

**STATE OF MINNESOTA
PUBLIC UTILITIES COMMISSION**

David Boyd
J. Dennis O'Brien
Tom Pugh
Phyllis Reha
Betsy Wergin

Chair
Commissioner
Commissioner
Commissioner
Commissioner

In the Matter of the Application of
Paynesville Wind, LLC for a Site Permit
for a 95 Megawatt Large Wind Energy
Conversion System in Stearns County

ISSUE DATE:

**DOCKET NO.
IP-6830/WS-10-49**

**FINDINGS OF FACT, CONCLUSIONS
OF LAW, AND ORDER ISSUING A
SITE PERMIT TO PAYNESVILLE
WIND, LLC FOR THE PAYNESVILLE
WIND FARM**

The above-entitled matter came before the Minnesota Public Utilities Commission (Commission) on January 29, 2010, pursuant to an application submitted by Paynesville Wind, LLC (Paynesville Wind or Applicant) for a site permit to construct, operate, maintain, and manage the Paynesville Wind Farm (Project), a 95 Megawatt (MW) nameplate capacity Large Wind Energy Conversion System (LWECS), including associated facilities, in Stearns County.

All of the proposed wind turbines and associated facilities will be located in Stearns County. Associated facilities will include pad mounted step-up transformers for each wind turbine, access roads, an electrical collection system including feeder and collector lines, a permanent meteorological tower, a Sonic Detection and Ranging unit or Light Detection Ranging unit, a project substation, and a metering yard. The energy from the proposed 95 MW Project will be delivered from the project substation via a 69 kV transmission line, which is anticipated to be permitted locally by Stearns County, to the existing Paynesville Substation in Paynesville Township in Stearns County.

STATEMENT OF ISSUE

Should the Applicant be granted a site permit under Minnesota Statutes section 216F.04 to construct a 95 MW Large Wind Energy Conversion System in Stearns County?

Based upon the record created in this proceeding, the Public Utilities Commission makes the following findings:

FINDINGS OF FACT

Background and Procedure

1. On January 29, 2010, Paynesville Wind filed an application with the Public Utilities Commission for up to 95 megawatts of nameplate wind power generating capacity identified as the Paynesville Wind Farm in Stearns County.¹
2. Office of Energy Security (OES) Energy Facility Permitting (EFP) staff reviewed and determined that the application complied with the application requirements of Minnesota Rule 7854.0500.²
3. On March 9, 2010, a Commission Order was issued accepting the application for the Paynesville Wind Farm.³
4. On March 18, 2010, OES EFP staff issued a notice of application acceptance and scoping meeting.⁴ This notice was posted on eDockets on March 30, 2010, and on the Commission's website on March 23, 2010.
5. Published notice of site permit application acceptance and opportunity to comment on the permit application and issues to consider in the development of a draft site permit appeared in the *Cold Spring Record* on March 30, 2010, and *The Paynesville Press* on March 31, 2010.⁵ The published notice provided: a) description of the proposed project; b) deadline for public comments on the application; c) description of the site permit review process; and d) identification of the public advisor. The notice published meets the requirements of Minnesota Rule 7854.0600, subpart 2. The notice was also published in the *EQB Monitor* on March 22, 2010.⁶
6. On March 23, 2010, the Applicant distributed copies of the site permit application and notice of application acceptance to government agencies and to landowners within the project boundary.⁷ The notice was distributed only to those who received the application pursuant to subpart 3. Therefore, not every township board and city council within Stearns County received a notice as required in subpart 2. All township boards and city councils within Stearns County were notified of the availability of the draft site permit as stated in Finding 11.
7. Public comments on the site permit application and issues to consider in the development of a draft site permit were accepted until May 10, 2010. Several comments that came in after the deadline were also reviewed as part of the comment period. OES EFP staff received 32 written comments during the comment period from 26 individuals.⁸

¹ Exhibit 1.

² Exhibit 2.

³ Exhibit 3.

⁴ Exhibit 4.

⁵ Exhibit 5.

⁶ Exhibit 6.

⁷ Exhibit 7.

⁸ Exhibit 8.

Approximately 115 people attended the public meeting that was held on April 29, 2010, in Lake Henry to receive comments on the scope of the environmental report and issues to be considered in developing the draft site permit. An oral record of the meeting was posted on eDockets.⁹

8. On May 27, 2010, OES EFP staff recommended that a draft site permit be issued and distributed for public comment.¹⁰
9. On June 4, 2010, a Commission Order made a preliminary determination that a draft site permit may be issued.¹¹
10. On June 16, 2010, OES EFP staff issued a notice of availability of the draft site permit.¹² The notice met the requirements of Minnesota Rule 7854.0900, subpart 1. This notice was posted on eDockets on June 21, 2010, and posted on the Commission website on June 16, 2010. The notice was published in the *Cold Spring Record* on June 22, 2010, *The Paynesville Press* on June 23, 2010, and in the *EQB Monitor* on June 28, 2010.¹³ Notice was sent to interested persons and government agencies.¹⁴ Distribution of the notice of availability of the draft site permit met the requirements in subpart 2.
11. On August 11, 2010, OES EFP issued a notice of public hearing and availability of the environmental report and draft site permit.¹⁵ This notice was posted on eDockets and the Commission website on August 12, 2010. Published notice of the public hearing and availability of the draft site permit and environmental report appeared in the *Cold Spring Record* on August 17, 2010, *The Paynesville Press* on August 18, 2010, *St. Cloud Times* on August 13, 2010, and the *EQB Monitor* on August 23, 2010, as required by Minnesota Rule 7854.0900, subpart 2.¹⁶ Notice was sent to interested persons and government agencies as required by Minnesota Rule 7854.0900, subpart 2.¹⁷ Notice was also sent to landowners in the Project area.¹⁸ The deadline for submitting comments on the draft site permit was September 8, 2010.
12. Public hearings were held on the afternoon and evening of August 25, 2010, in Paynesville, Minnesota, presided over by Administrative Law Judge Raymond Krause from the Office of Administrative Hearings. Approximately 50 people attended the public hearing and 22 people offered testimony. A court reporter prepared a record of the public hearing.¹⁹

⁹ Exhibit 9.

¹⁰ Exhibit 10.

¹¹ Exhibit 11.

¹² Exhibit 12.

¹³ Exhibits 13 and 14.

¹⁴ Exhibit 13.

¹⁵ Exhibit 15.

¹⁶ Exhibits 17 and 18.

¹⁷ Exhibit 15.

¹⁸ Exhibit 16.

¹⁹ Exhibit 19.

13. On September 22, 2010, Administrative Law Judge Raymond Krause filed a “Summary of Public Testimony.”²⁰ Written comments were also posted on eDockets.²¹

Certificate of Need

14. The Applicant is seeking a certificate of need because the Project is a large energy facility as defined by Minnesota Statutes section 216B.2421.²²

Permittee

15. Paynesville Wind is a wholly owned subsidiary of Geronimo Wind Energy, which may sell or assign the Project at any time.²³
16. Paynesville Wind does not have a power purchase agreement or other enforceable mechanism for the sale of the power to be generated by the Project.

Interconnection Agreement

17. Paynesville Wind does not yet have an interconnection agreement.

Project Description

18. The Project will be comprised of up to 60 General Electric (GE) 1.6 MW wind turbine generators, up to 53 Vestas 1.8 MW turbines, or up to 42 Siemens 2.3 MW wind turbine generators.²⁴ The Project name plate capacity will be 95 MW. Associated facilities will include pad mounted step-up transformers for each wind turbine, access roads, an underground electrical collection system (feeder and collector lines), a permanent meteorological tower, a Sonic Detection and Ranging unit or Light Detection Ranging unit, a project substation, and possibly a metering yard. The Project’s turbine locations and associated facilities are shown on maps posted on eDockets on November 9, 2010, and are attached to the site permit.²⁵
19. Because Midwest Independent Transmission System Operator (MISO) is currently reviewing interconnection facilities for this Project, it is unclear how electricity will be delivered to the point of interconnection at the existing Paynesville Substation. In its application, the Applicant anticipated delivery of power through a collection system to two separate locations, both of which will connect to the existing Paynesville Substation. The electricity from a group of turbines totaling 50 MW would be transported via the collection system, operating at 34.5 kV, to the project substation, which will step up the voltage to 69 kV and be transported on a new 69 kV line of less than one mile in length to

²⁰ Exhibit 20.

