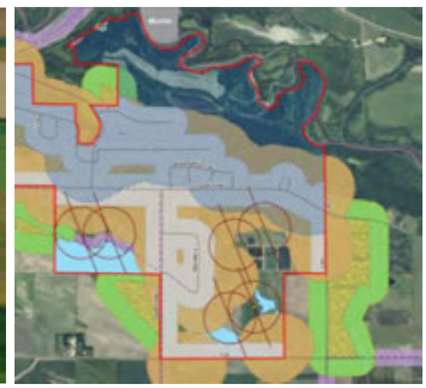
LOWER SIOUX INDIAN COMMUNITY

Wind Energy Feasibility Study

April 2012



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1. Executive Summary

This report describes the process and findings of a Wind Energy Feasibility Study (Study) conducted by Westwood Professional Services (Westwood) for the Lower Sioux Indian Community (Community) and Dakota Futures, Inc. The Community is evaluating the development of a wind energy project located on tribal land. This study was conducted as part of a grant from the US Department of Energy Tribal Energy Program. The program solicits, awards, administers, and manages financial assistance agreements for renewable energy and energy efficiency projects on tribal lands. The Community received a grant through this funding opportunity in 2009 to evaluate the feasibility of an approximately 10 MW wind project on lands held in trust for the Community. The Community contracted with Westwood in May 2010 to conduct and deliver a wind energy feasibility study.

1.1. Project Background

The project site is the Community's Reservation, located in Redwood County, Minnesota (the Site), along the southern bank of the Minnesota River south of the city of Morton (the City). The reservation is 1,743 acres in size. Figure 1-1 shows the Site. The Community is comprised of 930 members, half of whom live on the reservation, and is governed by the Lower Sioux Community Council. The Community has a number of enterprises, including the Jackpot Junction Casino Hotel (the Casino). The Casino complex also houses the Dacotah Exposition Center and Outdoor Amphitheater, and the Lower Sioux Lodge.[1]

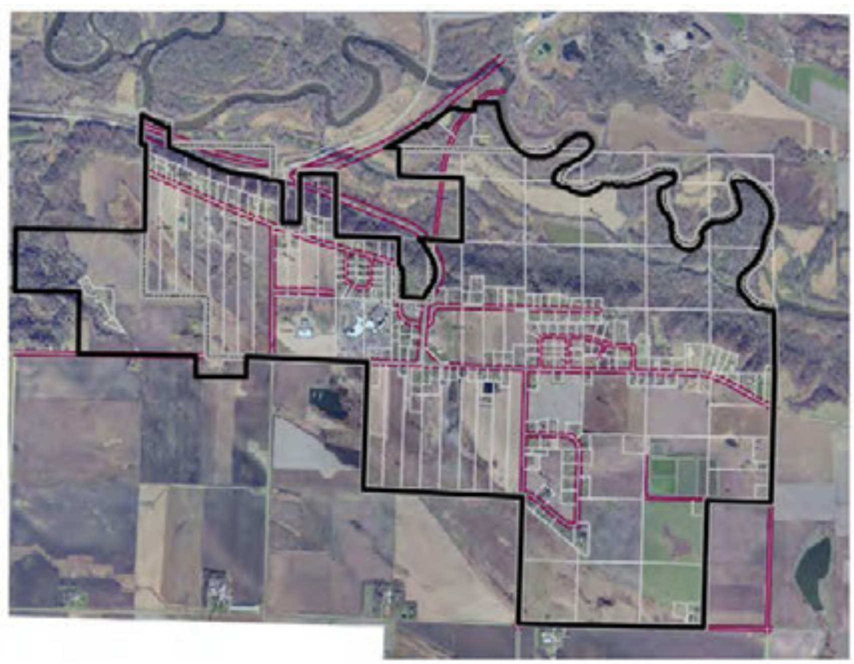

Figure 1-1

[1] "Lower Sioux Wind Feasibility Development: DOE Tribal Energy Program Review." Presentation by Dakota Futures, November 2009.

The Community has had some experience with wind energy studies in the past. With Environmental Protection Agency (EPA) funding, the Community monitored wind resources at four locations in 1995-97, however results were inconclusive, as it was unclear whether the wind monitoring was performed at ideal locations. In 1999 a small 20 kilowatt (kW) demonstration turbine was installed, however the turbine is no longer operating due to repair and refurbishment issues. Wide support and interest for wind energy in the Community led to the application for the Federal grant and the current feasibility study.[2]

The Community's stated goals[3] for renewable energy development are:

- Provide cleaner and more environmentally safe energy resources for the tribal reservation by installing wind energy throughout the Community;
- Sell off excess power to the grid, or more specifically to adjacent power companies;
- Lower the cost of energy to local businesses and homeowners in the Community; and
- Provide new employment opportunities to Community members.

The Community's specific wind energy development objectives are twofold[4]:

1. Develop a preliminary wind energy project with a single wind turbine generator (WTG) to serve a large facility in the Community within two years; and
2. Develop a larger, multi-turbine wind energy project to provide power to be sold to the grid within four years.

1.2. Feasibility Study Scope and Objectives

Westwood's scope in this project was to analyze the critical issues in determining advantages and disadvantages of wind development within the Community. This analysis addresses both of the Community's wind energy development objectives: the Facility-scale single turbine project (Facility Project), and the Commercial-scale multiple turbine project (Commercial Project).
The main tasks of the feasibility study, and the overall results of these tasks, are discussed below. The Study has been separated into four sections:

- Constraint Analysis
- Wind Resource Evaluation
- Utility Interconnection Analysis
- Project Structure and Economics

1.2.1. Constraint Analysis

The Constraint Analysis revealed encumbrances and physical constraints to project development, and outlined areas best suited for further evaluation. A geographic information system (GIS) was utilized for this task to overlay Community properties with digital data pertaining to aerial photography, publicly available wind resource data, land use, physical infrastructure, communications infrastructure, environmental features, and known cultural resource features. The GIS identified development opportunities and provided the framework for further analysis and project design. The result of this task was a Preliminary Turbine Locations Map of the Community that highlighted developable areas and identified preliminary turbine locations for

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[2] Ibid.
[3] Ibid.
[4] Ibid.

both Facility and Commercial Projects. The task is comprised of a number of separate areas of research, including:

- *Setback Analysis*: Setback standards for the state and county (Redwood) were applied to the Site to delineate wind-developable areas within the Community. These include setbacks from roadways, residences, wetlands, public lands, the Minnesota River Bluff, and other features. The analysis also incorporates industry standard spacing requirements, such as turbine-to-turbine setbacks and wind access buffers, to ensure maximum wind harvesting from every turbine.
- *Cultural Resource Review*: A background literature review assessed previously recorded cultural resources in the project area and the immediate surrounding region. The review identified cultural resources that may require additional analysis prior to wind energy development.
- *Communications Infrastructure Review*: A microwave beam path analysis identified the locations of existing communications towers (radio, air traffic, etc.) and their transmission paths to determine if proposed wind turbines will impact communications in the region. It was found that turbines located on Community lands would not interfere with current communications.
- *Site and Wetland Survey*: Westwood conducted a topographic survey of existing contours and conditions at the proposed turbine sites. This task formed the basis for wind farm design and civil engineering. A wetland survey delineated sensitive wetland areas that must be avoided or mitigated per jurisdictional regulations.
- *Geotechnical Study*: The purpose of the geotechnical (geotech) study was to assess the area's soil and geology as it relates to supporting a wind turbine. This also provides definition to the tower foundation engineer about the type of foundation required for the area, its costs and cost effectiveness. Westwood conducted a geotech survey at the proposed location of the Facility Project, which is also the location of the meteorological tower that monitors wind resource. Additional geotech studies would be required for each turbine in the Commercial Project.
- *Environmental Permitting*: This task was a review of federal, state, and local permitting regulations for wind energy development and how they might impact development on tribal lands. This task addressed the next steps in the permitting process. This review addressed the following issues:
    - The extent to which federal permitting requirements are applicable to the planned project;
    - Whether the setback and permit standards required by the Minnesota Public Utilities Commission (PUC) for site permits for Large Wind Energy Conversion Systems (LWECS) are applicable to the planned project; and
    - Whether state or local jurisdiction applies to the placement of a planned electric transmission line extending from within the Lower Sioux Indian Community boundaries to a substation located outside of the exterior boundary of the Lower Sioux Indian Community.

1.2.2. Wind Resource Evaluation

The Wind Resource Evaluation combined a year-long on-site wind monitoring project with a broader view of meteorological trends in the region to provide an understanding of the available wind resource and how it may change over the life of a wind energy project.

- *On-Site Evaluation:* A 60-meter "met" tower was installed and activated on January 1, 2011, near Jackpot Junction Casino. The met tower collected wind speed and wind direction data for an entire year, which was used for wind resource analysis, turbine selection, power production estimates, and financial analysis.
- *Long-Term Evaluation:* Real-world data collected from the met tower was combined with meteorological models and additional project assumptions to predict a wind energy installation's annual energy production over the long term, and quantifying uncertainties in production and data collection.
- *Wind Turbine Energy Estimation:* Using on-site and long-term wind data, combined with power production information for the selected turbines, Westwood estimated the energy production and capacity factor for each wind project.

1.2.3. Utility Interconnection Analysis

Westwood analyzed the utility interconnection opportunities for the Facility and Commercial wind projects, and the advantages and disadvantages of each opportunity, including the approval and permitting processes and barriers to interconnection.

- *Facility Project:* Westwood evaluated the interconnection of a 600kW single-turbine project with Xcel Energy. This evaluation included an analysis of the historical energy loads and trends of Community facilities, such as the Jackpot Junction Casino, and how a mid-size wind turbine would affect those loads and trends.
- *Commercial Project:* Westwood evaluated the interconnection of a 14.4MW nine-turbine project with a high-voltage 69kV transmission line owned by Great River Energy (GRE) and operated by the Midwest Independent System Operator (MISO). This evaluation incorporated a review of the MISO process and the current situation with the MISO project queue.

1.2.4. Project Structure and Economics

This task evaluated project finance and ownership opportunities, revenue potential, project expenses, and project implementation resource development.

- *Project Implementation:* Westwood prepared a preliminary Request for Proposals, 30% Civil Plan Set, and Electrical One-Line for the Commercial Project.
- *Project Ownership:* Westwood identified potential funding sources and project ownership structures available to the Lower Sioux Indian Community. Project economics were evaluated under various ownership and funding scenarios.
- *Project Economics:* Westwood prepared financial models for the Facility and Commercial Projects with a simple payback analysis, incorporating energy production, O&M costs, projected system revenues, and potential grant sources.

