However, the field survey revealed that property 32SK0092 is an abandoned farmstead with

no standing structures. A Class III Cultural Resources Inventory for historic structures is scheduled for spring 2015.

During the archaeology field surveys to date, 12 new cultural resources were documented within the direct effects APE. Avoidance is recommended for the seven sites and 10 isolated finds within the APE. The survey report will be submitted to the North Dakota SHPO for review and concurrence when the survey is completed in spring 2015.

10.10 Effect of Site on Biological Resources

The impact of the Project on wildlife is expected to be low. There is potential for avian and bat collisions with facility turbines, power lines, and meteorological towers, as well as the potential for habitat loss and fragmentation; however, Dickinson Wind will implement measures to avoid and minimize potential impacts to biological resources from the proposed Project. Risks of collision will be minimized by siting facilities away from wetlands, and burying collection lines. Similarly, risk of impacts to habitat will be avoided and minimized by Reseeding or planting disturbed areas with native material, if approved by landowner.

Detailed discussion of potential impacts and proposed mitigation measures on biological resources is provided in **Section 7.14** (Vegetation), **Section 7.15** (Wildlife), and **Section 7.16** (Rare and Unique Natural Resources).

10.11 Cumulative Effects

Activities that currently exist within the Project Area and vicinity and may expand in the near future include agriculture, oil and gas production, and lignite mining. The exploitation of oil is an existing industrial component of the landscape in Stark County, with approximately 25 percent of the county covered by oil fields (NDIC 2014). Oil production is expected to increase in the county (NDIC 2015).

Wind energy development is anticipated to have a positive cumulative impact on air quality, and minimal impacts to geology, soils, water, noise, safety and health issues, and cultural resources. Socioeconomic impacts are anticipated to be positive, as the rural economy is stimulated and local energy production is diversified. The potential negative cumulative impacts are anticipated to be primarily on land use and on vegetation, and wildlife. In addition to the proposed Project, there is one other utility-scale wind energy facility planned in Stark County and Morton County within 10 miles to the east. There are also two existing non-utility scale wind turbines near Richardton, ND and the Project Area.

With the increase in the amount of land being used for wind energy generation activities, farming activities may decrease slightly. This potential shift in land use in rural communities that have historically made their living from agricultural activities may lead to a cumulative impact; however, the additional income to farmers from wind development may make it more feasible for them to keep most of their land in agricultural uses rather than being developed for residential, commercial, or industrial uses. By enabling farmers to keep land in agriculture, wind energy development may lead to a net positive cumulative impact as less total land from agricultural use than other forms of development.

With regard to the potential cumulative impacts to wildlife resources, there is potential for the Project to affect local wildlife both directly (mortality) and indirectly (habitat loss and fragmentation). Both direct and indirect potential impacts will be avoided and minimized to the extent practicable, and therefore, are not expected to cause cumulative impacts. Although the wind turbines will contribute to the utility/industrial component of the existing landscape, the area will remain primarily agricultural in nature. As these agricultural lands are of minimal value to wildlife compared to native vegetation, the proposed Project is not expected to result in a cumulative loss of quality wildlife habitat. Based on the existing land use, location of existing and planned facilities, and known impacts from similar wind facilities in the area, it is expected that the Project will have minimal cumulative impacts to wildlife.

10.12 Agency Comments

Agency coordination and potential permits/approvals are discussed in **Section 8** and **Section 9**, respectively. A copy of agency response letters is included in **Appendix B**.