²¹ Exhibit 21.

²² Exhibit 1 at 1-4.

²³ *Id.* at 1-5.

²⁴ *Id.* at 4-1 and Exhibit 22.

²⁵ Exhibit 25.

the Paynesville substation.²⁶ The electricity from the remaining turbines would be transported via the 34.5 kV collection system and delivered to a new metering yard adjacent to the Paynesville substation where it would connect to the Paynesville substation.²⁷ Paynesville Wind is also considering delivering all 95 MW of electricity to a Project substation that could be located near the existing substation or up to approximately four miles north of the existing substation.²⁸ This may include an alteration of the line voltage as initially described in its application.²⁹ The turbine layout maps attached to the site permit (see Attachment 1) include three possible substation locations. Two possible substation locations are shown on maps submitted by the Applicant at Exhibit 25.

20. The 34.5 kV electrical collection system will be undergrounded by trenching, plowing, or drilling the cables.³⁰ The electrical collection system will only be located above ground when shallow bedrock, restrictive environmental conditions, or conflicts with underground utility infrastructure are encountered.³¹ Because shallow bedrock is not present and Stearns County has an ordinance requiring that all feeder lines be buried unless shallow bedrock is present, section 13.1.1 of the site permit requires that the collector and feeder lines be underground.
21. The 69 kV transmission line will be permitted by Stearns County. The operation and maintenance building will be permitted by Stearns County or the township where the facility will be located, and will likely be outside the Project area.³²
22. The turbine towers will be either 262.5 feet (80 meters) or 328 feet (100 meters) in height.³³ Based on turbines under consideration, the total height of the tower and blade in the vertical position will range from approximately 398 feet (121.25 meters) to 428 feet (130.5 meters) if the 80 meter towers are selected. The total height of the tower and blade in the vertical position will range from approximately 463 feet (141.25 meters) to 493.8 feet (150.5 meters) if the 100 meter towers are selected. The rotor diameter for the GE turbine is 270 feet (82.5 meters) and the rotor swept area is 50,127 square feet (4,657 square meters). The rotor diameter for the Siemens turbine is 331 feet (101 meters) and the rotor swept area is 86,111 square feet (8,000 square meters). The rotor diameter for the Vestas turbine is 295 feet (90 meters) and the rotor swept area is 68,477 square feet (6,361 square meters). The GE turbine has a rotor speed that varies from 9 to 18 revolutions per minute, a cut-in wind speed of 7.8 miles per hour, and a cut-out wind speed of 56 miles per hour. The Siemens turbine has a rotor speed that varies from 6 to 16 revolutions per minute, a cut-in wind speed of 8.9 miles per hour, and a cut-out wind speed of 56 miles per hour.³⁴ The Vestas turbine has a rotor speed that varies from 9 to

²⁶ Exhibit 1 at 2-3.

²⁷ *Id.*

²⁸ Exhibit 25.

²⁹ *Id.*

³⁰ Exhibit 1 at 2-3.

³¹ *Id.*

³² *Id.* at 1-3.

³³ Exhibit 22.

³⁴ Exhibit 1 at 2-2.

14.9 revolutions per minute, a cut-in wind speed of 7.8 miles per hour, and a cut-out wind speed of 56 miles per hour.³⁵

23. Paynesville Wind will select a turbine type as the Project nears construction to ensure the selection of the most cost-effective, available, and optimal design for the Project site.³⁶ The GE, Vestas, and Siemens turbines have a similar rotor and nacelle design. The rotor consists of three blades, composed of carbon fibers and fiberglass, mounted to the hub, which is attached to the nacelle that houses the main components of the wind turbine, including the gearbox, generator, and the main control panel. The yaw system automatically directs the orientation of the rotor into the wind based on the wind vane readings from the top of the nacelle. Electricity is produced by the generator and transmitted through insulated cables to the power conditioning unit known as a pad mount transformer located at the base of the tower.
24. Paynesville Wind is considering towers either 80 or 100 meters in height.³⁷ The Applicant requested the 100 meter tower option in comments e-filed on August 24, 2010 (see Exhibit 22). The Applicant believes that additional energy will be generated if taller towers are used. Towers will be solid tubular in design and are painting a non-glare white. The tower foundation will be located below ground level except for approximately 18 inches that will remain above-ground, allowing the tower to be appropriately bolted to the foundation.³⁸ The expected tower foundation will be a spread foundation design.³⁹
25. The Project will have one permanent meteorological tower and either a Sonic Detection and Ranging (SODAR) or (Light Detection Ranging) LIDAR unit as part of the associated facilities for this LWECs Project.⁴⁰ The meteorological tower will be free standing, made of galvanized steel, and lighted as required by the Federal Aviation Administration.
26. All turbines and the permanent meteorological tower will be interconnected with fiber optic communication cable that will be installed underground. The communication cables will run back to a central host computer, which will be located either at the Project substation or at the operations and maintenance facility where a supervisory control and data acquisition (SCADA) system will be located. Signals from the current and potential transformers at each of the delivery points will also be fed to the central SCADA host computer. This computerized supervisory network will provide detailed operating and performance information for each wind turbine. The Permittee will maintain a computer program and database for tracking each wind turbine's maintenance history and energy production.

³⁵ *Id.*

³⁶ *Id.* at 2-1.

³⁷ *Id.* at 4-3 and Exhibit 22.

³⁸ Exhibit 1 at 2-1.

³⁹ *Id.*

⁴⁰ *Id.* at 2-4.

27. Paynesville Wind expects to begin commercial operation in the third quarter of 2011.⁴¹
28. The estimated Project capital costs are estimated to be \$197 million and ongoing operations and maintenance are estimated to be \$4.8 million per year.⁴² If the 100 meter towers are selected, costs will increase approximately \$150/kW to \$240/kW, which would bring the total estimated capital costs to \$206.5 million.⁴³

Site Location, Characteristics and Topography

29. The proposed Project will be located in Stearns County, in Paynesville (section 5), Zion (sections 4-9, 16-22, 29-32), Spring Hill (section 36), and Lake Henry (sections 1, 11-13, 22-27) townships in southern Stearns County. The Project area is located north of Paynesville and south and east of Lake Henry. The Project site encompasses approximately 15,000 acres, which is primarily agricultural land.⁴⁴ Corn, soybeans and livestock, especially dairy cattle, make up the agriculture-based economy.⁴⁵ Elevation varies from 1,161 to 1,332 feet above mean sea level.⁴⁶ The Project area is nearly level to gently sloping.⁴⁷ Wind turbine and access roads are sited to take into account the contours of the land to minimize impact.
30. Construction of the turbines sites and access roads will involve temporarily disturbing land within the Project area. Temporary access roads will be approximately 40 feet wide and permanent access roads will be approximately 16 to 33 feet wide using crushed rock.⁴⁸ Total miles of access roads will be approximately nine miles, depending on final turbine layout.⁴⁹

Wind Resource Considerations

31. Wind monitoring within the Project area indicates that the long-term predicted mean wind speed for the Project is 7.63 meters per second (17.08 miles per hour).⁵⁰ Paynesville Wind expects a range of long-term mean annual 80 meter (262 feet) wind speeds will be 7.6 to 7.9 meters per second (17 to 17.676 miles per hour).⁵¹ Wind speeds are generally greater in the night and early morning hours and decline at midday. Regionally, the prevailing wind directions are generally south and northwest. In general, a higher percentage of the annual energy budget results from southerly winds, which are most frequent in the warmer weather months. The north and northwest winds typically occur in winter.

⁴¹ *Id.* at 4-10.

⁴² *Id.* at 3-6.

⁴³ Exhibit 22 (Applicant's post-hearing comments).

⁴⁴ Exhibit 1 at 1-2 and 5-1.

⁴⁵ *Id.* at 5-1.

⁴⁶ *Id.* at 5-21.

⁴⁷ *Id.*

⁴⁸ *Id.* at 2-3.

⁴⁹ Exhibit 25.

⁵⁰ Exhibit 1 at 3-1 to 3-2.

⁵¹ *Id.* at 3-1.