1.3. Feasibility Study Results

1.3.1. Facility Project

In order to conduct a detailed Facility Project analysis, Westwood modeled a specific wind turbine for its review. The Facility Project as defined by the feasibility study process is a single 600kW turbine from RRB Energy, the PS-600. This turbine is described in Section 1.4. For the study process, Westwood located the turbine to the west of the Casino on suitable land identified through Westwood's constraint analysis. The project is "behind-the-meter," meaning it provides power directly to an existing facility, in this case the Casino, or Hotel. The local utility, Xcel Energy (Xcel), was engaged in this study to determine the maximum load that could be backfed onto the grid from a wind turbine at this location (assuming the Casino had no load and the turbine was operating at full power), and it was determined that a 600kW turbine was the maximum size Xcel would allow at this point on their distribution line, without significant upgrades to the line at the expense of the Community.

The capital cost of the project is estimated to be $1,877,000. The turbine is forecast to produce an estimated 1,205,909 kilowatt-hours (kWh) annually, operating at a 23 percent average capacity factor. The average annual wind speed at the turbine's hub height of 63 meters is 13.58 miles per hour.

The primary disadvantage of the Facility Project is the wind resource itself. At the RRB turbine's hub height the site has an annual average wind speed of 13.58 mph. At this wind speed the Facility site is considered a Class 2, or Marginal, wind regime. The turbine's 23 percent capacity factor is less than ideal; 30-40 percent is an industry standard minimum threshold for a new wind farm. Additionally, Xcel's 600kW limit restricts turbine options; as the wind industry has grown, so has the size of new, commonly available turbines. There are only a few turbines available that meet Xcel's size limit.

The primary advantage of this Project is its direct offset of Casino electricity usage at retail power rates, reducing both energy purchased from the utility and, potentially, peak power demand charges imposed by Xcel. The 600kW turbine can be installed without any upgrades to the Xcel distribution line, and the Project's small size allows for installation without the extensive approval/permitting processes of the Minnesota Public Utilities Commission (PUC) and Midwest Independent System Operator (MISO). The Community could potentially train and employ its own members and facilities personnel to assist in operations and maintenance of the turbine. Westwood did not identify any fatal flaws in its feasibility study, however it is understood that should the Community wish to move forward with the Facility Project that additional reviews would be required, which may identify previously unforeseen issues with project implementation.

Finally, Westwood found that the Facility behind-the-meter project offsetting the Casino's load at retail electricity rates has the potential to break even in the project's 20-year lifetime.

1.3.2. Commercial Project

Similar to the Facility Project, Westwood modeled its review on a specific turbine. The Commercial Project defined by the feasibility study process is 14.4 megawatts (MW), a nine-turbine wind farm using the 1.6 megawatt (MW) turbine from General Electric. This turbine is described in Section 1.4. The turbines are located on suitable Community land identified through Westwood's constraint analysis. Through a substation located on Community land, the Project would be interconnected directly with the nearby 69kV transmission line owned by Great River Energy (GRE) and operated by MISO. The Project would not provide direct power to the Community, but sell power to another party through a power purchase agreement (PPA).

The capital cost of the Project is estimated to be $30,450,350. The wind farm is forecast to produce an estimated 41,728,200 kilowatt-hours (kWh) annually, operating at a 33 percent average capacity factor. The average annual wind speed at the turbines' hub height of 80 meters is 15.5 miles per hour.

The wind resource, although better at 80 meters than at the Facility Project's 60 meters, is still considered a Class 3, or Fair, wind regime. The turbine's capacity factor is at the low end of the industry standard minimum threshold for a new wind farm.

The primary advantage of this Project is its 14.4MW size, which increases efficiencies in construction costs over the Facility Project and avoids the limitations of connecting to the local distribution line. The Community could potentially train and employ its own members and facilities personnel to assist in operations and maintenance of the turbine. Westwood did not identify any fatal flaws in its feasibility study, however it is understood that should the Community wish to move forward with the Commercial Project that additional reviews would be required, which may identify previously unforeseen issues with project implementation.

A project of this size will require approvals from both MISO and PUC. The involvement of the PUC may mean additional scrutiny and environmental permitting, and at the current rate the process of working through the congested MISO project queue would take at least two to three years, per the review in Appendix Q. The Project could also be subject to infrastructure improvement costs dependent on the time and point of interconnection with MISO.

Westwood found that two project payback scenarios, with power purchase rates at $0.045 and $0.05 per kilowatt-hour (kWh), yielded positive returns on investment in 20 years.

1.4. Wind Turbine Selections

Preliminary turbine selections were made for both the Facility and Commercial projects. These turbines fit within the landscape defined by the Constraint Analysis; match well with the wind resource at the Site; conform to the interconnection guidelines established for each project; and are industry standard products readily available at a known cost.

1.4.1. Facility Project

The limiting agent in turbine selection for the Facility Project was the distribution line power limit set by Xcel Energy, as discussed in Section 4.2. The current state of the Xcel power line effectively limits any wind turbine connected to the Casino to a rated power of 600kW.

Westwood subsequently researched available 600kW wind turbines. As the wind industry has progressed, the average size of commonly available turbines has increased. Today commercial wind turbines from the most reliable companies are larger than 1MW, or else found in the "small wind" category of 10-100kW. The new class of mid-range turbines is relatively small. However, Westwood found two turbines which fit the project size:

- RRB Energy PS-600: RRB Energy purchased the production rights from Vestas for the V47 turbine, once Vestas' flagship 600kW model. Updating Vestas' technology, the company began producing the WTG. Westwood consulted with a major wind contractor that has installed a number of PS-600s, and the contractor gave a positive assessment of the turbine's availability and reliability. RRB has installed more than 2,000 turbines in India and around the world.

- Fuhrlander FL-600: Fuhrlander continues to include the FL-600 on its list of producible wind turbines; however after meeting with a company representative, Westwood learned that the company produces the turbine by order only, at a cost significantly higher than that of the RRB turbine. The representative was not aware of the company having built an FL-600 for the American market in recent years.

Due to the Fuhrlander's high production costs and limited availability, Westwood chose the RRB turbine to model the Facility Project. The PS-600's specifications and power production information are available online from the company's website, and within the software Westwood used to assess turbine performance.

The PS-600 turbine has a 47 meter rotor diameter and typically uses a 63 meter tubular tower.

1.4.2. Commercial Project

In choosing a turbine for project design, Westwood's goal was to maximize power production over the available landscape and within the established constraints, and the General Electric 1.6-82.5 allowed Westwood to meet that goal.

In 2011 GE was the sixth largest wind turbine manufacturer in the world in terms of market share. The 1.6-82.5 turbine and its immediate predecessor the 1.5xle account for nearly 50% of America's commercial wind energy fleet with over 10,000 turbines in operation.

The 1.6-82.5 is a 1.6MW turbine with an 82.5 meter rotor diameter. The turbine's large rotor allows it to operate efficiently in a wind range of wind speeds. The turbine specified for this project will sit on an 80 meter tubular tower. There are nine turbines in the Commercial Project.

1.5. Wind Energy Technical Review

Wind turbine generators (WTG), or wind turbines, generate electricity by harnessing the energy contained in blowing winds and converting it to usable energy.

The most visible part of the WTG is the blade. A typical turbine has three blades that are shaped as airfoils, much like an airplane's wing. A wing uses the contrasting forces of lift and drag to lift a plane into the air; a set of wind turbine blades uses these forces to activate a generator, rotating a magnet inside of an electrical field. The same principle is used in conventional fossil-fuel and nuclear generators, which generate heat to produce steam pressure to spin a turbine. This rotation produces electricity. The faster the blades and the magnet spin, the more electricity is produced. The electricity is then sent through a power conditioning device to produce smooth and consistent AC power to be used by homes, businesses, and utilities to run appliances, lights, computers, and machines.

A typical wind system will also include a tall tower to support the turbine at the ideal altitude; basic electrical components such as fuses, safety switches, transformers, conductors, and conduit; and a monitoring and control system for remote access to real-time operations and historical data about the system.

2. Constraint Analysis

2.1. Overview

The Constraint Analysis revealed encumbrances and physical constraints to project development, and outlined areas best suited for further evaluation. This task includes research both by Westwood and its subconsultants in the following areas:

- Setbacks: Required and Best Practices
- Cultural Resource Review
- Communications Infrastructure Review
- Site Survey and Wetland Delineation
- Geotechnical Study
- Airspace Review
- Environmental Permitting

In general, the work done for the Constraint Analysis was focused on Commercial-scale development across the Community. For the smaller and more specific Facility Project, Westwood developed specific analysis tasks, such as a small-scale site survey, which are described throughout this section where applicable. It should be understood that for most tasks, however, the analysis results are applicable to both the Commercial and Facility projects except where noted.

2.2. GIS Analysis

In addition to the narratives and reports contained in this study, Westwood used the data collected from the research listed above to create a geographic information system (GIS) for this task, which overlay Community properties with digital data pertaining to aerial photography, publicly available wind resource data, land use, physical infrastructure, communications infrastructure, environmental features, and known cultural resource features. The GIS mapping analysis consisted of assembling available GIS data layers obtained from federal, state, and local government sources. These data layers were used to create maps for understanding environmental, physical and logistical constraints in the project area (Appendix A). The GIS identified development opportunities and provided the framework for further analysis and project design. The result of this task was a Preliminary Turbine Locations map (Appendix B) of the Community that highlighted developable areas and identified preliminary turbine locations for both Facility and Commercial Projects. Figure 2-1 below shows the preliminary turbine locations.