11. QUALIFICATIONS OF CONTRIBUTORS

Name Project Role	Education and Professional Experience
MELISSA HOCHMUTH Project Manager, Development NEER	<p>Ms. Hochmuth joined NEER in August 2008 and serves as NEER's lead developer for North Dakota. Melissa has over six years of experience in various roles with NEER. She spent five years in the environmental compliance and regulatory departments and began her role as lead developer for wind projects in North Dakota in October 2013. Melissa is responsible for managing and coordinating key functions of project development including site prospecting, meteorological tower deployment, financial analysis, land acquisition, contract negotiations including leases and obtaining all state, local, and environmental permits. Melissa holds a BA, Masters of Educational Administration and Law Degree from the University of Florida.</p>
KIMBERLY WELLS, PH.D. Environmental Services Project Manager NEER	<p>Dr. Wells has ten years of environmental permitting experience including experience as both a consultant and environmental manager in the renewable industry. Her primary expertise is technically challenging and interdisciplinary projects on private and public land, with a focus on large environmental impact assessment and permitting projects with the National Environmental Policy Act (NEPA) and state equivalents; the ESA, the Clean Water Act, and associated natural resource laws. She is a certified wildlife biologist and obtained her BS in Natural Resource Management from the University of Arizona, her MS in Fisheries and Wildlife Ecology from Oklahoma State, and her PhD in Fisheries and Wildlife Sciences from the University of Missouri – Columbia.</p>
JASON UTTON Director Development NEER	<p>Mr. Utton currently directs all wind energy development efforts in the Midwest ISO and PJM markets. Jason joined NEER in 2007. While with NEER, he has successfully developed over 500 MW of clean, renewable energy, which reflects a total company investment of over \$2.0B. Jason is the lead negotiator for all commercial contracts in North Dakota.</p>
JOE MARCHESE Senior Director Construction NEER	<p>Mr. Marchese is responsible for the management and oversight of all phases of engineering, construction, startup and performance testing of wind projects. Duties also include budget development, contract writing and administration, production, safety, and Operation & Maintenance setup, transition and turnover of facilities. Joe has over 30 years of experience in the supervision and construction management of energy facilities. He has supervised and managed design, construction, testing, operation and maintenance of wind, oil, coal, and nuclear energy facilities. He has also served as the maintenance manager at FPL's nuclear facilities where he had the responsibility to manage over 300-station construction and maintenance personnel. Joe is a professional Engineer licensed in Florida and Virginia.</p>
BRIAN BJELLA Attorney for Applicants Crowley Fleck PLLP	<p>Applicant's counsel. J.D. and Bachelor's degree, both from University of North Dakota.</p>
ANNE-MARIE GRIGER, AICP Project Manager Tetra Tech, Inc.	<p>Ms. Griger has ten years of experience in environmental planning and permitting, including NEPA compliance, for large-scale infrastructure projects including wind energy generating facilities, solar energy facilities, and highways. She serves as Project Manager for wind energy projects in Kansas, North Dakota, South Dakota, and Texas. Master's in Urban and Regional Planning and Bachelor's degree in Environmental Policy and Planning, both from Virginia Tech.</p>

Name Project Role	Education and Professional Experience
<p>LORI DAVIDSON Environmental Planner Tetra Tech, Inc.</p>	<p>Ms. Davidson has nine years of experience in environmental planning and landscape architecture. She has a particular expertise in working with public agencies and private sector clients on a variety of project types and scales, including transmission line studies, and solar and wind facility studies, as well as preparing federal, state, and local documents such as Environmental Assessments and Environmental Impact Statements.</p> <p>Master's in Landscape Architecture, University of Michigan Bachelors of Science in Environmental Studies and Application, Michigan State University</p>
<p>JAKE ENGELMAN GIS Analyst Tetra Tech</p>	<p>Mr. Engelman prepared the application figures, impact calculations, and other GIS tasks in support of this permit application.</p> <p>He is a GIS specialist with four years of experience in environmental resource and utility planning projects. His skills include geographic information systems (GIS), cartographic and graphic design, remote sensing, natural and cultural environmental resource mapping, and global positioning system (GPS) data collection. He uses these skills to produce high-quality graphic products of proposed projects, ranging from generation scale utility projects to single parcel substations.</p> <p>BS, Geography, Minnesota State University-Mankato, 2010</p>
<p>ADAM HOLVEN Archaeologist Tetra Tech</p>	<p>Mr. Holven led the Class I and Class III Cultural Resources Inventory for archaeology for the Project. He has extensive archaeological field experience, including large-scale multi-square mile cultural resource surveys for wind farms in North Dakota, South Dakota, and Minnesota.</p> <p>MA, Anthropology, Iowa State University, 2006 BA, Anthropology, University of Northern Iowa, 2003 BS, Geology, University of Northern Iowa, 2001</p>
<p>STEVE YARBROUGH Wetlands Biologist Tetra Tech</p>	<p>Mr. Yarbrough led the wetlands delineation surveys for the Project. He is a certified professional ecologist with the Ecological Society of America and a director on the board of the Colorado Native Plant Society, and has 26 years of experience as a biologist and environmental scientist in the environmental consulting field.</p> <p>MA (Master of Arts), Biology, University of Colorado, Denver, 2000 BA (Bachelor of Arts), Environmental Studies, University of Kansas, 1983</p>
<p>EVONNE SCHROEDER Wildlife Biologist Tetra Tech</p>	<p>Ms. Schroeder has 10 years of experience as a wildlife biologist, conducting wildlife monitoring and other field studies in a variety of habitats and regions. Her primary focus has been in avian biology. She has experience conducting field studies including breeding bird surveys, avian point count surveys, avian capture using mist nests and banding, raptor surveys, vegetation sampling, and small mammal trapping using live traps.</p> <p>MS, Wildlife Science, Texas Tech University, 2010 BS, Conservation Biology (emphasis: Wildlife Biology), Brigham Young University, 2002</p>