32. For this Project, turbines will be generally sited in short strings or clusters within the site boundaries. Wind turbines are sited to have good exposure to winds from all directions with emphasis on exposure to the prevailing wind directions while considering site topography, natural resource features, setbacks and wind resources. The turbines are typically oriented west-southwest to north-northeast, which is roughly perpendicular to the prevailing southerly and northwest winds. Turbine placement, aside from other resource features where setbacks or wind access buffers are required, will be designed to provide sufficient spacing between the turbines to minimize internal wake losses. Given the prevalence for southerly and northerly winds, the spacing is widest in the north-south direction. Greater or lesser spacing between the turbines or turbine strings may be used in areas where terrain dictates the spacing. Sufficient spacing between the turbines is utilized to minimize wake losses when the winds are blowing parallel to the turbines. Wake loss occurs when a turbine is spaced too close downwind of another turbine, and therefore, produces less energy and is less cost-effective. Section 4.10 of the site permit addresses turbine spacing.
33. According to the application, projected average net annual output will be approximately 291,270 to 332,880 MWh (megawatt hours).⁵² If 100 meter towers are used, the projected average net annual output will increase approximately 41,000 MWh to 47,000 MWh.⁵³

Wind Rights and Easement/Lease Agreements

34. In order to build a wind facility, a developer must secure leases or easement agreements to ensure access to the site for construction and operation of a proposed project. These lease or easement agreements also prohibit landowners from any activities that might interfere with the execution of the proposed Project. Land and wind rights will need to encompass the proposed LWECS, including all associated facilities such as access roads, meteorological towers, and electrical collection system.
35. The Applicant has executed easement agreements that grant Paynesville Wind the necessary wind rights for the construction and operation of the Project. Within the approximately 15,000 acres site, the Applicant has easement agreements for approximately 11,500 acres.⁵⁴ Section 10.1 of the site permit requires the Applicant to demonstrate it has obtained the wind rights necessary to construct and operate the Project at least 10 working days before the pre-construction meeting.

Site Considerations

36. Minnesota Statutes chapter 216F and Minnesota Rules chapter 7854 apply to the siting of LWECS. The rules require an applicant to provide a substantial amount of information to allow the Commission to determine the potential environmental and human impacts of the proposed project and whether the project is compatible with environmental

⁵² *Id.* at 3-6.

⁵³ Exhibit 22 (Applicant's post-hearing comments).

⁵⁴ Exhibit 1 at 2-4.

preservation, sustainable development, and the efficient use of resources.⁵⁵ Pursuant to Minnesota Statutes section 216F.02, certain sections in Minnesota Statutes chapter 216E (Minnesota Power Plant Siting Act) apply to siting LWECS, including section 216E.03, subdivision 7 (considerations in designating sites and routes). The analysis of the environmental impacts required by Minnesota Rule 7854.0500, subpart 7, satisfies the environmental review requirements; no environmental assessment worksheet or environmental impact statement is required for a proposed LWECS project.⁵⁶ Therefore, environmental review is based on the application and the record. The following analysis addresses the relevant considerations to be applied to a LWECS project.

Human Settlement

37. The site is in an area of relatively low population density, which is characteristic of rural areas throughout Minnesota. Population densities range from 9 people per square mile in Lake Henry Township to 46 people per square mile in Paynesville Township.⁵⁷ The population of the city of Lake Henry, which is adjacent to the Project, was estimated at 78 in 2009, and has decreased over the last decade.⁵⁸ The city of Paynesville, which is located 1.5 miles south of the Project, had a population of 2,313 in 2009.⁵⁹ In 2009, Stearns County had an estimated population of 148,671.⁶⁰
38. Since December 2009, Stearns County has had authority to permit LWECS up to 25 MW under Minnesota Statute section 216F.08. The Project area is located in an area zoned for agricultural use (A-160 (most restrictive), A-80 (some restrictions), and A-40 (least restrictive)), most of which is zoned A-80.⁶¹
39. The Applicant has committed to a setback of 750 feet to all residences, regardless of whether that landowner is a participant in the Project, and will not site turbines less than 1,000 feet from residences unless other arrangements have been made with certain landowners.⁶² Preliminary turbine layouts on the Applicant's constraint maps show setbacks from residences at 1,000 feet (see Exhibit 25). Stearns County requires a setback of 750 feet from residences. Section 4.2 of the site permit incorporates this setback. Paynesville Wind will also be required to set back its turbines a minimum of five rotor diameters (between 1,350 feet and 1,655 feet, depending on turbine selection) on the prevailing wind axis from non-participating landowners' property lines and three rotor diameters (between 810 feet and 993 feet, depending on turbine selection) on the non-prevailing wind axis; this condition can be found in section 4.1 of the site permit. Paynesville Wind's proposed Project design must comply with the Minnesota Pollution

⁵⁵ Minn. Stat. § 216F.03 and Minn. R. 7854.0500.

⁵⁶ Minn. R. 7854.0500, subp. 7.

⁵⁷ Exhibit 1 at 5-1 (using 2009 data).

⁵⁸ Department of Administration, Office of Geographic and Demographic Analysis, State Demographic Center, <http://www.demography.state.mn.us/resource.html?Id=19243> (follow hyperlink).

⁵⁹ Department of Administration, Office of Geographic and Demographic Analysis, State Demographic Center, <http://www.demography.state.mn.us/resource.html?Id=19243> (follow hyperlink).

⁶⁰ Department of Administration, Office of Geographic and Demographic Analysis, State Demographic Center, <http://www.demography.state.mn.us/resource.html?Id=19244> (follow hyperlink).

⁶¹ Stearns County, <http://www.co.stearns.mn.us/Environment/LandUseandAgriculture/PlanningandZoning>.

⁶² Exhibit 1 at 1-3.

Control Agency (PCA) noise standards pursuant to Minnesota Rules Chapter 7030. A table of setbacks is included in the Applicants comments submitted November 9, 2010 (see Exhibit 25).

40. Stearns County requires a setback from road rights-of-way of 250 feet or 1.1 times the total height of the tower, whichever is greater. However, the Stearns County Chair of the Board of Commission submitted comments stating the board does not object to a 250 foot setback, provided the setback is measured from the road to the tip of the blade, not the tower.⁶³ The Applicant agreed to the Stearns County suggested setback in its comments, dated September 8, 2020.⁶⁴ Section 4.4 of the site permit requires that turbines not be located closer than 250 feet from the nearest public road right-of-way. Preliminary turbine layouts show that the Applicant will meet or exceed this setback.
41. There will be no displacement of existing residences or structures in siting the wind turbines and associated facilities. The impact of the proposed Project on human settlement and public health and safety will be minimal.

Noise

42. Wind turbines generate sound or noise when in motion. The level of sound (noise) varies with the speed of the turbine, the distance of the listener or receptor from the turbine, and surface characteristics of the site. Operation and maintenance of wind turbines and associated facilities increases noise levels. However, increases in noise levels are expected to be minimal due to the noise levels produced by the wind itself. Background noise levels in the Project area are typical of those in a rural setting, where existing nighttime noise levels are commonly in the low to mid-30 dBA. The dBA scale represents A-weighted decibels based on the range of human hearing.
43. Noise impacts to nearby residents will be factored into the turbine micro-siting process. The Applicant must demonstrate the Project can meet the noise standard pursuant to Minnesota Rules chapter 7030 (site permit, sections 4.2 and 4.3). Noise levels predicted by computer models were compared to the Minnesota Pollution Control Agency (PCA) Daytime and Nighttime L10 and L50 Limits as stated in Minnesota Rule 7030.0040. These standards describe the limiting levels of sound established on the basis of present knowledge for the preservation of public health and welfare. These standards are consistent with speech, sleep, annoyance, and hearing conversation requirements for receivers within areas grouped according to land activities by the Noise Area Classification (NAC) system established in Minnesota Rule 7030.0050. The NAC-1 was chosen for receivers in the Project Area since this classification includes farm houses as household units. Daytime and nighttime limits for this classification are: (1) L50 limit of 60 dBA and L10 limit of 65 dBA in daytime and (2) L50 limit of 50 dBA and L10 limit of 55 dBA at nighttime. The nighttime L50 limit of 50 dBA is the most stringent limit.

⁶³ Exhibit 23.

⁶⁴ Exhibit 22 (Applicant's post-hearing comments).