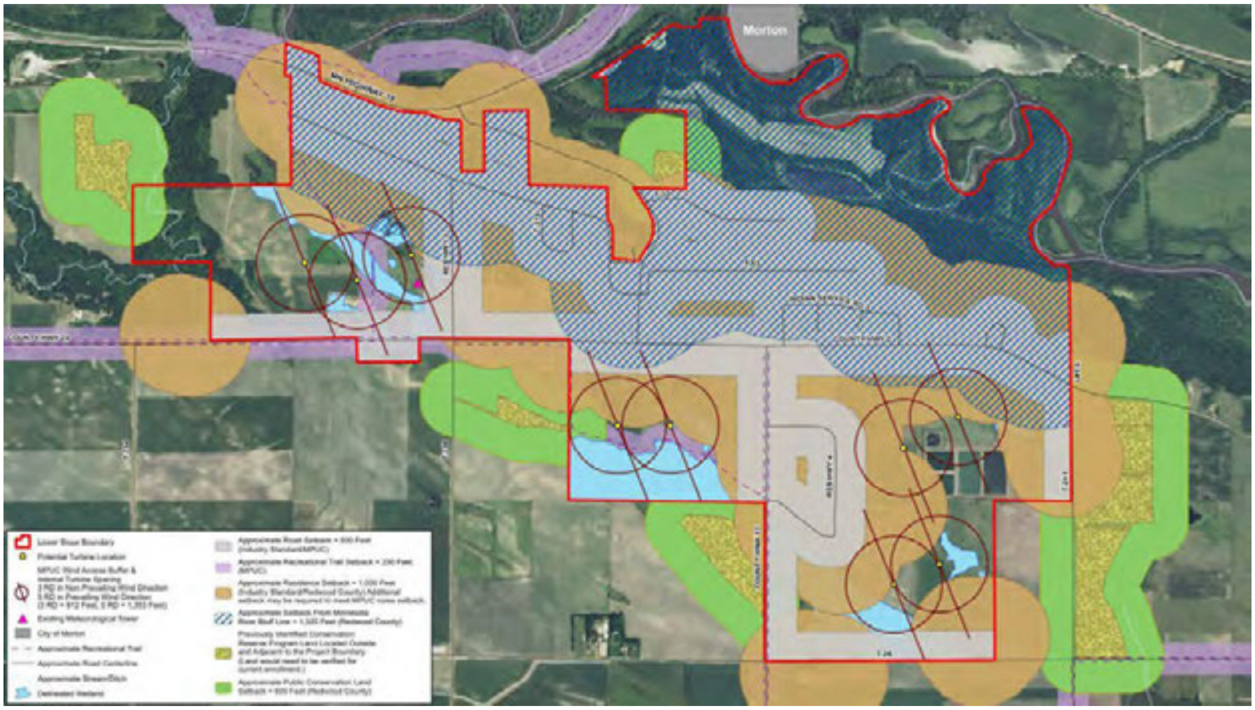

Figure 2-1

This GIS-level analysis did not identify fatal flaws that would typically preclude permitting of a wind energy facility. However, Westwood identified several elements that could present challenges to the development of portions of the overall project area that may need to be further explored depending upon the preferred turbine locations being considered. Approval of certain locations may require special negotiation or mitigation coordination with federal, state, and other governmental agencies. While these issues may require some additional coordination and permitting, Westwood does not anticipate them rising to the level of fatal flaws. Identified areas which may require additional coordination include:

- Wetlands, Public Waterbodies and Watercourses
- Forested Areas and Grasslands (possibly native grasslands)
- Conservation Easement Lands (WRP, CRP, RIM, etc.)
- MnDNR Lands and Wildlife Management Areas
- Cultural Resources
- Setbacks from occupied structures
- Airports/Air Safety Hazards (e.g. Redwood Falls Municipal Airport)

Based on this analysis, Westwood found that approximately 190 acres of the overall 1,987 acres found in the Site are likely suitable for wind development.

2.3. Setback Analysis

Westwood completed an evaluation of potentially developable parcels and land use constraints using applicable turbine setbacks (Appendix A, Exhibit 6). Exhibit 6 illustrates the maximum available land for the Commercial Project after incorporating all potential setbacks.

Setbacks allow for a specific amount of area between the turbines and other features, such as adjacent turbines, wetlands, and residences. It is important to note that not all local setbacks are applicable to the Project because not all setbacks apply on sovereign land. However, wind turbine setbacks, whether protecting water features or surrounding citizens, are often indications of best practices for developing wind farms. For that reason, Westwood analyzed the potential wind developing using both the Minnesota Public Utilities Commission (MPUC) General Wind Turbine Permit Setbacks and Standards for Large Wind Energy Conversion Systems as well as the local Redwood County Setbacks. The Redwood County Setbacks would also be required for any impact on the land adjacent to the Lower Sioux Community, such as surrounding residences in Redwood County. Additional discussion regarding environmental permitting requirements related to setbacks is reviewed under Section 2.9 – Environmental Permitting.

A summary of the state and county setbacks is provided below, with indications of where the project meets, or is likely to meet, the setback requirements. These setbacks assume the use of the GE 1.6MW turbine with an 82.5m rotor diameter on an 80m tower. Moreover, in evaluating the setbacks throughout the site, Westwood was able to narrow down appropriate locations for commercial turbines as well as the facility site.

2.3.1. MPUC Setbacks

The Minnesota Public Utilities Commission (MPUC) will use the General Wind Turbine Permit Setbacks and Standards for Large Wind Energy Conversion Systems (LWECS) in determining appropriate setbacks for the project.

The Project has been designed to ensure consistency with setbacks established in recent LWECS site permits that have been approved by the PUC and by PUC actions, such as adoption of General Permit Standards for projects under 25 MW.[1] This includes a wind access buffer of 5 rotor diameters (RD) in the prevailing wind direction (northwest) and 3 RD in the non-prevailing wind directions; a noise setback meeting Minnesota Noise Standards, Minnesota Rules Chapter 7030; at least a 500-foot setback from homes; a 250-foot setback from public roads and recreational trails; and a 250-foot setback from roads and project boundaries for meteorological towers. Below are the setbacks considered in developing the Preliminary Turbine Locations Map as illustrated in Appendix B.

1. **Wind access buffer**: Met using 3 RD x 5 RD setback (circle/line interpretation).
1.1. Circle = 3 RD from center
1.2. Line = 5 RD from center extending out in prevailing wind direction.
2. **Internal turbine spacing**: Met using 3 RD x 5 RD setback (circle/line interpretation).
3. **Homes**: Assumed met 1,000 foot setback (Industry standard applied). Additional studies required, see 7 below. Setbacks from non participating landowners and road right-of-way lines protect adjacent properties and vehicles while minimizing the liability of the turbine owner should the structure fail.

[1] See *Order Establishing General Wind Permit Standards*, Docket No. E,G-999/M-07-1102, Issue Date January 11, 2008;
http://energyfacilities.puc.state.mn.us/documents/19302/PUC%20Order%20Standards%20and%20Setbacks.pdf.

4. **Public roads**: Met with 500 foot setback from road centerline [1.1 tip height + 60 foot assumed ROW] (Industry Standard Applied).
5. **Recreational trails**: Likely to meet. 250 foot setback from snowmobile trails. MPUC reviews setbacks from trails on a case by case basis.
6. **Wetlands**: No setbacks required. Avoidance only. Met using field delineation of wetlands.
7. **Noise standard**: Study required. Most states and county governments throughout the US mandate that turbines be sited at a distance far enough away from residences so that noise levels attenuate to the 45 - 50 decibel (dB(A)) level at the residence location. This setback distance is necessary so that the noise emitted from the turbines isn't noticeable during operation. This distance for most 1.6 MW turbine models ranges from 500 – 750 feet.
8. **Native Prairie**: No setbacks required. Avoidance only. Study required.
9. **Sand & gravel operations**: No setbacks required. Avoidance only.
10. **Aviation**: Setbacks and other limitations determined in accordance with MNDOT and FAA.

2.3.2. Redwood County Setbacks

Redwood County setbacks were not incorporated into the Preliminary Turbine Locations Map because Redwood County would have no jurisdiction over the Community. However, as shown below, the Project as currently designed meets or likely meets all the setback requirements.

1. **Property lines**: Met using 3x5 RD setback (circle line interpretation). Also met with 1.1 tip height setback.
2. **Structures/Residences**: Met with 1,000 foot setback (Industry standard applied).
3. **Other commercial wind energy generators**: Met due to no nearby existing wind energy generators. The Redwood County Ordinance indicates a wind rights setback of "5 rotor diameters from any other wind tower project." Wind right setbacks were not incorporated into the analysis, based on the assumption that there are no existing turbines within 5 rotor diameters of the property on adjacent land. Typically this rule applies to any non-participating landowner, though the way it is stated in this ordinance it would only apply to existing structures. This is likely not a requirement on sovereign land, but would also be something to consider if a turbine is erected on adjacent land prior to the construction of a turbine on the project area.
4. **Public conservation lands managed as grasslands**: Likely to meet. Reviewed and setback 600 feet previously mapped Farm Service Agency (FSA) Conservation Reserve Program (CRP) lands that were located outside the reservation. CRP lands inside the project boundary were not mapped or setback. If turbines placed on CRP land, landowner CRP contract would need to be amended. All lands would need to be verified for current enrollment. Potential native grassland study required.
5. **Minnesota River Bluff Line**: Likely to meet. Bluff line was approximated from topographic map. Location of bluff line would require County approval.

Most setbacks were applied using approximate and potentially incomplete GIS datasets. Additional features and setbacks may need to be incorporated or updated following the finalized land survey and determination of the scope of a final turbine layout depending on the needs of the Community.

Considering the distribution and abundance of the above-listed potentially applicable setback requirements, the southern and western portions of the project area appear to have the fewest constraints for wind development as shown on the Preliminary Turbine Locations map in Appendix B.

2.4. Cultural Resource Review

In June 2010 followed by an update in January 2012, a Westwood Cultural Resource Specialist conducted a background literature review of the Site, including a one-mile buffer. The review was conducted at the Office of the State Archaeologist (OSA) located at Fort Snelling in St. Paul, MN, and the Minnesota State Historic Preservation Office (SHPO) located at the Minnesota History Center in St. Paul, MN. Archaeological site and historic/architectural resource files were examined to obtain a list of all previously recorded archaeological and historic/architectural sites within the proposed Site. Cultural resource investigation summary reports for the county were reviewed to determine if previous surveys have been conducted within the Site.

The full Westwood Cultural Resource Review is in Appendix C.

2.4.1. Archaeological Resources

A review of records at the MN SHPO and OSA indicated that 18 previously recorded archaeological sites have been identified within the project area and a one-mile buffer. Eight sites are located within the project area and the additional 10 are located within the one-mile buffer. Two of the sites within the buffer are alpha sites, which are reported, but unverified archaeological sites. These sites are identified through either historical documentation or an informant's report, but have not yet been verified by a professional archaeologist.

The Lower Sioux Agency (21RW0011) located within the buffer, is listed on the National Register of Historic Places (NRHP). This site consists of structural ruins and artifacts related to the historic reservation agency. Jackpot Junction (21RW0053) located within the project area is eligible for listing on the NRHP, is an artifact scatter relating to the Archaic Tradition. The majority of sites are prehistoric sites. One cemetery (21RWam) is identified as possibly being in the buffer. Site types identified as earthworks may also be burials.

2.4.2. Historic/Architectural Resources

A review of records at the MN SHPO indicated that 30 historic/architectural resources have been previously inventoried within the project area and the one-mile buffer. The majority of resources (21) are located within the City limits. Four historic/architectural resources have been previously inventoried within the project area itself. Two resources, St. Cornelia's Episcopal Mission (RW-LSC-001) and the Birch Coulee School (RW-LSC-002) are listed on the NRHP. Both of these resources are located within the Site. The James McGowen House (RW-MRC-014), located within the buffer, is eligible for listing on the NRHP.