12. REFERENCES

- AirNav. 2014. Airport Search. <http://www.airnav.com/cgi-bin/airport-search>, accessed online in December 5, 2014.
- Anderson, F. J., 2010, Locations of Sand and Gravel Sites in North Dakota, North Dakota Geological Survey.
- ASM (American Society of Mammologists). 2014. Mammals of North Dakota. <http://www.mammalsociety.org/mammals-north-dakota>. Accessed: August 2014.
- AWEA (American Wind Energy Association). 2014. State Wind Energy Statistics: North Dakota. Available online <http://www.awea.org/Resources/state.aspx?ItemNumber=5191>, accessed June 26, 2014.
- Austin, J.E. and A.L. Richert. 2001. A comprehensive review of the observational and site evaluation data of migrant whooping cranes in the United States, 1943-99. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota, and State Museum, University of Nebraska, Lincoln, Nebraska. 157 pp.
- Basin (Basin Electric Power Cooperative). 2014. Basin Electric signs contracts for wind generation. http://www.basinelectric.com/News_Center/Publications/News_Releases/basin-electric-signs-contracts-for-wind-generation-.html. Accessed January 15, 2015.
- Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/506>.
- CWS (Canadian Wildlife Service) and USFWS (U.S. Fish and Wildlife Service). 2007. International recovery plan for the whooping crane. Ottawa: Recover of the Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, NM.
- Cryan, P.M. 2003. Seasonal distribution of migratory tree bats (*Lasiurus* and *Lasionycteris*) in North America. *Journal of Mammology* 84:579-593.
- EmPower ND. 2010. 2010 - 2025 Comprehensive State Energy Policy. Available online at <http://www.commerce.nd.gov/uploads/4/empowernd92010.pdf>, accessed on March 10, 2014.
- EIA (Energy Information Administration). 2014. North Dakota Quick Facts. March 27, 2014. <http://www.eia.gov/state/?sid=nd>. Accessed December 16, 2014.
- EPA (US Environmental Protection Agency) and USACE (US Army Corps of Engineers). 2008. "Revised Guidance on Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision in *Rapanos v. United States* & *Carabell v. United States*." December 2. Available online at http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/cwa_guide/cwa_juris_2dec08.pdf.