44. The Applicant analyzed noise for the Vestas V90 1.8 MW, Siemens 101 SWT 2.3 MW, and the GE 1.6 MW turbine, which replaces the GE 1.5 MW turbine option in its application. Sound is generated from the wind turbine at points near the hub or nacelle, 80 to 105 meters in the air, from the blade tips as they rotate.⁶⁵ According to the manufacturers' noise data, sound power levels are 106 dBA for the GE turbine, 103.5 dBA for the Vestas turbine, and 107 dBA for the Siemens turbine.⁶⁶ The Applicant used Cadna-A, an acoustical analysis software, for its noise modeling. The modeling did not consider project-specific terrain and assumed flat ground to reduce the opportunity for terrain to potentially block the line-of-sight between turbines and receptors.⁶⁷ The Applicant used a ground absorption factor of 0.7, which is suggested by the Ontario Ministry of the Environment.⁶⁸ In addition, the modeling conservatively calculated the noise levels at all receptors by assuming that the wind blows in all directions all the time.⁶⁹ The Applicant also applied a five dBA buffer suggested in the Minnesota Department of Health white paper, *Public Health Impacts of Wind Turbines*, and anticipates that noise levels will not exceed 45 dBA at noise receptors.⁷⁰
45. Cumulative noise impacts resulting from multiple turbine strings were analyzed and geographically represented in maps in the application.⁷¹ The GE 1.6 MW turbine noise map can be found in the Applicant's post-hearing comments at Exhibit 22. The modeling conducted by the Applicant demonstrates that sound levels for all three turbine layouts are expected to be below 50 dBA at all receptors. The Applicant will conduct noise modeling on preliminary turbine layouts on 100 meter towers.⁷² However, the Applicant does not anticipate any additional mitigation would be necessary if 100 meter towers were used.⁷³
46. Section 6.6 of the site permit requires Paynesville Wind to conduct a post-construction noise study. The noise study will determine the noise levels at different frequencies and at various distances from the turbines at various wind directions and speeds. The purpose of the post-construction noise study is to confirm the PCA noise standards have been met.

Shadow Flicker

47. Concerns regarding shadow flicker were raised during both public comment periods.⁷⁴ Shadow flicker is described as a moving shadow on the ground resulting in alternating changes in light intensity. Shadow flicker computer models simulate the path of the sun over the year and assess at regular time intervals the possible shadow flicker across a project area. The outputs of the model are useful in the design phase of a wind farm. Generally, shadow flicker occurs in the morning and evening hours when the sun is low

⁶⁵ Exhibit 1 at 5-3.

⁶⁶ *Id.*

⁶⁷ *Id.* at 5-4

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ *Id.*

⁷¹ *See id.* at figures 5-2 and 5-3 .

⁷² Exhibit 22 (Applicant's post-hearing comments).

⁷³ *Id.*

⁷⁴ Exhibits 8, 9, 19, 20, and 21.

in the horizon and the shadows are elongated. Shadow flicker does not occur when the turbine rotor is oriented parallel to the receptor or when the turbine is not operating. In addition, no shadow flicker will be present when the sun seen from a receptor is obscured by clouds, fog, or other obstacles already casting a shadow such as buildings and trees.

48. Shadow intensity, or how “light” or “dark” a shadow appears at a specific receptor, will vary with the distance from the turbine. Closer to a turbine, the blades will block out a larger portion of the sun’s rays and shadows will be wider and darker. Receptors located farther away from a turbine will experience much thinner and less distinct shadows since the blades will not block out as much sunlight. Shadow flicker will be greatly reduced or eliminated within a residence when buildings, trees, blinds, or curtains are located between the turbine and receptor. Shadow flicker consultants generally agree that flicker is not noticeable beyond about 10 rotor diameters from a wind turbine.⁷⁵ Evidence of health effects from shadow flicker is scant, suggesting that it is more of a nuisance issue. Minnesota has no published standards for shadow flicker and no examples of turbines causing photosensitivity related problems. Several jurisdictions in other countries have established guidelines for acceptable levels of shadow flicker based on certain assumptions. The site permit does not contain shadow flicker limits.
49. The Applicant discussed shadow flicker in its comments, dated September 8, 2010. Paynesville Wind plans to engage a consultant, using a widely-accepted software package such as WindPro or GH WindFarmer, to perform shadow flicker modeling for the final turbine layout.⁷⁶ The model will use actual data from the Project, such a coordinates of receptors, digital elevation data to account for topography, and the physical characteristics of the selected wind turbine.⁷⁷ The use of 100 meter towers would likely increase shadow flicker impacts. Section 6.2 of the site permit requires the Paynesville Wind to provide data on the duration of shadow flicker on each residence, noting whether the residence is on property that is participating in the Project, and documentation of efforts to minimize shadow flicker impacts.

Visual Values

50. The placement of up to 60 General Electric (GE) 1.6 MW wind turbine generators, 53 Vestas 1.8 MW turbines, or 42 Siemens 2.3 MW wind turbine generator for the Paynesville Wind Farm will affect the appearance of the area. The wind turbines will be mounted on tubular towers that are either approximately 262 feet (80 meters) or 328 feet (100 meters) tall. The rotor blades will have a diameter between 270 and 331 feet. The turbine towers and rotor blades will be prominent features on the landscape. There will be intermittent, expansive views of the turbines to passing motorists on State Trunk Highways 4 and 55 in addition to nearby roads.⁷⁸ Further, the Project may be visible to

⁷⁵ Environmental Health Division, Minnesota Department of Health, *Public Health Impacts of Wind Turbines*, May 22, 2009, at 14, available at <http://energyfacilities.puc.state.mn.us/documents/Public%20Health%20Impacts%20of%20Wind%20Turbines,%205.22.09%20Revised.pdf>.

⁷⁶ Exhibit 22 (Applicant’s post-hearing comments).

⁷⁷ *Id.*

⁷⁸ Exhibit 1 at 33-34.

residents of the cities of Paynesville and Lake Henry and users of public lands (see Findings 73 to 78 for a discussion on recreational resources).

51. The visual impact of the wind turbines will be reduced by the use of a neutral paint color. The only lights will be those required by the Federal Aviation Administration (site permit section 7.18). All site permits issued by the Commission require the use of tubular towers; therefore, the turbine towers will be uniform in appearance. Blades used in the proposed Project will be white or grey. The turbines and associated facilities necessary to harvest the wind for energy are not inconsistent with existing agricultural practices.
52. Wind facilities can be perceived as a visual intrusion on the natural aesthetic value on the landscape or having their own aesthetic quality. Existing wind facilities have altered the landscape elsewhere in Minnesota from agricultural to wind plant/agricultural. This Project will modify the visual character of the area. Wind generation development is likely to continue in Stearns County.
53. Visually, the Paynesville Wind Farm will be similar to other LWECs projects located elsewhere in the state.

Public Health and Safety

54. There are eight airports located in Stearns County within 20 miles of the Project area. A review of the AirNav, LLC (AirNav 2009) database identified the Paynesville Municipal Airport as the only airport within five miles of the Project, which is located two miles south of the Project. The Paynesville Municipal Airport has an asphalt runway of 1,180 feet in length and the approach zone for this airport is outside the Project boundary.⁷⁹ The Applicant has not yet been issued a “no hazard” determination from the Federal Aviation Administration (FAA). Section 4.12 of the site permit requires the Applicant to avoid placing wind turbines or associated facilities in a location that could create an obstruction to navigable airspace to certain airports. The Applicant must comply with the requirements of the Minnesota Department of Transportation, Department of Aviation, and FAA (site permit sections 10.5.1 and 4.12).
55. The addition of up to 60 wind turbines in active croplands and a permanent free standing meteorological tower increase the potential for collisions with crop-dusting aircraft. The turbines would be visible from a distance and lighted according to FAA requirements (see section 7.18 of the site permit). The permanent meteorological tower will be free standing and have lighting consistent with the turbines. The Minnesota Aeronautical Chart produced by the Minnesota Department of Transportation is available and shows wind turbine locations throughout the state.
56. Some concern was expressed about the ability of emergency medical helicopters to access residents in the Project area during times of emergency. Officials at the Mayo Clinic in Rochester, Minnesota, have noted that impacts on helicopter operations due to

⁷⁹ *Id.* at 5-14 and 5-15.

wind projects in the area have been insignificant.⁸⁰ A Stearns County resolution, which adopted findings of fact to support its decision not to impose a moratorium, concluded that wind turbines are no different than buildings and other towers in respect to emergency response.⁸¹ Stearns County took testimony from Air Medical Services for LifeLink III to support its finding.⁸² The Applicant will prepare an emergency response plan in consultation with the emergency responders having jurisdiction over the Project area and provide landowners, interested persons, public officials, and emergency responders with all applicable safety information (see sections 7.15 and 7.16 of the site permit). The Applicant agreed to submit its emergency response plan 60 days prior to the start of construction and obtain approval from the Stearns County Emergency Services Department, which was requested by Stearns County.⁸³ There is no reason to conclude that the Project poses any more risk to medical helicopters than any other wind farm located in the state.