2.4.3. Conclusion

Upon review of the archaeological sites and historic properties inventories compiled for the defined project area, Westwood concluded that the archaeological and historic investigations executed to date have not examined the entire potential for existence of cultural resources in the area. While several investigations have been carried out in the project area, many of these have been limited in scope and concentrated on relatively small property parcels or immediate right-of-ways. Due to its proximity to the Minnesota River and the historic Lower Sioux Agency, the project area has high potential for cultural resources.

Based upon the result of the investigations reported here, Westwood recommends a Phase I cultural resources survey be conducted within the defined construction area for the project. Attention should be paid to the location of the recorded archaeological and architectural properties identified during this investigation and those potentially identified in subsequent field investigations to ensure that negative impacts to the properties can be avoided during the construction phase of the project. Ultimately, the project should follow the guidelines for cultural resource investigations as defined by the MN SHPO.

As the project is located within the boundaries of the Lower Sioux Indian Community, it is recommended that the Lower Sioux Tribal Historic Preservation Office (THPO) be contacted in reference to the project. The THPO office should be contacted to ascertain if tribal laws and regulations in regards to cultural resources may be relevant. If the project will be reviewed for cultural resources under Section 106 of the National Historic Preservation Act or NEPA, the Lower Sioux THPO will assume the duties of the MN SHPO in regards to review and compliance.

2.5. Communications Infrastructure Review

Wind turbines may have a negative impact to existing microwave systems by physically blocking the line-of-sight between transmitters. Many states and other jurisdictions have recognized the need for regulating the potential for interference to these signals caused by wind turbine development. It has become an industry standard to perform various studies to ensure proposed structures will not cause interference to prevent the potential for legal and regulatory complications and to promote a good neighbor approach to their projects.

ATDI, a subconsultant to Westwood, conducted an analysis to identify and map any licensed non-federal government microwave paths that intersect the general Project area. They also determined the worst case Fresnel Zone (WCFZ) boundaries for each path. The WCFZ is a swath along the microwave path where wind turbines could obstruct the path.

The results of the study show that all wind turbines are clear of existing microwave links and fresnel zones. No interference is to be expected with the current layout. The complete communications infrastructure review by ATDI is in Appendix D.

2.6. Airspace Review

Capitol Airspace Group, a subconsultant to Westwood, conducted a comprehensive airspace and obstacle evaluation for the Lower Sioux Wind Project. This evaluation is in Appendix E. The purpose of this study was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that would limit the height or location of proposed wind turbines. At the time of this study, the location of individual wind turbines had not been determined. Therefore, the study assessed the height limitations in the Project area to facilitate optimal turbine sites.

Capitol Airspace evaluated all 14 CFR Part 77 imaginary surfaces, published instrument approach and departure procedures, visual flight rules and en-route operations. All formulas, headings, altitudes, bearings and coordinates used during this study were derived from the following documents and data sources:

- 14 CFR Part 77 "Object Affecting Navigable Airspace"
- FAA Order 8260.3B (Change 21) "United States Standard for Terminal Radar Procedures (TERPS)"
- FAA Order 7400.2G "Procedures for Handling Airspace Matters"
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data

The results of this study show that height limits exist over the project area due to the close proximity to Redwood Falls Municipal Airport. The most restrictive height limits occur over the northwestern portion of the project. The height limits over the remainder of the project site limit the total height of potential wind turbines to a range of 400-500 feet. The total turbine height of the GE 1.6-82.5 is just below 400 feet. It should be noted that these results assume the FAA finds no substantial electromagnetic interference with communications, navigation, or surveillance systems. These results may also vary depending on future development of the Redwood Falls Municipal Airport.

This report does not in any way replace the official Federal Aviation Administration's Obstruction Evaluation/Airport Airspace Analysis (FAA OE/AAA) review and permitting processes and procedures. The FAA notification process requires submission of a Notice of Proposed Construction or Alteration Application (FAA Form 7460-1) to obtain a Determination of No Hazard to Air Navigation (DHN) for each structure over 200 above ground level (AGL) 30 to 60 days prior to construction. For each structure approved by the FAA with a Determination of No Hazard to Air Navigation, the FAA process also requires submission of a Notice of Actual Construction of Alteration (FAA Form 7460-2) within five days of each structure reaching their greatest height.

2.7. Site Survey and Wetland Delineation

Westwood surveyors and wetland specialists surveyed the Project Site for this Study. These surveys record the current topographic contours of proposed Project areas, establish the locations of topographical constraints, and define project boundaries and control points.

In wind turbine generation (WTG) siting, surveys identify topographically ideal locations, and constraints such as wetlands, land depressions and tall forests. Changes in topography can affect wind speeds and wind turbulence. Minor wind disturbances can significantly alter WTG efficiency, because available wind energy is formulated by multiplying wind speed by a power of three. In this way small changes are quickly magnified. Topography also impacts WTG civil and electrical design, including site access, foundation design, infrastructure, and electrical conductor runs and sizing, among other design features. In later development stages these survey resources will be used to mark final WTG locations in the Project Site where they will maximize production.

2.7.1. Site Survey

For this study, Westwood surveyors worked in two phases to record the Site's contours, topographic features, and boundaries. In phase one the survey crew performed a survey in November 2010 to define the contours of a site approximately 125-acres in size and is located in the SE ¼ of S. 2, T.112N, R. 35W, Paxton Township, Redwood County, MN. In relation to Community landmarks, Site 1 is located west of the Casino, in the far western area of the Community. The 600kW Facility Project turbine and three 1.6MW Commercial Project turbines have proposed locations in Site 1. The survey was performed ahead of the installation of the met tower to ensure the tower was located properly. See Appendix F for the met tower survey drawing and location.

To survey the remaining portion of the Project Site for this Study, Westwood obtained contour data in the form of a high-accuracy digital elevation map from the State of Minnesota, based on data collected using LiDAR (Light Detection And Ranging). A contractor for the State collected aerial LiDAR data from approximately 17,260 square miles of land around the Minnesota River Basin, including Redwood County, where the Project is located. The LiDAR data was collected during spring and fall leaf-off periods in 2010. This data was provided by the State, and as public data it is available at no cost to the project. Its accuracy was vetted by Westwood and deemed sufficient for this Study.

2.7.2. Wetland Delineation

In November 2010 and July 2011, a Professional Wetland Scientist conducted wetland delineations in two areas of the Project Site, called Subject Properties, determined suitable as wind turbine sites by the GIS constraint analysis. A wetland survey delineates sensitive areas that must be avoided and/or mitigated according to wetland regulations. The wetland's location determines the authority having jurisdiction (AHJ), that is, the party responsible for creating and enforcing the rules regarding the wetland. Part of Westwood's scope was to identify the AHJ for wetlands within the Project Site, and submit wetland reports to that authority for determinations.

The Subject Properties were identified as Site 1 and Site 2 in the Wetland Delineation Reports, attached in Appendix G. Site 1 is approximately 125-acres in size and is located in Paxton Township, Redwood County, MN. In relation to Community landmarks, Site 1 is located west of the Casino, in the far western area of the Community. Site 1 was delineated on November 8, 2010. A total of eight wetlands were identified on Site 1. The 600kW Facility Project turbine and three 1.6MW Commercial Project turbines have proposed locations in Site 1. The Project's met tower was formerly located in Site 1, its location based on the delineation performed by Westwood.

Site 2 is approximately 740-acres in size and is located in Paxton and Sherman Townships, both in Redwood County. In relation to Community landmarks, Site 2 is located in the southern and southeastern areas of the Community. Site 2 was delineated on July 25 and 26, 2011. A total of 19 wetlands were delineated on Site 2. Six 1.6MW Commercial Project turbines have proposed locations in Site 2.

One Wetland Delineation Report was completed for each Site. The reports were submitted to the U.S. Army Corps of Engineers (USACE) for the approval of the delineated wetland boundaries and to receive a preliminary jurisdictional determination for the subject properties. Following the submittal, Westwood's Wetland Scientist met with a representative from the USACE to review the delineated boundaries.

On November 8, 2011, the USACE issued a preliminary jurisdictional determination for Site 1 and Site 2 and approved the delineated boundaries on Sites 1 and 2. The USACE agrees with the delineation and won't add wetlands or expand wetland boundaries. The determination on both sites effectively says that there may be wetland or water features that the USACE would have jurisdiction over on the Subject Properties, and the USACE would have jurisdiction over all of the wetlands on the site when/if the project moves to the permitting phase. The terms of this preliminary determination may change in later stages of permitting and development.

When the Projects move to the permitting phase then the Projects would likely get processed under a USACE Nationwide Permit, provided the permanent impacts to wetlands are limited to <0.5 acres and 300 linear feet of streams. There are no limits to temporary impacts provided the area is returned to pre-construction condition after work is completed.

2.8. Geotechnical Study

Braun Intertec, a subconsultant to Westwood, conducted a comprehensive geotechnical evaluation and report for the Lower Sioux Wind Project. This report is in Appendix H. The purpose of this evaluation was to identify and assess the Project Site's soils and geology to determine its suitability for installation of a WTG and met tower. The report also provides engineering details and recommendations pertinent to the WTG civil, tower, and foundation designers.

This initial study was scoped for the area of the Facility Project and Study met tower. Braun Intertec made a single soil boring to assess ground conditions at a location west of the Casino proposed for the met tower and a single WTG (presumed to be the 600kW Facility WTG). The met tower was located at this site for the duration of the Study; the Facility WTG would be installed at the same site, or near enough that the soil boring would continue to be valid. Should the Community proceed with the Commercial Project, soil borings would be needed at more locations to account for all the WTG installations.

The specific scope of this geotechnical evaluation was to characterize subsurface geologic conditions at a boring location within the turbine foundation area and evaluate their impact on the design and construction of the proposed wind turbine, access road, and crane pad.

The resulting report from Braun Intertec indicated that the geologic materials present at WTG structure subgrade elevations generally appear suitable for support of conventional foundations, crane pads and access roads, when certain qualifications and design recommendations are met.

2.9. Environmental Permitting

All wind development projects must review and ultimately engage in environmental permitting. The scope and types of permits range from federal to local requirements, reviewing multiple environmental impacts including noise, wetlands, and endangered species. An extensive list of the permits and descriptions of each is at Appendix I. Given that the Facility and Commercial

Projects are Tribal Energy projects on sovereign land, not all local and state permits are required. Specific permit requirements will depend in part of the final project determinations and specifically impacted lands. Even in the event that all typical permits are not required given the sovereign nature of the tribal land, it is recommended to review and consider all permits as industry practice. To that end, Westwood incorporated environmental setbacks in development of the Commercial Project's maximum available land plan as indicated in Exhibit 6 to Appendix A.