- FAA (Federal Aviation Administration). 2012. Department of Defense Preliminary Screening Tool.
<https://oeaaa.faa.gov/oeaaa/external/gisTools/gisAction.jsp?action=showLongRangeRadarToolForm>. Accessed December 15, 2014.
- Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PE&RS, PE&RS, Vol. 77:858-864.
- Grover, S. 2002. Economic Impacts of Wind Power in Kittitas County, Final Report. Funded by State of Washington Office of Trade and Economic Development and the Energy Foundation. ECONorthwest. Portland, OR. 20 pp.
- Gullickson, G. *no date*. Bats of North Dakota. North Dakota Game and Fish and Bat Conservation International.
- Hagen, S.K., P.T. Isakson, and S.R. Dyke. 2005. North Dakota Comprehensive Wildlife Conservation Strategy. North Dakota Game and Fish Department. Bismarck, ND. 454 pp.
- Hoen, B, J. Brown, T. Jackson, R Wiser, M Thayer, and P Cappers. 2013. A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States. Lawrence Berkley National Laboratory. August 2013. Available at <http://emp.lbl.gov/sites/all/files/lbnl-6362e.pdf>
- Johnson, S. 2010. Nesting in numbers. ND Outdoors February 2010:14-17.
- Kochert, M. N. 1986. Raptors. Pages 313-349 in Inventory and monitoring of wildlife habitat. (Cooperrider, A. L., R. J. Boyd, and H. R. Stuart, Eds.) Chapter 16. U.S. Dep. Int., Bur. Land Manage., Serv. Center, Denver, CO.
- Kochert, M. N., K. Steenhof, C. L. McIntyre and E. H. Craig. 2002. Golden Eagle (*Aquila chrysaetos*). The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/684>. Leistriz, F. Larry and Randal C. Coon. 2009. "Socioeconomic Impacts of Developing Wind Energy in the Great Plains." Great Plains Research 10 (Spring 2009): 3-12.
- Lewis, J.C. 1995. Whooping Crane (*Grus americana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bnaproxy.birds.cornell.edu/bna/species/153>
- Menkens, G.E., Jr. and S.H. Anderson. 1987. Nest site characteristics of a predominantly tree-nesting population of golden eagles. Journal of Field Ornithology 58:22–25.
- MAPP (Mid-Continent Area Power Pool). 2009. Load and Capability Report. May 1, 2009. Available online at: <http://nocapx2020.info/wp-content/uploads/2009/08/2009-mapp-1c.pdf>, accessed December 2014.
- MISO. 2012. "Multi Value Project Portfolio; Results and Analyses." Miso Energy. January 10, 2012.

- <https://www.misoenergy.org/Library/Repository/Study/Candidate%20MVP%20Analysis/MVP%20Portfolio%20Analysis%20Full%20Report.pdf> (accessed December 16, 2014).
- Morkill, A.E. and S.H. Anderson. 1991. Effectiveness of marking powerlines to reduce sandhill crane collisions. *Wildlife Society Bulletin* 19: 442-449.
- Murphy, E. 2005. Lignite Reserves Dickinson 100k Sheet, North Dakota. Available online at: https://www.dmr.nd.gov/ndgs/Coalmaps/pdf/100k/dksn_100k_c.pdf. Accessed December 2014.
- Murphy, E. 2002. Caves in North Dakota. Available online at: https://www.dmr.nd.gov/ndgs/ndnotes/caves/caves_h.asp. Accessed December 2014. Murphy, R.K, S.M. McPherron, G.D. Wright, and K.L. Serbousek. 2009. Effectiveness of avian collision averters in preventing migratory bird fatality from powerline strikes in the central Platte River, Nebraska. 2008-2009 Final Report.
- Nagy, L., B. Gibson, K.L. Kosciuch, J. Jones, and J. Taylor. 2012. Whooping and Sandhill Crane Behavior at an Operating Wind Farm. Poster presented at National Wind Coordinating Committee Annual Research Meeting, Denver, CO.
- National Institute of Environmental Health Sciences. 2002. EMF-RAPID Program. EMF Electric and Magnetic Fields Associated with the Use of Electric Power. June 2002. Available online at http://www.niehs.nih.gov/health/assets/docs_p_z/results_of_emf_research_emf_questions_answers_booklet.pdf, accessed in December 2014.
- NatureServe. 2014. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://explorer.natureserve.org>, accessed December 2014.
- NextEra Energy Inc. 2014. Corporate Responsibility Report. <http://www.fplfeeds.com/pdf/www/>. Accessed January 2015.
- NDDMR (North Dakota Department of Mineral Resources) 2014. Oil and Gas Division well search: <https://www.dmr.nd.gov/oilgas/>. Accessed November 2014.
- NDDOT (North Dakota Department of Transportation). 2013 State Traffic Counts. <http://www.dot.nd.gov/road-map/traffic/index.htm>, accessed December 15, 2014.
- NDGF (North Dakota Game and Fish Department). 2012. Black-footed Ferret. Available online at: <http://gf.nd.gov/wildlife/fish-wildlife/id/mammals/carnivores/ferret>. Accessed December 2014.
- NDGS (North Dakota Geological Survey). 2014. Review of Coal Maps for resources in the Project Area. Available online: <https://www.dmr.nd.gov/ndgs/Coalmaps/>. Accessed November 2014.
- NDGS 2007. Surface Geology of Bratburg Butte Quadrangle, North Dakota. Map by Edward C. Murphy.
- NDGS 2006. Surface Geology of the Boyle Quadrangle, North Dakota. Map by Edward C. Murphy.