57. As with any large construction project, some risk of worker or public injury exists during construction. Paynesville Wind and its construction representatives and workers will prepare and implement work plans and specifications in accordance with applicable worker safety requirements during construction of the Project. Paynesville Wind will also control public access to the Project during construction and operation. Paynesville Wind will provide security during construction and operation of the project, including fencing, warning signs, and locks on equipment and facilities (site permit section 7.15).
58. Each turbine will be clearly labeled to identify each unit and a map of the site with the labeling system will be provided to local authorities as part of the emergency response plan (site permit sections 7.17 and 7.16).
59. Possible health effects associated with wind turbines and transmission of electricity generally include those from electric and magnetic fields (EMF). The term EMF refers to electric and magnetic fields that are present around electrical devices. Electric fields arise from the voltage or electrical charges and magnetic fields arise from the flow of electricity or current that travels along transmission lines, power collection (feeder) lines, substation transformers, house wiring and electrical appliances. The intensity of the electric field is related to the voltage of the line and the intensity of the magnetic field is related to the current flow through the conductors (transmission line wire).
60. The Applicant believes that the Project will not have any impact on public health and safety due to EMFs.⁸⁴ While there is no conclusive evidence that EMFs from power lines and wind turbines pose a significant health impact, turbines will be installed no closer than 750 to 1,000 feet from residences, where EMFs are expected to be at background levels. Based on the most current research on EMFs, and the distance between any turbines or collector lines and homes, the proposed Project is not anticipated to have

⁸⁰ Mayo: Turbines do not hamper medical helicopters, Rochester Post-Bulletin, May 18, 2010, http://www.postbulletin.com/newsmanager/templates/localnews_story.asp?z=2&a=452955.

⁸¹ Exhibit 24.

⁸² *Id.*

⁸³ Exhibit 22 (Applicant's post-hearing comments).

⁸⁴ *Id.* at 5-16.

significant impact to public health and safety due to EMFs. As referenced in Finding 21, the 69 kV transmission line will be permitted locally.

61. One person expressed concern about the effect of stray voltage on their dairy operations.⁸⁵ Stray voltage is an extraneous voltage that appears on grounded surfaces in buildings, barns and other structures. Stray voltage can be a problem for hospitals, manufacturing plants and farms. In hospitals and manufacturing plants, stray voltage may interfere with sensitive electronic equipment. On the farm, if this voltage reaches sufficient levels, animals coming into contact with grounded surfaces may receive a mild shock that can cause a behavioral response. Significant research on the effects of stray voltage on dairy cows has been conducted over the past 40 years. A comprehensive review of this research is presented in a report to the Ontario Energy Board (Literature Review and Synthesis of Research Findings on the Impact of Stray Voltage on Farm Operations, 2008, Prepared by Douglas J. Reinemann, Ph.D.). Stray voltage and its impact on dairy farms is normally an issue associated with electrical distribution lines and is a condition that can exist between the neutral wire of a service entrance and grounded objects in buildings. The source of stray voltage is a voltage that is developed on the grounded neutral wiring network of a farm and/or the electric power distribution system. The direct effect of animal contact with electrical voltage and the resulting current flowing through their bodies can range from mild behavioral reactions to intense behavioral responses indicative of pain. The indirect effects of these behaviors can vary considerably depending on the specifics of the contact location, level of current, pathway, frequency, and other factors related to the daily activities of the animals.
62. The quality of the farm wiring system has the largest single influence on voltage exposure levels. Stray voltage sources can be reduced in three fundamental ways: 1) reduce the current flow on the neutral system, 2) reduce the resistance of the neutral system, or 3) improve the grounding of the neutral system. The electrical collection system proposed for the Project is designed to be “a separately derived system” as defined in the National Electric Code. The system will have no direct electrical connection (including grounded circuit conductors) to conductors originating in another system. The Applicant stated it is committed to siting turbines and transmission lines to avoid conflicts with dairy farms in the Project area.⁸⁶
63. In winter months ice may accumulate on the wind turbine blades when the turbines are stopped or operating very slowly. Furthermore, the anemometer may ice up at the same time, causing the turbine to shut down during any icing event. As weather conditions change, any ice will normally drop off the blades in relatively small pieces before the turbines resume operation. This is due to flexing of the blades and the blades’ smooth surface. Although turbine icing is an infrequent event (2.5 days per year), it remains important that the turbines are not sited in areas where regular human activity is expected below the turbines during the winter months. The turbine setbacks from residences and roads will minimize impacts from ice throw (see sections 4.2 and 4.4 of the site permit).

⁸⁵ Exhibit 20 at 7.

⁸⁶ Exhibit 1 at 5-20.

Public Services and Infrastructure

64. The proposed Project is expected to have minimal effects on existing public infrastructure. The proposed Project would not generate an increase in traffic volumes or daily human activity, except for a short period of time during construction and occasionally during operation and maintenance activities. The construction contractor will repair any road damage that may occur during the construction of the Project (see site permit section 7.8).
65. Other than short-term impacts, no significant permanent changes in road traffic patterns or volume are expected. The busiest traffic would occur when the majority of the foundation and tower assembly is taking place. Township and county officials will receive advance notice of the construction schedule at the pre-construction meeting, including the timing of the delivery of towers and turbines and arrival of the crane to erect project equipment (site permit section 5.6). Paynesville Wind will work with all parties involved to address concerns related to roadway use, and adhere to state, county, and township requirements for transportation infrastructure.
66. Construction of the proposed Project requires the addition of access roads that will be located on private property. Access roads would be built adjacent to the turbine towers, allowing access both during and after construction. The access roads will be sited in consultation with local landowners and completed in accordance with specified design requirements, and will be located to facilitate both construction (e.g., cranes) and continued operation and maintenance. Siting roads in areas with unstable soil will be avoided wherever possible. Roads may include appropriate drainage and culverts while still allowing for the crossing of farm equipment. The permanent access roads would comprise approximately nine miles.⁸⁷ Permanent access roads will be approximately 16 to 33 feet wide, depending on turbine selection.⁸⁸ Local requirements would be followed wherever access roads join state or local roadways. During construction only, temporary access roads will be approximately 40 feet wide to accommodate delivery of turbines, towers, and other related equipment.⁸⁹ The Applicant estimated there will be up to 75 large truck trips per day and up to 175 small-vehicle trips per day during peak construction periods.⁹⁰ If 100 meter towers are used, an additional 66 trips in total will be necessary to accommodate the towers.⁹¹ Once construction is completed, roads will be re-graded, filled, and dressed as needed.
67. If access roads are installed across streams or drainage ways, the Applicant, in consultation with Minnesota Department of Natural Resources, will design and locate the roads so the original water flow or drainage patterns are not altered. Any work required below the ordinary high water line, such as road crossings or culvert installation, will require a permit from Minnesota Department of Natural Resources. See section 10.5 of the site permit for a list of other permits that may be required.

⁸⁷Exhibit 25.

⁸⁸ Exhibit 1 at 4-4.

⁸⁹ *Id.*

⁹⁰ *Id.* at 4-5.

⁹¹ Exhibit 22 (pre-hearing comments).