Westwood also engaged Fredrikson & Byron, P.A. (Fredrikson) to review environmental permitting requirements for the Lower Sioux Wind Project. The Fredrikson legal team has extensive experience permitting and negotiating wind development in Minnesota, and in particular negotiates both on-site facility and commercial projects with local utilities. The Fredrikson team reviewed permitting requirements for tribal lands, specifically the impact and applicability of: (1) federal permitting requirements; (2) Minnesota Public Utilities Commission (PUC) site permitting requirements for Large Wind Energy Conversion Systems (LWECS); and (3) jurisdiction of state or local transmission line requirements. The full analysis is provided in Appendix J.

Generally, when developing a wind project, federal regulations such as the Clean Water Act and Clean Air Act will apply. Minnesota cannot, however, assert regulatory jurisdiction over tribal activities solely affecting tribal lands held in trust and tribal members. Yet, it may be practical for the Lower Sioux Community follow the PUC guidelines as best practices with regard to siting wind turbines to help ensure that no jurisdictional questions arise. Finally, depending on the voltage and length of the transmission line, state or local jurisdiction will apply to that portion of the line located outside reservation boundaries.

3. Wind Resource Evaluation

The Wind Resource Evaluation combined a year-long on-site wind monitoring project with a long-term view of meteorological trends in the region to provide an understanding of the available wind resource and how it may change over the life of a wind energy project. The following is a summary of the measured wind data at the Lower Sioux Indian Community for the year 2011, and explanation of the data collection and interpretation processes.

3.1. On-Site Wind Evaluation

A major component of this Study was the collection of real-world wind data at the Lower Sioux Indian Community, in order to provide a baseline understanding of the wind resource in the area. Westwood's task was to collect and analyze wind data for one year. Westwood collected on-site wind data with wind measuring tools onboard a meteorological ("met") tower located on Community land.

3.1.1. Meteorological Tower Specifications

The met tower used at the Lower Sioux Indian Community is a 60-meter tubular tower from NRG Systems. The datalogger is a NRG SymphoniePlus, which transmits data over a CDMA cellular network using the NRG Symphonie iPack.

The tower is configured with six NRG #40C anemometers, offset from True North by 60 and 240 degrees (three at each angle) to minimize the effects of tower shading in the prevailing winds from the northwest. The six anemometers are mounted at three heights: 58.98 meters, 47.32m, and 31.70m. These staggered sensor heights are used to measure wind shear, meaning the change in wind speed across a vertical dimension, and predict wind speeds at elevations higher than the met tower itself.

The tower also utilizes two NRG #200P wind direction vanes, mounted at 57.15m and 42.6m. These wind vanes are offset from True North by 240 degrees. Additional tower-mounted sensors include temperature and barometric pressure sensors mounted six feet above the tower base. Complete configuration data is located in Appendix K. Westwood's subcontractor National Wind Assessments constructed and commissioned the tower, and the data was monitored by Westwood.

3.1.2. Monitoring Process

Westwood's factors in identifying an ideal wind data collection site were:

- An optimal wind location;
- A location that Westwood had already vetted as a preliminary turbine location; and
- Centrally located in the Community and easily accessible for the year-long monitoring process.

Optimally, a met tower (or turbine) should be a minimum 30 feet higher than anything within a 500 foot radius. After conducting the GIS constraint analysis of the Community land, Westwood and the Community identified a parcel one half mile west of the Jackpot Junction Casino Hotel suitable for the met tower, and for the proposed 600kW WTG. The location close to the Casino made it an ideal site for the met tower, where Casino facilities personnel and other contractors could easily access the installation for construction and maintenance. Within the site chosen, Westwood performed a site survey and a wetland delineation of the plot to establish existing conditions. Braun Intertec performed its geotechnical study at the location. The soil boring is a necessity for the design of both the wind turbine tower foundation and the anchoring system of the met tower. With the soil conditions established, Westwood contracted with National Wind Assessments to install the tower, calibrate the instruments, and activate the datalogger and transmitter. The tower was installed and commissioned in one day, on December 18, 2010.

On January 1, 2011, Westwood began receiving data from the met tower, transmitted weekly through a cellular data network. This weekly transmittal included data on wind speed at three heights, wind direction at two heights, temperature, and barometric pressure. Westwood collected data from the met tower until December 31, 2011 at midnight to complete the year's worth of wind data.

During the first quarter of 2012, this raw wind data was processed and interpreted at Westwood using software from Windographer. This software allowed a broad range of dissection, from specific analysis of ten-minute wind occurrences to overall wind patterns by day, week, or month. Over the course of 2011, Westwood provided the Community with monthly wind reports, chronicling the wind resource characteristics of each month. For this Study Westwood summarized the twelve months of wind data in an annual report. The Annual Wind Report is in Appendix L and a summary of the report is below.

3.1.3. Annual Wind Report Summary

3.1.3.1. Overview

The data for this summary was collected from the meteorological tower located at the Lower Sioux Indian Community. This report collects data reported between 1/1/11 12:00AM and 1/1/12 12:00AM. It incorporates data from six anemometers and two wind vanes, along with temperature, air density, and barometric pressure sensors.

3.1.3.2. Wind Speed Evaluation

The recorded average wind speed for the year at this location, at an anemometer height of 59 meters (193 feet) is **6.071 meters per second (13.58 mph)**. This average is based on the combined average wind speed of the two anemometers located at 59 meters, "59m A" and "59m B." The following table shows cumulative monthly average wind speeds for 2011, and the following figure shows the same data as a graph.

Anemometer	59 m A	59 m B	47 m A	47 m B	32 m A	32 m B
January 2011	5.485	5.502	4.906	5.114	4.05	4.487
February 2011	6.612	6.581	5.925	6.105	4.979	5.364
March 2011	6.025	6.064	5.344	5.692	4.457	5.046
April 2011	6.721	6.717	6.063	6.356	5.247	5.651
May 2011	6.925	6.724	6.186	6.275	5.269	5.528
June 2011	6.333	6.228	5.533	5.864	4.737	5.061
July 2011	5.056	5.063	4.191	4.659	3.476	3.956
August 2011	4.642	4.663	3.736	4.298	3.095	3.549
September 2011	5.356	5.203	4.515	4.786	3.742	4.006
October 2011	6.698	6.816	5.934	6.245	5.012	5.435
November 2011	6.832	6.804	6.11	6.269	5.135	5.444
December 2011	6.216	6.256	5.507	5.788	4.556	5.006
Average (m/s)	**6.075**	**6.052**	**5.329**	**5.621**	**4.480**	**4.878**
Average (mph)	**13.59**	**13.54**	**11.92**	**12.57**	**10.02**	**10.91**

Table 3-1

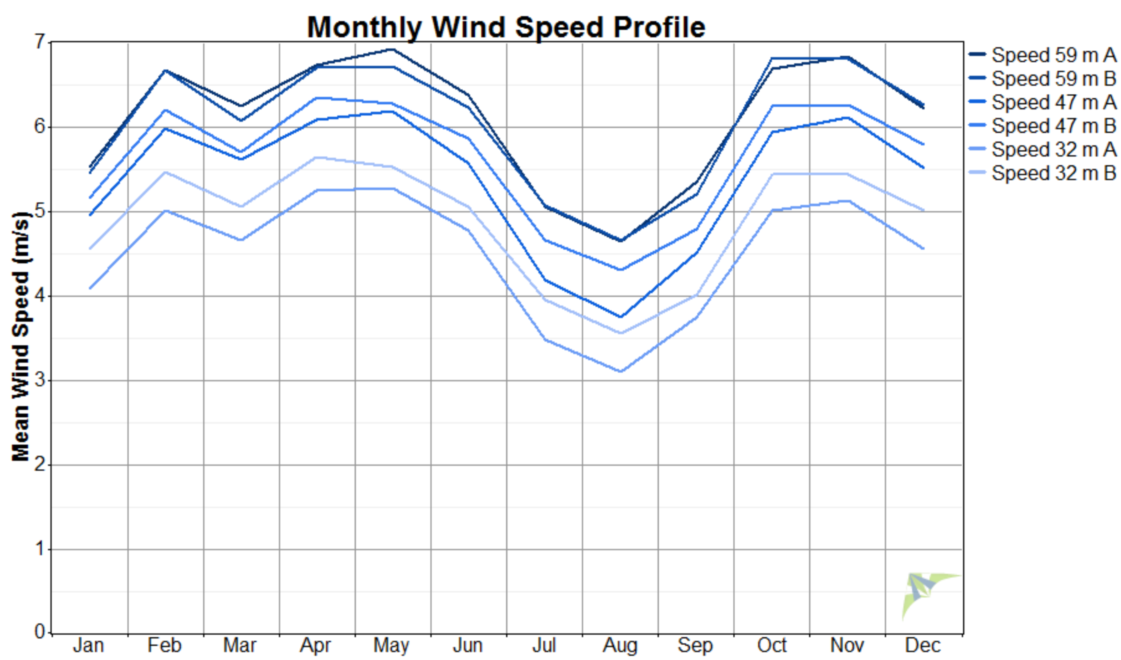

Figure 3-1

Table 3-2 below ranks each month's average wind speed at 59m, from most to least windy. May was the windiest month of the year at 6.825 m/s (15.27 mph), and August was the least windy month at 4.653 m/s (10.41 mph).

Month	Wind Speed (m/s)
May	6.825
Nov	6.818
Oct	6.757
Apr	6.719
Feb	6.597
Jun	6.281
Dec	6.236
Mar	6.045
Jan	5.494
Sep	5.280
Jul	5.060
Aug	4.653

Table 3-2

3.1.3.3. Wind Direction Evaluation

Wind direction is measured by two wind vanes on the met tower, located at 57 meters and 43m. Direction is an important metric for evaluating the quality of wind in a given area. If wind is too turbulent, flowing infrequently from many directions rather than from one prevailing direction, a wind turbine will be less efficient because it will spend more time yawing from one direction to another instead of steadily collecting wind energy from one focused direction.

In constructing wind farms it is important to understand the prevailing wind direction so wind turbines are arrayed in such a way as to receive the most high-quality wind power possible without interfering with one another.

An analysis of wind direction data collected at the met tower in 2011 shows that the wind most often blows from the northwest. This is the prevailing wind direction. However the data indicate that significant wind energy also comes from the southeast.

Wind direction data is mapped in a polar graph called a wind rose. A wind frequency rose shows the frequency with which wind blows from a certain direction. The figure below shows wind frequencies by direction for 2011 at a wind vane height of 57m. The figure makes clear that the northwest is the prevailing wind direction.