- NDGS 2005a. Surface Geology of the Davis Buttes Quadrangle, North Dakota. Map by Robert F. Biek.
- NDGS 2005b. Surface Geology of the Dickinson South Quadrangle, North Dakota. Map by Edward C. Murphy.
- NDGS 2005c. Surface Geology of the Lehigh Quadrangle, North Dakota. Map by Edward C. Murphy.
- NDGS. 1977. The Face of North Dakota – The Geologic Story, by John P. Bluemle. NDGS Educational Series 11.
- NDIC (North Dakota Industrial Commission). 2015. North Dakota Oil and Gas: ArcIMS Viewer. Available online: <https://www.dmr.nd.gov/OaGIMS/viewer.htm>
- NDIC. 2014. North Dakota Drilling Production Statistics. Available online at: <https://www.dmr.nd.gov/oilgas/stats/statisticsvw.asp>
- NDPR (North Dakota Parks and Recreation). 2015. "Dickinson Wind Energy Center in Stark County, North Dakota." Letter to Anne-Marie Griger. January 21, 2015.
- NDSWC (North Dakota State Water Commission). 2014. ND State Water Commission Map Service, Water Well Data. Available online: <http://www.swc.state.nd.us/4dlink2/4dcgi/wellsearchform/Map%20and%20Data%20Resources>, accessed November 2014.
- NRCS (Natural Resources Conservation Service). 2013. *Web Soil Survey* online tool, accessed February 2015 at <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>.
- NRCS. 2006. Land Resource Regions and Major Land Resource Areas of the United State, the Caribbean, and the Pacific Basin. USDA Handbook 296. Issued 2006.
- Pearce-Higgins, J.W., L. Stephen, A. Douse, and R.H.W. Langston. 2012. Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. *Journal of Applied Ecology* 49: 386-394.
- PSC (North Dakota Public Service Commission). 1979. PSC Guidelines: Energy Conversion and Transmission Facility Siting. November.
- SkyVector. 2014. Aeronautical Charts: Jurgens Airstrip Airport. Available online at <https://skyvector.com/airport/75ND/Jurgens-Airstrip-Airport>, accessed December 15, 2014.
- Stark County. 2010a. Stark County Comprehensive Plan: Background Report. http://www.starkcountynd.gov/index.asp?Type=B_BASIC&SEC={753D39CD-92E1-43BF-A325-3DEF4ACDBB7F}&DE={02C8E260-4298-45A1-8E70-8B4ECCD85AE5}, accessed December 5, 2014.
- Stark County. 2010b. Stark County Comprehensive Plan, Update: 2010. Available online at http://www.starkcountynd.gov/vertical/sites/%7B32FA3A56-B3F6-4B8B-A428-F9C97B78EC24%7D/uploads/Stark_County_Comp_Plan_2010.pdf, accessed December 2014.