68. There are three existing 69 kV high-voltage transmission lines that cross the Project area.⁹²
69. The proposed Project will have approximately 44 miles of underground 34.5 kV electrical collector lines within the Project area.⁹³ Generally, the underground lines will be laid in trenches and installed along the edge of farm fields.⁹⁴ The collection lines will occasionally require an above ground junction box.⁹⁵ Placement of collector and feeder lines is addressed in the site permit at section 4.15.
70. Prior to construction, Gopher State One Call will be contacted to locate underground facilities so they can be avoided. Further, section 7.15 of the site permit requires the Applicant to submit the location of all its underground cables and collector and feeder lines to Gopher State One Call. To the extent Project facilities cross or otherwise affect existing telephone lines or equipment, Paynesville Wind will make arrangements with applicable service providers to avoid interference with such facilities.
71. The presence or operation of the Project could potentially impact the quality of television and radio reception in the area. Previous analysis on television reception issues indicates that in some cases new antennas or relocation of existing antennas can restore television signal strength reception. There are two active microwave beam paths in the Project area.⁹⁶ The Applicant stated its setback from microwave beam paths is equal to the blade length from the fresnell zone.⁹⁷ The Applicant will not operate the wind farm so as to cause microwave, radio, telecommunications, television, or navigation interference in violation of Federal Communications Commission regulations or other applicable law. If operation of the Project causes such interference, Paynesville Wind will take steps necessary to correct the problem. Section 6.4 of the site permit requires the Applicant to submit a plan to conduct an assessment of television and radio signal reception, microwave signal patterns, and telecommunications in the Project area. Section 4.15 of the site permit requires the Applicant to comply with all Institute of Electrical and Electronics Engineers, Inc. standards.
72. Construction, operation, and maintenance of the proposed wind plant will comply with all of the required federal, state, and local permit requirements. See section 10.5 of the site permit.

Recreational Resources

73. There are four Wildlife Management Areas (WMAs) adjacent to the Project area and 10 WMAs located within five miles of the Project area. WMAs are managed to provide wildlife habitat, improve wildlife production, and provide public hunting. The four adjacent WMAs are: Zion WMA, Salem Community Prairie WMA, Miller Spring Lea

⁹² Exhibit 1 at 5-8.

⁹³ *Id.* at 1

⁹⁴ *Id.* at 4-3.

⁹⁵ *Id.*

⁹⁶ *Id.* at 5-9.

⁹⁷ Exhibit 25.

Farm WMA, and the Spirit Prairie WMA. The Roseville WMA is located 0.5 miles from the Project boundary. The WMAs are shown in the constraint maps at Exhibit 25. Section 4.5 of the site permit requires that a setback of three RD in the non-prevailing wind direction and five RD in the prevailing wind direction from all WMAs.

74. The Bauman Wildlife Production Area (WPA) is located within the Project area.⁹⁸ The Lake Henry WPA and the Zion WPA are adjacent to the Project. There are four WPAs located within five miles of the Project. The WPAs are shown on the constraint maps at Exhibit 25. WPAs are managed to protect habitat used for breeding, foraging, shelter, and migration for waterfowl. Section 4.5 of the site permit requires that a setback of three RD in the non-prevailing wind direction and five RD in the prevailing wind direction from all WPAs.
75. There is one Scientific and Natural Area (SNA) located within five miles of the Project. The Roscoe Prairie SNA is located approximately 1.25 miles from the Project Area.⁹⁹ SNAs are designated areas to protect rare and endangered species habitat, unique plant communities, and significant geologic features. This SNA is located well beyond the setbacks required in the site permit.
76. Lake Henry is located approximately one half mile west of the Project area. Lakes in the area are used for recreational boating and fishing.¹⁰⁰ Spring Hill County Park is located one mile north of the Project area.¹⁰¹ These features are located well beyond the setbacks required in the site permit.
77. Glacial Lakes State Trail crosses the southern portion of the Project area along the former Burlington Northern Railroad and is open for hiking, horseback riding and biking.¹⁰² The site permit does not provide for a setback to this trail. Preliminary turbine layouts included in the site permit show turbines show a setback of at least one mile and will likely be at least five RD from the trail. The electrical collection system will have to cross the Glacial Lakes State Trail in order to deliver power to the Paynesville Substation. Section 13.1.1 of the site permit requires the line to be buried underground. Section 10.5 of the site permit addresses other permits that may be required.
78. The Project area has a grant-in-aid snowmobile trail that runs through the center of the Project. The site permit does not provide a setback to this trail because the trail is located on private property and its location can vary from year to year. However, preliminary turbine layouts indicate no turbines located within 250 feet of the current trail location. The Applicant will take into consideration the location of known snowmobile trails during the final siting of the turbines.

Community Benefits

⁹⁸ Exhibit I at 5-13 (note that the application excludes this WPA from the Project, but it is within the exterior boundaries).

⁹⁹ *Id.*

¹⁰⁰ *Id.*

¹⁰¹ *Id.*

¹⁰² *Id.*

79. Paynesville Wind will pay a Wind Energy Production Tax to the county and townships each year, which is expected to be approximately \$350,000 to \$450,000 million per year.¹⁰³ If 100 meter towers are used, the Applicant anticipates that an additional 10 to 15 percent in production tax revenue would be raised.¹⁰⁴ Landowners with wind turbines on their property will also receive payments from the Applicant. The Project is expected to create new job opportunities within the local community, both during construction and operation.

Effects on Land-Based Economies

80. The Project area includes 12,401 acres of cultivated agricultural land.¹⁰⁵ The turbines and associated facilities are expected to occupy between 31 and 48 acres of agricultural land.¹⁰⁶ A typical turbine will permanently displace approximately 0.5 to 1.0 acre of agricultural land. The Project substation will require less than one acre of land.¹⁰⁷ The Applicant has stated it will repair drain tile damage in accordance with specific landowner agreements.¹⁰⁸ The application did not address the total number of acres that would be temporarily impacted due to construction activities associated with the Project (e.g., grading, soil compaction, access roads, turn around areas, and temporary construction staging areas). Overall, impact to agricultural lands as a result of the Project is anticipated to be short term, and is not expected to alter crop production. Once in operation, it may occasionally be necessary for Paynesville Wind to complete repairs, or clear vegetation around a turbine or facility, which could result in additional temporary impacts to agricultural operations. These interruptions are expected to be infrequent and short term. Section 7 of the site permit addresses mitigation measures for agricultural lands.
81. The Applicant has determined that there are no gravel pits within the Project area.¹⁰⁹ However, there are seven active gravel mines, three inactive gravel mines, and two active aggregate mines located less than five miles of the Project area.¹¹⁰ The proposed Project does not adversely affect any sand or gravel operations.
82. Paynesville Wind will avoid impacts to Reinvest in Minnesota (RIM) land and will minimize impacts to Conservation Reserve Program (CRP) land.¹¹¹ If CRP land is impacted, the Applicant will work with the landowner to remove the impacted portion of the parcel from the CRP program.¹¹² RIM land has not been identified within the Project area. Section 6.1 of the site permit requires certain inventories to be conducted of potentially impacted land. Therefore, CRP or additional RIM land would be identified if potentially impacted.

¹⁰³ *Id.* at 5-2.

¹⁰⁴ Exhibit 22 (pre-hearing comments at 3).

¹⁰⁵ Exhibit 1 at 5-18 – 5-19.

¹⁰⁶ *Id.* at 3-1.

¹⁰⁷ *Id.* at 2-4.

¹⁰⁸ *Id.* at 5-19.

¹⁰⁹ *Id.*

¹¹⁰ *Id.* at 5-23.

¹¹¹ *Id.* at 5-20.

¹¹² *Id.* at 5-20.

Property Values

83. Several residents expressed concern over the impact of the Project on property values.¹¹³ A study conducted by the Lawrence Berkley National Laboratory found an absence of negative impacts to property values from wind farms within a project view shed.¹¹⁴ On June 1, 2010, the Stearns County Assessor's Office prepared "A Study of Wind Energy Conversion System in Minnesota," which did not find any changes in property valuation to properties hosting a wind tower based on information provided by assessors from Dodge, Jackson, Lincoln, Martin, Mower, and Murray counties.¹¹⁵ However, the study acknowledged that there is insufficient data to allow for a reasonable analysis of the development of wind facilities on property values. The Stearns County study also cited studies completed by the Renewable Energy Policy Project, which analyzed 25,000 sales inside and outside of view sheds of a wind facility and concluded that property values appear not be affected, and a study conducted by the Royal Institute of Chartered Surveyors, which examined the impact of wind facilities on property values in the United Kingdom and found that almost 30 percent of the respondents reported a decrease in property values.