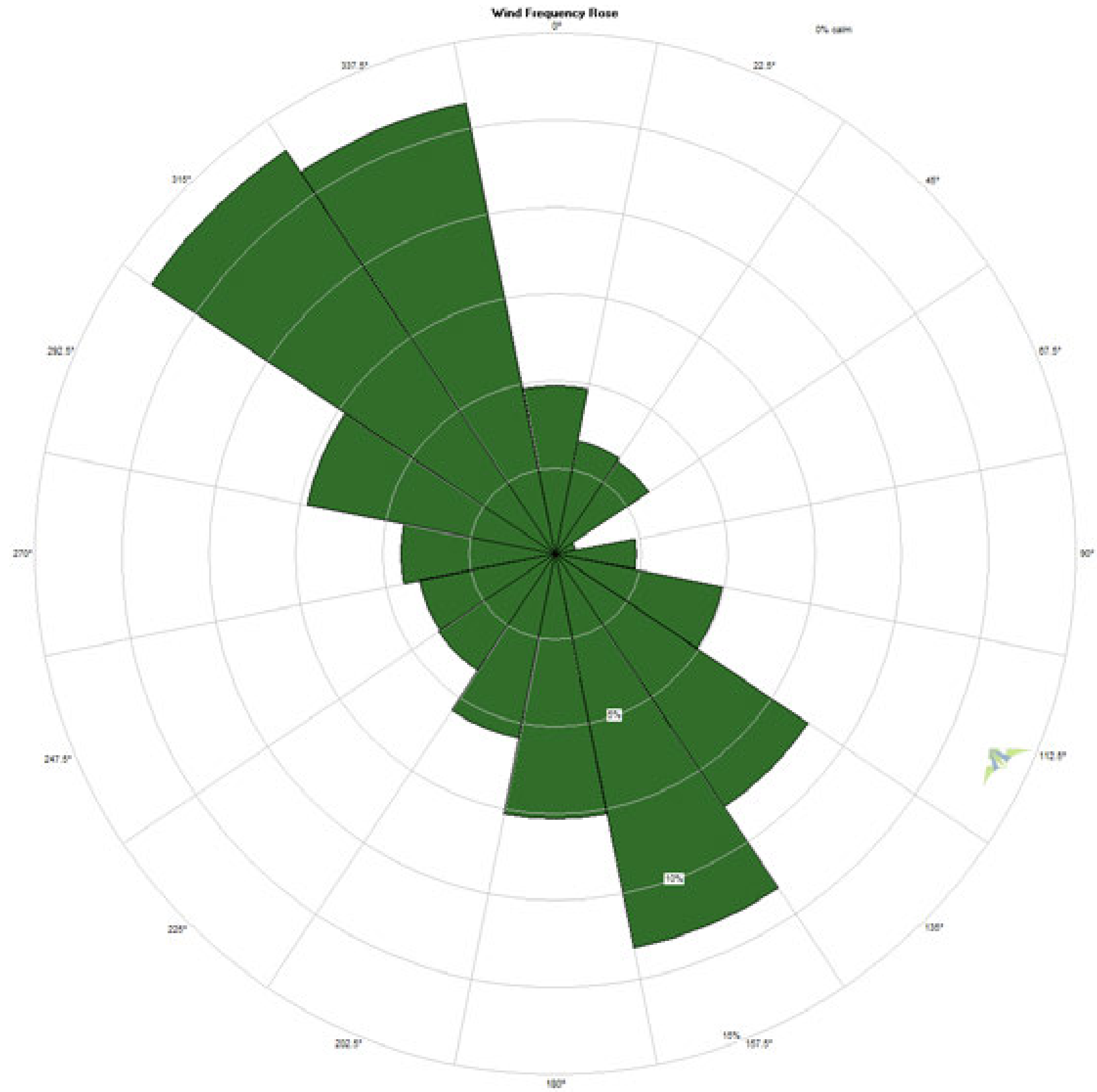

Figure 3-2

3.1.3.4. Wind Power Density Evaluation

The recorded average wind power density (WPD) for the year at this location, at an anemometer height of 59 meters is **237 watts per square meter (w/m^2)**. WPD is a measurement of the potential power generated by the wind over a certain area. This estimate is calculated using wind speed and air density data.

The wind industry uses a class rating system to quantify, on a scale, the energy content of the wind at a project site. The Department of Energy's National Renewable Energy Laboratory (NREL) defines the wind class of a site on a scale from 1 to 7 (1 being poor and 7 being excellent) based on average wind speed and power density at 50 meters. The wind power class scale is as follows:

Wind Power Class	Description	Power Density (W/m^2)
1	Poor	0-200
2	Marginal	200-300
3	Fair	300-400
4	Good	400-500
5	Excellent	500-600
6	Outstanding	600-800
7	Superb	800-2000

Table 3-3

This establishes the available wind in 2011 at the 60m height of the met tower as a Class 2 "Marginal" resource.

3.1.3.5. Conclusion

This data represents a single year's research and should not alone be considered a definitive marker of wind resource and WTG production at the Community over the long term. For a longer-term analysis, Westwood contracted with WindLogics to explore the long-term wind resource and its variability from a wider meteorological perspective. A review of WindLogics' report and findings is in the following section.

3.2. Long-Term Wind Evaluation

To understand the wind resource in the Community over the long-term, in addition to the near-term reporting by the met tower, Westwood engaged the subconsultant WindLogics, a renewable energy consulting service focusing on wind forecasting, meteorological analysis, and project optimization. WindLogics is located in St. Paul, Minn., and is a subsidiary of NextEra Energy. WindLogics' complete report is located in Appendix M and is summarized below.

WindLogics' focus was on the feasibility of the nine-WTG Commercial Project, though its results are applicable to the Facility Project as well. As such, the data WindLogics provided pertain to the wind resource at 80 meters, which is the hub height of the GE 1.6MW wind turbine used for the Commercial Project.

3.2.1. Wind Speed Evaluation

To initiate the review process, Westwood supplied WindLogics with the raw met tower data for the year 2011. The data from the met tower were put through a quality-checking process, and were then extrapolated to the projected hub height of 80 meters above ground level. The extrapolation process includes the application of wind shear data obtained by the tower to predict, using an industry-standard exponential function, wind speeds at a higher elevation outside the range of the tower.

The extrapolated wind data were combined with 30 years of meteorological reference data from NASA using the WindLogics Enhanced Measure-Correlate-Predict (E-MCP) method. This combination normalizes the on-site data with NASA's database. The output of the E-MCP method is a thirty-year time-series of estimated values representative of on-site wind flow. Finally, WindLogics used a second process to check for errors and validate their approach. The resulting estimated wind data were statistically summarized as annual and monthly wind speed and wind direction, which represent the long-term characteristics of the site.

WindLogics found that at the met tower location, the normalized average annual wind speed at 80m is 6.94 meters per second (15.52 mph). Monthly average wind speeds are as follows:

Month	Wind Speed (m/s)
January	7.20
February	7.11
March	7.21
April	7.30
May	7.23
June	6.51
July	5.88
August	5.95
September	6.89
October	7.30
November	7.29
December	7.41
Average (m/s)	**6.94**
Average (mph)	**15.52**

Table 3-4

3.2.2. Probability Analysis

WindLogics performed a wind speed probability analysis for the met tower location at 80m. WindLogics estimated project-specific uncertainties and measured their individual and cumulative effects on wind speeds. Uncertainties include wind speed variability, met tower sensor reliability, normalization modeling, long-term reference modeling, and extrapolation methods. The resulting probability analysis describes WindLogics' certainty that wind speeds will probably meet certain values, with each "p-value" representing the probability percentage. For example, according to the table below, it is probable that over a 30-year period the minimum annual wind speed will be 6.94 m/s fifty percent of the time. As the certainty of the prediction grows to 99 percent, the annual average wind speed drops to a level that is more reliable.

P-Value (%)	Wind Speed (m/s)
50	6.94
75	6.72
85	6.60
90	6.52
95	6.40
99	6.18

Table 3-5

This estimation is based on data collected from one met tower, and is subject to change with any additional studies in the area. The location and number of turbines installed may also affect wind speeds and turbine production in the area.

3.3. Wind Turbine Energy Estimation

Based on the data collected from the Community met tower, Westwood and WindLogics estimated wind turbine energy production and capacity factor for the Facility and Commercial Projects.

Commercial Project

The Commercial Project is comprised of nine GE 1.6MW turbines, specifically the GE 1.6-82.5 at an 80 meter hub height. Using the extrapolated, normalized met tower data correlated over a 30-year period, WindLogics determined average annual and monthly wind speeds with a fifty percent (P50) probability. The P50 value assumes that the various project uncertainties described above remain as estimated throughout the lifetime of the wind project. This estimate incorporates a number of assumptions:

- Wind speeds seen at the met tower are repeated at each of the nine turbines, though some of them are preliminarily located some distance from the met tower.
- The nine turbines will be optimally located.
- The wind turbines will be maintained in such a way as to preserve the same production values throughout the project lifetime, 20 years.
- The change between gross and net production/capacity will be a 15% industry standard loss factor, incorporating icing, soiling, and location losses, in addition to downtime and maintenance.

Under the assumptions described above, the turbine's power profile was applied to wind speed model outputs, with the resulting average annual energy estimations for nine (9) GE 1.6-82.5 turbines as follows:

Energy Estimation	Value
Gross Capacity Factor (%)	38.81%
Gross Energy Production (kWh)	49,092,000
Net Capacity Factor (%)	32.65%
Net Energy Production (kWh)	41,728,200

Table 3-6

Over 20 years, the total energy produced is estimated at 834,564,000 kWh. This amount of power could meet the annual electrical needs of 3,267 homes for 20 years.[5]

[5] The Environmental Protection Agency states that the average American single-family home consumes 12,773 kWh of electricity annually. Source: "2005 Residential Energy Consumption Survey." http://www.eia.gov/emeu/recs/recs2005/c&e/summary/pdf/tableus3.pdf

Facility Project

The Facility Project is one RRB Energy 600KW turbine, specifically the PS-600 at a 63-meter hub height. Using the met tower data collected in 2011, Westwood determined average annual and monthly wind speeds at 63 meters. This estimate incorporates a number of assumptions:

- Wind speeds at the met tower are the same for the turbine, or the turbine is at the same location as the met tower.
- The wind turbine will be maintained in such a way as to preserve the same production values throughout the project lifetime, 20 years.
- The change between gross and net production/capacity will be a 10% industry standard loss factor, incorporating icing, and soiling in addition to downtime and maintenance. This loss factor is lower than the Commercial Project because there is only one turbine in the Project, therefore wind speeds will not be affected by other nearby turbines. The corresponding loss factor is reduced by 5%.