- Tetra Tech. 2015a. Shadow Flicker Analysis for the Dickinson Wind Energy Center. Prepared for NextEra Energy Resources, LLC, February 2015.
- Tetra Tech. 2015b. Acoustic Assessment for the Dickinson Wind Energy Center. Prepared for NextEra Energy Resources, LLC, February 2015.
- Tetra Tech. 2015c. Whooping Crane Likelihood of Occurrence Report for the Dickinson Wind Energy Center. Prepared for NextEra Energy Resources, LLC, February 2015.
- Tetra Tech. 2015d. Bat Likelihood of Occurrence Report for the Dickinson Wind Energy Center. Prepared for NextEra Energy Resources, LLC, February 2015.
- Tetra Tech. 2013. Critical Issues Analysis for the Dickinson Wind Energy Center, Stark County, North Dakota. Prepared for NextEra Energy Resources, LLC, October 2013.
- USACE and EPA (U.S. Army Corps of Engineers and Environmental Protection Agency). 2007. Jurisdictional Determination Form Instructional Guidebook. Available online at http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/cwa_guide/jd_guidebook_051207final.pdf, accessed September 2014.
- U.S. Census Bureau. 2015. Stark County, North Dakota QuickFacts. <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>, accessed February 19, 2015.
- USDA (U.S. Department of Agriculture). 2014. Soil Survey Geographic (SSURGO) for Stark County, North Dakota. Available online: <http://SoilDataMart.nrcs.usda.gov/>, accessed on June 2014.
- USDA. 2012. 2012 Census of Agriculture, County Profile, Stark County. Available online at http://www.agcensus.usda.gov/Publications/2012/Online_Resources/County_Profiles/North_Dakota/cp38089.pdf, accessed December 2014.
- USDA NAIP (National Agriculture Imagery Program). 2014. Review of aerial photography using *NAIP Viewer*, accessed February 2015 at <http://www.gis.apfo.usda.gov/gisviewer>.
- USDOE. 2014. North Dakota 50-Meter Wind Resource Map, last updated February 18, 2014. http://www.windpoweringamerica.gov/maps_template.asp?stateab=nd and http://www.nrel.gov/gis/data_wind.html. Accessed October 2011.
- USDOE (U.S. Department of Energy). 2015. Renewable Electricity Production Tax Credit (PTC). Available online at http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=US13F, accessed February 2015.
- USFWS (U.S. Fish and Wildlife Service). 2014a. National Wetland Inventory (NWI) using *Wetlands Mapper* online tool, accessed February 2015 at <http://www.fws.gov/wetlands/data/mapper.HTML>.
- USFWS. 2014b. Species by County Report: Stark County, ND. Available online at: http://ecos.fws.gov/tess_public/countySearch!speciesByCountyReport.action?fips=38089. Accessed December 2014.
- USFWS. 2014c. Winter 2013-2014 Whooping Crane Survey Results. Available online at

<http://www.fws.gov/nwrs/threecolumn.aspx?id=2147544385>.

- USFWS. 2014d. Black-footed Ferret. Available online at: <http://www.fws.gov/mountain-prairie/species/mammals/blackfootedferret/>. Accessed December 2014.
- USFWS. 2014e. Gray Wolf (*Canis lupus*). Available online at: <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?scode=A00D>. December 2014.
- USFWS. 2014f. Gray Wolves in the Northern Rocky Mountains. <http://www.fws.gov/mountain-prairie/species/mammals/wolf/>, accessed December 2014.
- USFWS. 2013a. Final U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines. March 2013. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf, accessed May 2013.
- USFWS. 2013b. North Dakota Field Office Mountain-Prairie Region: Species of Habitat Fragmentation Concern. Available online at: http://www.fws.gov/northdakotafieldoffice/species_of_habitat_fragmentation.htm. Accessed February 2015.
- USFWS. 2013c. Eagle Conservation Plan Guidance Module I – Land Based Wind Energy. Available online at: <http://www.fws.gov/windenergy/pdf/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf>. Accessed February 2015.
- USFWS. 2012b. “Endangered and Threatened Wildlife and Plants; Removal of the Gray Wolf in Wyoming From the Federal List of Endangered and Threatened Wildlife and Removal of the Wyoming Wolf Population’s Status as an Experimental Population,” *Federal Register* 77:55530– 55604.
- USFWS. 2011. Flyways. Retrieved from: <http://flyways.us/flyways/info> Accessed December 2014.
- USFWS. 2010. Fact sheet: Black-footed ferret (*Mustela nigripes*). Available online at: <http://www.fws.gov/mountain-prairie/factsheets/Black-Footed-Ferret.pdf>. Accessed December 2014.
- USFWS. 2009. Wetland Easements. <http://www.fws.gov/longlake/wetland%20easements.htm>, accessed December 2, 2009.
- USGS (US Geological Survey). 2014. Map of Faults in the U.S. known to generate earthquakes with magnitudes of 6 or greater. Available online: <http://earthquake.usgs.gov/hazards/qfaults/>. Accessed November 10, 2014.
- USGS. 2010. National Hydrography Dataset (NHD), *NHD Viewer* online tool, accessed February 2015 at <http://viewer.nationalmap.gov/viewer/nhd.html?p=nhd>.
- USGS. 2008. National Seismic Hazard Maps. – 2008. Available online: <http://gldims.cr.usgs.gov/website/nshmp2008/viewer.htm>, accessed November 2014.
- USGS. 1975. Geology and Groundwater Resources of Hettinger and Stark Counties, North Dakota, by Henry Trapp Jr. and M. G. Croft. North Dakota State Water Commission County Groundwater Studies 16 – Part 1.