Archaeological and Historical Resources

84. A review of the Minnesota State Historic Preservation Office (SHPO) computer database and 19th century Public Land Survey maps identified one archeological site within the data-gathering area, which is represented by a small lithic scatter.¹¹⁶ An expanded search area revealed 10 additional sites of a similar nature.¹¹⁷ Two rural schools, a church, and a rail related facility have been identified within the Project area.¹¹⁸
85. An archaeological survey is recommended for all the proposed turbine locations, access roads, junction boxes, and other areas of Project construction impact to document any previously unrecorded archaeological sites within the Project site. Section 6.3 of the site permit requires the Applicant to conduct an archaeological reconnaissance survey (Phase I or Phase IA). An archaeological reconnaissance survey is used to determine if archaeological sites exist within the area or are potentially affected by the Project through literature review and, if warranted, field review including visual inspection and sampling. Depending upon the results of the reconnaissance survey, more detailed work may be necessary. The Applicant has not yet begun its Phase I or 1A survey at the time the Applicant submitted its site permit application.¹¹⁹
86. If archaeological sites are found during the Phase I survey, their integrity and significance should be addressed in terms of the site's potential eligibility for placement on the National Register of Historic Places (NRHP). If such sites are found to be eligible for the

¹¹³ Exhibit 20.

¹¹⁴ Ben Hoen et al., *The Impact of Wind Power Projects on Residential Property Values in the United States*, Lawrence Berkeley National Laboratory (Dec. 2009).

¹¹⁵ Exhibit 22 (Applicant's July comments).

¹¹⁶ Exhibit 1 at 5-10.

¹¹⁷ *Id.* at 5-10 and 5-11.

¹¹⁸ *Id.* at 5-11.

¹¹⁹ *Id.* at 5-12.

NRHP, appropriate mitigative measures will need to be developed in consultation with the SHPO, the State Archaeologist, and consulting American Indian communities. Section 6.3 of the site permit also requires the Applicant to stop work and notify the SHPO and the Commission if any unrecorded cultural resources are found during construction.

Air and Water Emissions

87. No harmful air or water emissions are expected from the construction and operation of the Project.

Wildlife

88. More than 80 percent of the Project area is used for agricultural purposes, primarily row cropping with some hay and pasture lands.¹²⁰ Bauman Waterfowl Production Area is within the Project area and six other WMAs and WPAs are adjacent to the Project boundary. See Findings 73 and 74 for additional information on WMAs and WPAs. The Project will have direct and indirect impacts on birds, bats, and other wildlife resources and their habitats. Direct impacts may include strike fatality from turbine blades, the 69 kV transmission line (which will be permitted locally), and related infrastructure. Indirect impacts may include displacement of birds and bats and other wildlife from their habitats, site avoidance, and behavioral modification.
89. The United States Fish and Wildlife Service (USFWS) developed Draft Guidelines for Wind Turbine Siting in 2010. The guidelines provide wind developers and regulatory agencies with the information needed to identify, assess, and monitor the potentially adverse impacts of wind energy projects on wildlife and their habitats, particularly migratory birds and bats. The guidelines focus on a tiered approach to gathering information on a site and potential risks to wildlife and wildlife habitat. Depending on the results obtained from each tier, pre-and/or post-construction survey work and mitigative measures are recommended.
90. The Applicant hired Hamer Environmental, L.P. (Hamer) to conduct pre-construction avian and bat surveys consistent with the USFWS tiered approach, which were conducted in 2009 and 2010.¹²¹ Results of the surveys indicate high levels of waterfowl and waterbirds within the Project area. Clear flight paths between natural features, such as WMAs and WPAs, were not evident.
91. Survey results analyzed flight data of species in the Zone of Risk (ZOR), which is the probable wind rotor plane of a typical wind turbine. Twenty-four percent of raptors (of 135 birds), 20 percent of waterbirds (of 272 birds), and 72 percent of waterfowl (of 1,092 birds) flew through the ZOR.¹²²

¹²⁰ *Id.* at 5-27.

¹²¹ *See* exhibit 26.

¹²² Exhibit 26 at 14.

92. Addendum A (Exhibit 26) addressed the impacts of 100 meter towers on birds. In general, raptors, waterbirds and waterfowl identified in Finding 91 would be less impacted by a higher rotor swept area.¹²³ However, migrating songbirds could be at increased risk with a higher rotor swept area because nocturnal migration has been known to occur as low as 150 meters.¹²⁴ The Siemens turbine would be 150.5 meters tall with the blade vertical position as discussed in Finding 22. Therefore, the Siemens turbine could impact migration on 100 meter towers. Section 4.9 of the site permit allows for the option of using 100 meter towers.
93. Due to the higher than expected bird activity in the Project area and numerous WMAs and WPAs adjacent to the site boundary (see Findings 73 and 74), Hamer recommended post-construction monitoring with additional mitigation measures implemented if necessary. Section 13.2 requires the Applicant to conduct a minimum of one year of post-construction avian and bat fatality surveys.
94. The results of acoustic bat studies, conducted by Hamer in 2009 and 2010, conclude that bat activity on the site is higher than expected and greater than what was recorded at Buffalo Ridge.¹²⁵ Based on the results, Hamer recommended post-construction surveys using pre-established protocols with additional mitigation measures implemented as necessary. Section 13.2 requires the Applicant to conduct a minimum of one year of post-construction avian and bat fatality surveys.
95. Recent studies indicate a broad range of avian and bat fatalities across the United States as a result of wind development, with the highest fatalities occurring in the eastern United States. In the Midwest, post-construction studies completed in Iowa, Minnesota, and Wisconsin confirm a broad range of fatalities. The highest bird and bat fatalities were found at the 145 MW Blue Sky Green Field wind facility in Wisconsin, which had bird fatalities at 12 birds per turbine per year and bat fatalities at 40 bats per turbine per year.¹²⁶ Fatalities range from one to four birds per turbine per year and from one to eight bats per turbine per year across most of the upper Midwest. Avian and bat studies conducted at the Buffalo Ridge, Minnesota, found an average of one to four bird fatalities per turbine per year and one to three bat fatalities per turbine per year. Projects in areas with similar habitat and cover types would likely have similar fatality rates, depending on migration patterns, known resting and foraging areas, and potential for bat hibernacula. However, as wind facilities increase and move into areas or landscapes where migration or use patterns are less understood, it becomes increasingly difficult to make landscape level comparisons between facilities and predict the impacts on avian and bat populations.
96. Section 6.7 of the site permit requires the Applicant to prepare an Avian and Bat Protection Plan, submit quarterly avian and bat reports, and report dead or injured avian and bats species under certain conditions. The DNR requested that the Avian and Bat

¹²³ Exhibit 26 (Addendum A).

¹²⁴ See exhibit 27.

¹²⁵ See exhibit 26.

¹²⁶ West, Inc., *Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin* (December 17, 2009).

Protection Plan specifically address steps to minimize impacts to breeding birds during the construction phase. Section 6.7 requires the Applicant to work with the Commission and the DNR in preparation of the plan; therefore, this request can be accommodated in that process. Additionally, USFWS expressed concern regarding proximity of turbines to WPAs (see Finding 74). These concerns can also be addressed in the Avian and Bat Protection Plan.

97. Section 6.1 requires the Applicant to conduct pre-construction desktop and field inventories of potentially impacted, if any, native prairies, wetlands, and any other biologically sensitive areas within the site and assess the presence of state threatened, endangered, or species of special concern or federally listed species. Section 4.5 requires that turbines and associated facilities will not be constructed in wildlife management areas, waterfowl production areas, or parks and a setback of five rotor diameter in the prevailing wind and three rotor diameter in the non-prevailing wind is applied to such public lands, which would minimize impacts to wildlife that utilize those public lands.

Rare and Unique Natural Resources

98. According to Natural Heritage Information System (NHIS) data, there are 21 recorded occurrences of special status species, plant communities, or other unique natural features within a one-mile radius of the Project area.¹²⁷ These recorded occurrences include eight rare species or native plant communities. Rare species include the Upland Sandpiper, small white Lady's slipper, Wilson's phalarope, Marbled Godwit, Bald Eagle, and regal fritillary. Native plant communities include Southern Mesic Prairie and Southern Wet Prairie.
99. Four species of birds listed for conservation in Minnesota were identified within the Project area in the Applicant's pre-construction avian survey (see Exhibit 26) and are listed in the table below:

Type of Bird	State Conservation Status
Trumpeter Swan	Threatened
American White Pelican	Special Concern
Franklin's Gull	Special Concern
Bald Eagle	Special Concern

100. Survey results found 100 percent of American White Pelicans (of 26 birds), 67 percent of Bald Eagles (of 6 birds), 50 percent of either Tundra or Trumpeter Swan (of 157 birds total), and 4.9 percent of Franklin's Gull (of 201 birds) flew through the ZOR.¹²⁸
101. As discussed in Finding 96 the Applicant will prepare an Avian and Bat Protection Plan, which will address rare and unique species. Further, Section 4.7 of the site permit requires a Prairie Protection and Management Plan if native prairie is identified in the surveys required under Section 6.1 of the site permit.