Under the assumptions described above, the turbine's power profile was applied to wind speed model outputs, with the resulting average annual energy estimation for one RRB PS-600 turbine as follows:

Energy Estimation	Value
Gross Capacity Factor (%)	25.50%
Gross Energy Production (kWh)	1,339,894
Net Capacity Factor (%)	22.94%
Net Energy Production (kWh)	1,205,909

Table 3-7

Over 20 years, the total energy produced is estimated at 24,118,186 kWh. This amount of power could meet the annual electrical needs of 95 homes for 20 years.[6]

[6] Ibid.

4. Utility Interconnection Analysis

The Utility Interconnection Analysis provided an understanding of the electrical utility interconnection opportunities for the Facility and Commercial Projects, including the advantages and disadvantages of each opportunity, the approval and permitting processes, and barriers to interconnection.

4.1. Overview

Westwood's initial scope of work for the Study was the evaluation of two possible wind projects:

- **Behind the meter (BTM)**: a project is directly connected to a facility with a large base load of electricity usage and, under normal operational circumstances, would utilize all the power produced by the renewable energy generator on-site without exporting any electricity to the grid.
- **Grid direct**: a project is interconnected with an existing power transmission line, or substation, and the power is sold to a utility offtaker. No electricity produced by the project is used on-site.

Westwood researched the Community's existing facilities, including a GIS review of nearby transmission and distribution lines (see Appendix A); an inspection of the Casino's on-site power facilities; and an analysis of the Casino's historical energy load. Following this preliminary research, Westwood applied for interconnection with Xcel Energy (Xcel), the utility serving the Community with power. The purpose of this interconnection application (IA) was to engage Xcel in an engineering study to identify potential connection points within the Project Site, and understand the power capacity limits that would be supported by Xcel's lines on the property and through to the substation.

For its initial IA Westwood reviewed a BTM opportunity through the Casino and the opportunity to interconnect with the on-site distribution line. Later Westwood researched interconnection points with transmission lines (as opposed to distribution lines) which involve process of interconnection evaluation with MISO (Midwest Independent Transmission System Operator). The MISO process and opportunities to interconnect with transmission lines is reviewed in more detail under Section 4.4.

Xcel's response to the IA, which is detailed in Section 4.2 below, effectively limited the size of the turbine that could be connected with Xcel from behind the Casino meter. Out of this limitation, the Community and Westwood shifted the Study's focus to two separate wind project types:

- The Facility Project, a 600kW BTM wind project feeding power to the Casino, meeting Xcel's conditions in the engineering study.
- The Commercial Project, a 14.4MW project directly connected to the grid through a nearby transmission line.

For the Facility Project, Westwood continued the evaluation process started with the initial IA, assessing the requirements for the interconnection of a single 600kW wind turbine with Xcel Energy. This evaluation included a review of the historical energy loads of the Jackpot Junction Casino complex, and the effect a mid-size wind turbine would have on those loads.

For the Commercial Project, Westwood evaluated the process and requirements for the interconnection of the 14.4MW wind project with the nearby transmission line operated by the Midwest Independent System Operator (MISO). This evaluation incorporated a review of the MISO interconnection process and the current status of the MISO project queue.

4.2. Facility Project Interconnection

In May 2010, Westwood performed a GIS review of the existing grid infrastructure in and around the Community. This review was done as part of the Constraint Analysis described in Section 1. The GIS study revealed an Xcel distribution line and substation nearby. Xcel Energy provides power to the Lower Sioux Community through a 23.9kV feeder circuit from the Morgan substation approximately 11.5 miles away. Community-owned transformers suitable for interconnection of a BTM project near the Casino were also identified.

In July 2010 Westwood applied for interconnection in order to initiate engineering reviews by Xcel. Westwood developed and submitted the IA, the Engineering Data Submittal, an electrical one-line, equipment specifications, and a site plan. The complete IA is in Appendix N. Westwood's IA proposed a "worst case" grid direct interconnection to Xcel for a 2MW renewable energy system which, when operating at full power, would exceed the total power needs of the Casino and enable the Community to sell power to Xcel Energy. The 2MW system was comprised of a single 1.5MW wind turbine (GE) and 500kW solar photovoltaic (PV) array. Westwood proposed that this system be interconnected with Xcel's 23.9kV feeder distribution line.

On November 22, 2010, Xcel provided a formal letter containing the results of their engineering study (see Appendix O). Through this letter and additional correspondence, Xcel explained their study results, which are summarized below:

- The proposed generation site is located 11.5 miles from the Morgan substation, one of the furthest points from the substation for the feeder circuit on which the Lower Sioux Community facilities are served. The nominal voltage of this feeder is 23.9KV.
  - The conductor from the substation to the proposed generation site is primarily 2AS, which is relatively small and correspondingly has high impedance. This existing feeder line is insufficient to support the flow of power, exceeding accepted limits.
- Interconnecting this magnitude of generation to the feeder circuit at the proposed location, as it currently exists, causes voltage effects outside acceptable limits.
  - Specifically the proposed generation would cause "flickering" on the distribution line. Flicker is defined as the percent difference in voltage before and after generator startup (i.e., when the wind turbine begins rotating after having stopped for a period of time). Flicker can negatively affect the power conditions for other Xcel customers on the feeder line.

  - The flicker caused by 2MW of generation is calculated to be approximately 6% under low load conditions. With variable and intermittent energy sources such as wind, voltage flicker should be under 2%.
  - Even subtracting PV from the renewable energy system, leaving only the 1.5MW wind turbine, voltage flicker is still above acceptable limits.

In the same letter, Xcel provided an estimate of the modifications and costs required to upgrade their facilities to meet the 2MW of renewable energy generation proposed by the Community. Xcel indicated that the upgrade costs would be carried by the developer (the Community) and not the utility itself. The estimate is based on typical conditions Xcel encountered on past projects, using historical data from those projects to provide a broad estimate of possible costs. Xcel's required modifications and their estimated costs are summarized below:

- Rebuild 11.5 miles of feeder line using a conductor with lower impedance, allowing more power to flow more easily. The new conductor would minimize voltage flicker within acceptable limits.
  - Cost: $1,000,000
- Modify voltage regulation scheme by moving and reprogramming three capacitor banks at the substation.
  - Cost: $10,000
- Modify feeder protection scheme by replacing electromechanical breaker protecting feeder line with microprocessor-controlled recloser. This scheme not only protects the feeder line supporting the renewable generation, but also protects the other feeder originating at the Morgan substation.
  - Cost: $100,000
- Install a Supervisory Control and Data Acquisition (SCADA) monitoring system at the substation and the point of generation to allow Xcel to view and control aspects of the generator's power production in real time.
  - Cost: $75,000. The Community would also carry the ongoing costs of maintaining the communications line required for SCADA.

Under this estimation, the total cost to upgrade Xcel facilities to allow for 1.5-2MW of generation in the Community would be $1,185,000. Considering this high cost of interconnection, Westwood sought to understand the maximum generation capacity that would be allowed to feed the Morgan substation if Xcel's recommendations were carried through. Xcel estimated the total generation capacity of the Morgan substation was 2.5MW, and that the additional half megawatt would require added line upgrades totaling $150,000. Combined, the upgrades needed for 2.5MW of interconnected generation would cost (in Xcel's estimation) $1,335,000.

Given the barrier presented by this high cost of grid direct interconnection, additional consideration was paid to a behind the meter wind project. This configuration is primarily intended to offset building electrical loads, rather than generation for wholesale purposes. This electrical design requires the wind generator connect on the customer side of an existing Utility meter at the site.

Westwood worked with Xcel to define the parameters for a project of this kind. Even in a BTM project, where little to no power would ever reach the grid, Xcel required that any generator connected to the 23.9kV line feeding Morgan substation meet the 2% flicker requirement. In a case where the interconnected facility loses its baseload and the generator is producing power and exporting it unrestricted to the grid, Xcel needed an assurance that this generator would not cause excess flicker on the feeder. This can be done one of two ways: through the $1.335 million line upgrade, or through the installation of a generator smaller than the 2MW system originally proposed. As a supplement to their previous engineering study, Xcel provided Westwood with the table below, showing common generation capacities and their flicker potentials.

Gen Capacity	State	Phase Voltage	Flicker
2000 KW	On	14360.8	
	Off	13538.3	6.08%
1800 KW	On	14287.7	
	Off	13538.4	5.53%
1600 KW	On	14212.8	
	Off	13538.3	4.98%
1400 KW	On	14136.1	
	Off	13538.3	4.42%
1200 KW	On	14057.3	
	Off	13538.3	3.83%
1000 KW	On	13976.5	
	Off	13538.3	3.24%
800 KW	On	13850	
	Off	13492.3	2.65%
600 KW	On	13764.2	
	Off	13492.3	2.02%
400 KW	On	13676.1	
	Off	13492.3	1.36%
200 KW	On	13585.5	
	Off	13492.3	0.69%

Table 4-1

As the table shows, 600kW is the largest generator capacity that meets the 2% flicker requirement without requiring any line upgrades.

Early GIS and equipment study determined that Jackpot Junction was ideal tie-in point for behind-the-meter wind application due to numerous large consistent loads and demand. An Xcel engineering study began Dec. 2010 for a behind-the-meter application. Their study reported that any renewable energy system smaller than 600kW would not require feeder line or equipment restructuring upgrades (see Appendix O).

4.3. Historic Electricity Load Analysis

As a potential behind-the-meter (BTM) wind energy project, the Facility Project would be directly interconnected with the Jackpot Junction Casino's internal distribution grid. Power and energy produced by the wind turbine generator (WTG) will be used entirely on-site during normal operation, effectively reducing the amount of power the Community purchases from the utility to power the Casino. This is in contrast to the Commercial Project, which is directly connected to the transmission facilities of a major utility and sells power to a third-party buyer at a fixed price.

In order to understand the value of the power produced by the Facility WTG and exported to the Casino, Westwood analyzed historic electricity consumption (in kilowatt-hours) and demand (in kilowatts) data for the Casino to chart monthly variability in consumption and demand for each site. This study provides an analysis of historical energy usage for the Community facilities and provides no guarantee that future energy usage will match the current load profiles. Similarly, the wind data provided are based on met tower readings collected in the year 2011 and may vary in the future.

The Casino complex receives power from the utility Xcel Energy. The Casino's service is split into two main load profiles, each with its own main service meter. One service provides power primarily to the Casino itself (Casino Service) and one provides power to the adjacent hotel (Hotel Service). It is understood by Westwood that complexities in the electrical system at the Casino may mean that, in fact, feeders from the Hotel Service may provide power to the Casino area, and vice versa. However, for the purposes of this review, it is assumed that the Hotel Service provides power from Xcel Energy through a single meter into the Hotel area, and the Casino Service provides the same into the Casino area. In analyzing these two services, Westwood was additionally tasked with identifying the service best suited to receive power from the 600kW WTG proposed for the Facility Project.