13. DEFINITIONS

AADT	Average Annual Daily Traffic
APE	Area of Potential Effects
Asynchronous Generator	A cage-wound generator, also called an induction generator, used to generate alternating current
BBCS	Bird and Bat Conservation Strategy
BGEPA	Bald and Golden Eagle Protection Act
BMPs	Best Management Practices; prevents soil erosion and sedimentation
capacity	The capability of a system, circuit, or device for storing electronic charge
Certificate	Certificate of Site Compatibility
CRP	Conservation Reserve Program
CUP	Conditional Use Permit
Distribution	Relatively low-voltage lines that deliver electricity to the retail customer's home or business
Electromechanical	Of, relating to, or being a mechanical process or device actuated or controlled electrically; especially being a transducer for converting electrical energy to mechanical energy
EMF	Electromagnetic Field
EPC	Engineering, procurement, and construction
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
GE	General Electric
Gearbox	An assembly of parts including the speed-changing gears and the propeller shaft by which the power is transmitted from an automobile engine to a live axle; the speed-changing gears in such an assembly
Generator	A machine by which mechanical energy is changed into electrical energy
Geotechnical	A science that deals with the application of geology to engineering
Hub	The central part of a circular object (as a wheel or propeller)
Interconnection	To be or become mutually connected
kV	kilovolt
m/s	meters per second
Mph	miles per hour
MW	megawatt
MAPP	Mid-Continent Area Power Pool
Micrositing	The process in which the wind resources, potential environmentally sensitive areas, soil conditions, and other site factors, as identified by local, state and federal agencies, are evaluated to locate wind turbines and associated facilities.
MISO	Midwest Independent System Operator
NDDOT	North Dakota Department of Transportation
NDAC	North Dakota Administrative Code
NDCC	North Dakota Century Code

NDGF	North Dakota Game and Fish Department
NDGS	North Dakota Geological Survey
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NTIA	National Telecommunications and Information Administrations
NWI	National Wetlands Inventory
NWP	Nationwide Permit
O&M	Operations and maintenance
Pitch	The action or a manner of pitching; especially an up-and-down movement
PLOTS	Private Lands Open to Sportsmen
Project, the	Dickinson Wind Energy Center
PSC	North Dakota Public Service Commission
PTC	Production Tax Credit
Resistance	The opposition offered by a body or substance to the passage through it of a steady electric current
Rotor	The rotor consists of three blades mounted to a rotor hub
rpm	Revolutions per minute
SCADA	Supervisory Control and Data Acquisitions (communications technology)
SHPO	North Dakota State Historic Preservation Office
Step-up Transformer	A transformer that increases voltage
Substation	A subsidiary station in which electric current is transformed
SWPPP	Storm Water Pollution Prevention Plan
Torque	A force that produces or tends to produce rotation or torsion; also a measure of the effectiveness of such a force that consists of the product of the force and the perpendicular distance from the line of action of the force to the axis of rotation : a turning or twisting force
Transformer	An electrical device by which alternating current of one voltage is changed to another voltage
Transmission	An assembly of parts including the speed-changing gears and the propeller shaft by which the power is transmitted from an automobile engine to a live axle; the speed-changing gears in such an assembly
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WoUS	water of the United States
WRRS	Wildlife Response and Reporting System
Yaw	To deviate erratically from a course (as when struck by a heavy sea); especially to move from side to side: to turn by angular motion about the vertical axis

FIGURES

Appendix A
Studies and Assessments

Appendix B
Agency Correspondence