¹²⁷ Exhibit 1 at 5-34 and Appendix A.

¹²⁸ Exhibit 26 at 14.

Vegetation

102. No public waters, wetlands, or forested land are expected to be adversely affected by the Project. No groves of trees or shelterbelts will need to be removed to construct and operate the system. Native prairie will also be avoided. Section 4.7 of the site permit will require a prairie protection and management plan if native prairie is discovered in the biological and natural resource inventories required in section 6.1 of the site permit.

Soils

103. The site permit has requirements to implement sound water and soil conservation practices during construction and operation of the Project in order to protect topsoil and adjacent resources and to minimize soil erosion. The Project will be subject to the requirements of the National Pollutant Discharge Elimination System/State Disposal System (NPDES/SDS) stormwater permit for construction activity. An erosion and sediment control plan and Storm Water Pollution Prevention Plan (SWPPP) will also be prepared for the Project and the disturbed areas will be seeded after construction to stabilize the area (site permit section 7.11).

Geologic and Ground Water Resources

104. The Project area is relatively flat and mostly tilled farmland. Turbines will be located on topographically elevated uplands and are not expected to affect streams, surface water bodies or floodplains. The Project area is served by an extensive network of state, county, and township roads, which will provide site access and egress. There are 21 domestic, three irrigation, one scientific, and two unknown wells within the Project area.¹²⁹ Based on the proposed site layouts, no impacts to streams, wetlands, floodplains, or shorelands are anticipated. Impacts to geologic and groundwater resources are not anticipated. Section 13.1.2 of the site permit prohibits siting turbines in shoreland districts identified by Stearns County. Exhibit 25 shows shoreland districts on constraint maps.

Surface Water and Wetlands

105. Wind turbines and associated facilities will not be located in public water wetlands, except that collector and feeder lines may cross if authorized by the appropriate permitting agency (site permit section 4.6). A permit may be required if surface waters are impacted (see section 10.5.1 of the site permit). There are a total of 784 acres of National Wetland Inventory (NWI) wetland types in the Project area.¹³⁰ Of the wetlands, 712 acres are freshwater emergent wetlands, 50 acres are freshwater forested/shrub wetlands, and 12 acres are freshwater pond wetlands.¹³¹ There are also 35.54 acres of Public Waters Inventory (PWI) wetlands; however, there may be some overlap between NWI and PWI wetlands.¹³² A wetland delineation report will be completed to determine

¹²⁹ Exhibit 1 at 5-23.

¹³⁰ *Id.* at 5-25.

¹³¹ *Id.*

¹³² *Id.*

all wetland boundaries adjacent to areas of proposed turbine locations and the layout will be designed to avoid and minimize wetland impacts.¹³³ If wetland impacts cannot be avoided, the Applicant must apply for the applicable permits from the U.S. Army Corps of Engineers (see section 10.5 of the site permit regarding other permits or requirements).

Future Development and Expansion

106. Current information suggests windy areas in this part of the state are large enough to accommodate more wind facilities. In addition to existing wind projects, the future will likely bring Stearns County and surrounding counties additional types and sizes of wind projects supplied by different vendors and installed at different times. The Applicant has indicated that it is considering Stearns County for future development, but if such a project is proposed, a separate site permit would have to be obtained in order to construct the project.
107. While large-scale projects have occurred elsewhere (Texas, Iowa, and California), little systematic study of the cumulative impact has occurred. Research on the total impact of many different projects in one area has not occurred. OES EFP staff will continue to monitor for impacts and issues related to wind energy development.
108. The Commission is responsible for siting of LWECS “in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources.”¹³⁴ Section 4.1 of the site permit provides for buffers between adjacent wind generation projects to protect wind production potential.

Maintenance

109. Maintenance of the turbines will be on a scheduled, rotating basis with one or more units normally off for maintenance each day, if necessary. Maintenance on the interconnection points will be scheduled for low wind periods. Paynesville Wind will have on-site service and maintenance activities, including routine inspections, regular preventive maintenance, unscheduled maintenance and repair, and routine minor maintenance on the wind turbines and associated facilities. The operations and maintenance facility will be permitted by Stearns County.

Decommissioning and Restoration

110. The existing easement agreements between the Applicant and landowners provide for decommissioning of turbines.¹³⁵ These agreements also require all foundations be removed to a depth of four feet below grade and buried back to grade.¹³⁶ Section 9.2 of the site permit requires removal of wind facilities to a depth of four feet and restoration and reclamation of the site to the extent feasible. The Applicant has agreed to meet all of the requirements of the Stearns County Solid Waste Ordinance for site restoration. The Project site would be restored within 18 months after Project expiration.

¹³³ *Id.* at 5-26.

¹³⁴ Minn. Stat. § 216F.03.

¹³⁵ Exhibit 1 at 4-10.

¹³⁶ *Id.* at 4-11.

111. Decommissioning activities will include: (1) removal of all wind turbine components and towers; (2) removal of all pad mounted transformers; (3) removal of overhead and underground cables and lines; (4) removal of foundations; and (5) removal of surface road material and restoration of the roads and turbine sites to previous conditions to the extent feasible.
112. As provided in section 9.1 of the site permit, the Applicant will ensure that it carries out its obligations to provide for the resources necessary to fulfill its requirements to properly decommission the Project at the appropriate time. Section 9.1 requires the applicant to submit a Decommissioning Plan to the Commission prior to the pre-operation compliance meeting. In addition to any requirements under the site permit, each individual land lease requires proper decommissioning of turbines. The Applicant will be responsible for costs to decommission the Project and associated facilities.

Site Permit Conditions

113. All of the above findings pertain to the Applicant's requested permit for a 95 MW LWECS project.
114. Most of the conditions contained in the site permit were established as part of the site permit proceedings of other wind turbine projects permitted by the Environmental Quality Board and the Public Utilities Commission. Comments received by the Commission have been considered in development of the site permit. Minor changes and special condition additions that provide clarification or additional requirements have been made.
115. The site permit contains conditions that apply to site preparation, construction, cleanup, restoration, operation, maintenance, abandonment, decommissioning, and all other aspects of the Project.

Based on the foregoing findings, the Minnesota Public Utilities Commission makes the following:

CONCLUSIONS OF LAW

1. Any of the foregoing findings, which more properly should be designated as conclusions, are hereby adopted as such.
2. The Minnesota Public Utilities Commission has jurisdiction over this matter pursuant to Minnesota Statutes section 216F.04.
3. The Applicant has substantially complied with the procedural requirements of Minnesota Statutes chapter 216F and Minnesota Rules chapter 7854.

4. The Minnesota Public Utilities Commission has complied with all procedural requirements required of Minnesota Statutes chapter 216F and Minnesota Rules chapter 7854.
5. The Minnesota Public Utilities Commission has considered all the pertinent factors relative to its determination of whether a site permit should be approved.
6. The Paynesville Wind Farm is compatible with the policy of the state to site LWECS in an orderly manner compatible with environmental preservation, sustainable development, and the efficient use of resources under Minnesota Statutes section 216F.03.
7. The Minnesota Public Utilities Commission has the authority under section 216F.04 to place conditions in a permit and may deny, modify, suspend, or revoke a permit. The conditions in the site permit are reasonable and appropriate.

Based on the foregoing Findings of Fact and Conclusions of Law, the Minnesota Public Utilities Commission issues the following:

ORDER

A LWECS Site Permit is hereby issued to Paynesville Wind, LLC to construct and operate the up to 95 MW Paynesville Wind Farm in Stearns County in accordance with the conditions contained in the site permit and in compliance with the requirements of Minnesota Statutes section 216F.04 and Minnesota Rules chapter 7854 for PUC Docket No. IP-6830/WS-10-49.

The site permit is attached hereto, with maps showing the approved site and preliminary turbine layouts.

BY THE ORDER OF THE COMMISSION

Burl W. Haar
Executive Secretary

(S E A L)

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