Note that there are additional services on the Casino property, however Westwood's preliminary analysis of those services indicated that they would not be sufficiently sized to efficiently receive and use power from the WTG.

4.3.1. Hotel Service

Westwood reviewed the Hotel's historic monthly electricity usage data supplied by Xcel Energy with permission from the Community. This data was provided in Microsoft Excel spreadsheets, arrayed in 15-minute bins, with one bin (spreadsheet cell) representing the power load (kilowatts of demand) in one 15-minute window on a certain day. (There are 96 bins/day). Westwood was provided data in this fashion for the years 2009 - 2011. From this data Westwood derived both energy usage and power demand statistics for the facility.

Of the two services studied, the Hotel was the larger energy load, meaning it consumed more power than the Casino. The Hotel's average daily energy usage varied from 650 kWh to 1100 kWh. Viewed over the entire year, the Hotel's largest daily loads were in the summer. Westwood estimated that this was due to increased air conditioning loads, in addition to a higher number of visitors to the Hotel.

Peak energy usage hours are defined by Xcel Energy to be the hours between 9:00AM and 9:00PM. The Hotel's highest energy usage does correlate strongly with this definition of peak hours, meaning the Hotel requires higher loads during this time period. Energy usage has little fluctuation throughout the peak period, however. Usage tends to increase slightly in the late afternoon and early evening, which is typical for buildings with housing, as this is the time when residents return home and certain loads increase, such as appliances and heating/cooling. Figure 4-1 below illustrates the seasonal variability of hourly demand loads at the Hotel.

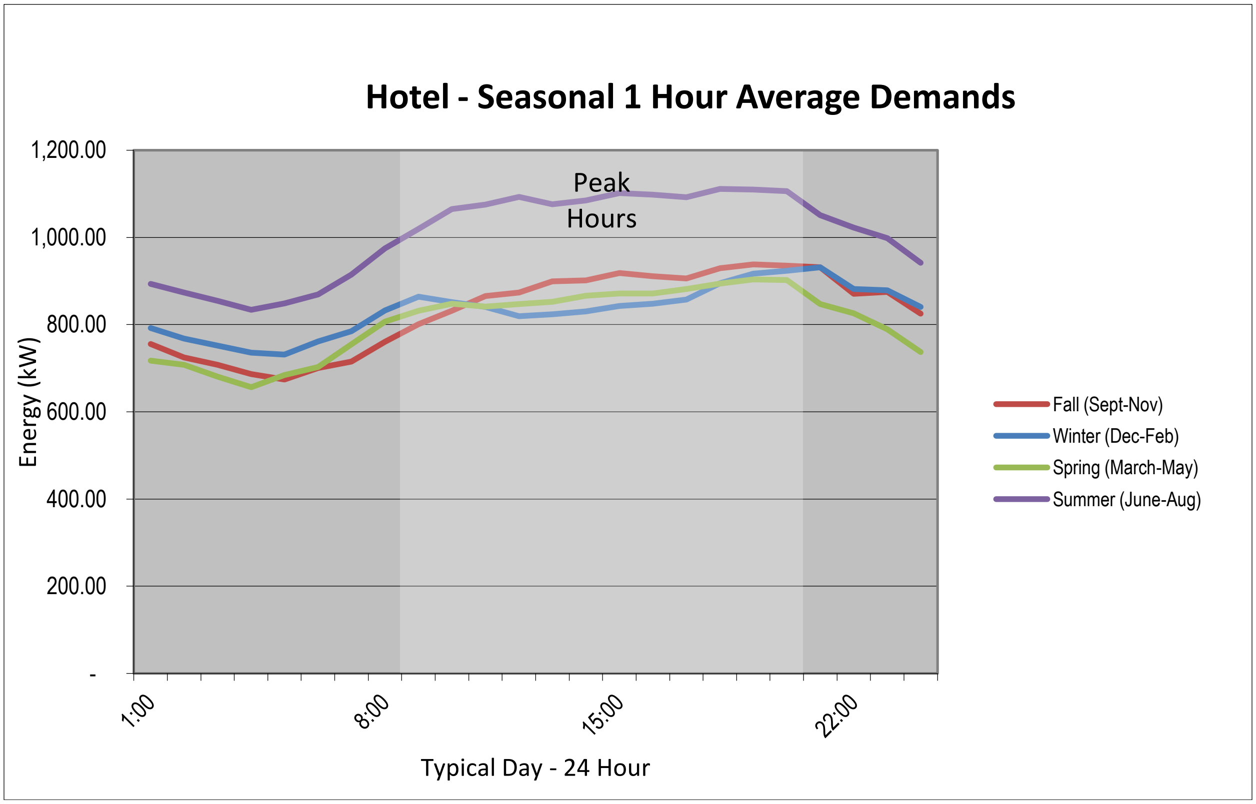

Figure 4-1

4.3.2. Casino Service

Westwood reviewed the Casino's historic monthly electricity usage data supplied by Xcel Energy with permission from the Community. This data was provided in Microsoft Excel spreadsheets, arrayed in 15-minute bins, with one bin (spreadsheet cell) representing the power load (kilowatts of demand) in one 15-minute window on a certain day. (There are 96 bins/day). Westwood was provided data in this fashion for the years 2009 - 2011. From this data Westwood derived both energy usage and power demand statistics for the facility.

Of the two services studied, the Casino was the smaller energy load. The Casino's average daily energy usage varied from 500 kWh to 800 kWh. Viewed over the entire year, the Casino's largest daily loads were in the summer.

The Casino's highest energy usage tends to correlate strongly with peak hours. In the summer, energy usage ramps up considerably during the late peak hours and into the evening, falling again overnight. Westwood estimated that this was due to increased air conditioning loads during the day, in addition to a higher number of visitors to the Casino in the afternoon/evening. In the three other seasons, peak usage is relatively flat. During fall and spring, energy usage ramps up in the afternoon as it does in the summer; however usage is flat throughout the day in the winter. Figure 4-2 below illustrates the seasonal variability of hourly demand loads at the Casino.

A comparison of the monthly average Hotel and Casino energy loads shows that the load profiles are nearly identical, with seasonal peaks and valleys neatly coinciding throughout the year. The major difference between the two loads is that the Hotel consumes almost a third more energy. Even though the Hotel consumes more energy, Westwood continued with the proposed turbine interconnecting with the Casino due to the location of the met tower and site review. Additionally, both the Casino and Hotel are positioned to utilize all the energy produced by the proposed wind turbine.

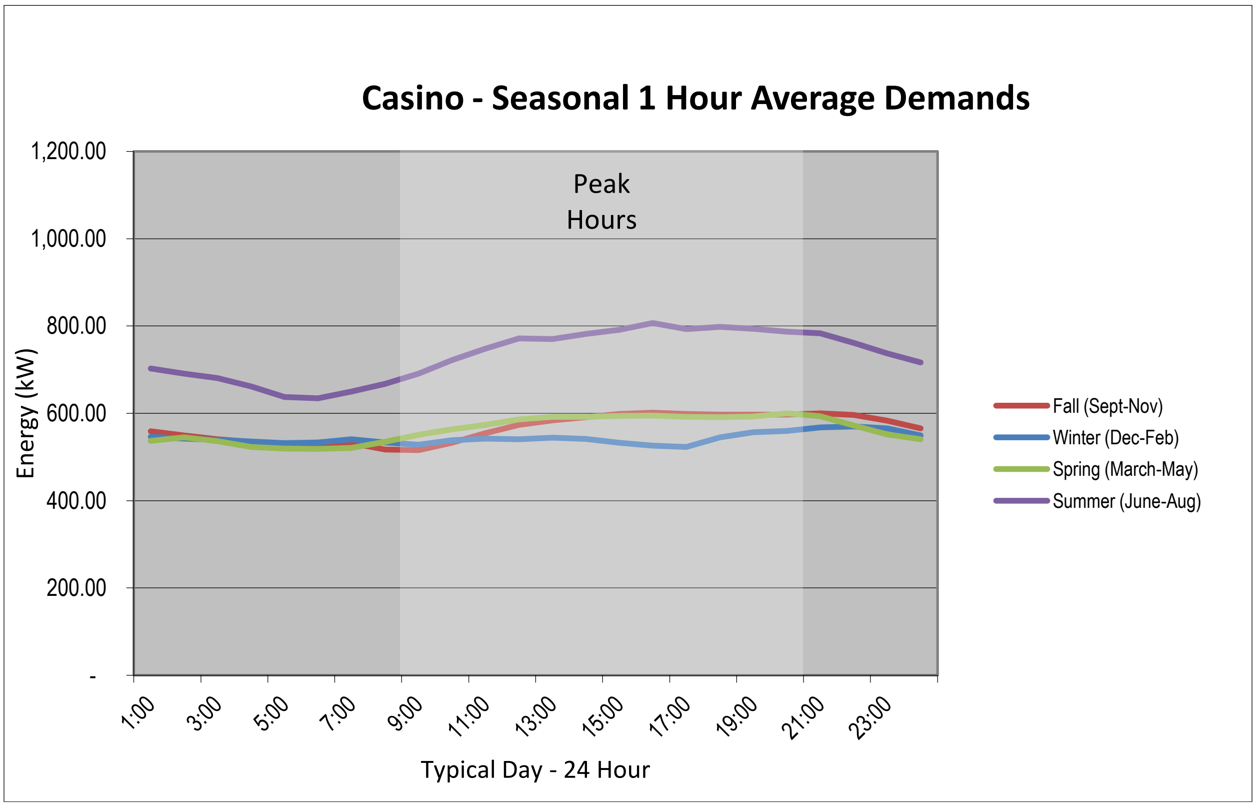

Figure 4-2

4.3.3. Wind Energy Production

For this comparative analysis, Westwood estimated the annual energy production of the Facility WTG, a 600kW wind turbine. This estimate used the wind resource data collected at the met tower and the power curve provided by the manufacturer. These data were exported to a Microsoft Excel spreadsheet and arranged in bins in the same format as the Xcel usage data for the Hotel and Casino services. This arrangement allowed a direct comparison between power consumption and power production at the Facility.

Westwood found that the WTG averaged daily about 100 kW to 200 kW of production. This level of energy production is lower than the lowest energy demand of either the Hotel or Casino average loads. This suggests that all of the energy produced by the WTG would be consumed by either the Hotel or Casino, with no net energy export to the utility.

The WTG's estimated energy production is lowest in the summer and highest in the spring. This is slightly offset from the services' historic energy loads, which peak in the summer months as shown above. However, as the figure shows below, the WTG's highest average production values often occur within the peak hours defined by Xcel Energy.[7] As Table 4-4 in the next section shows, 38% of the turbine's production is in peak hours, resulting in energy offsets at higher monetary values for the Community.

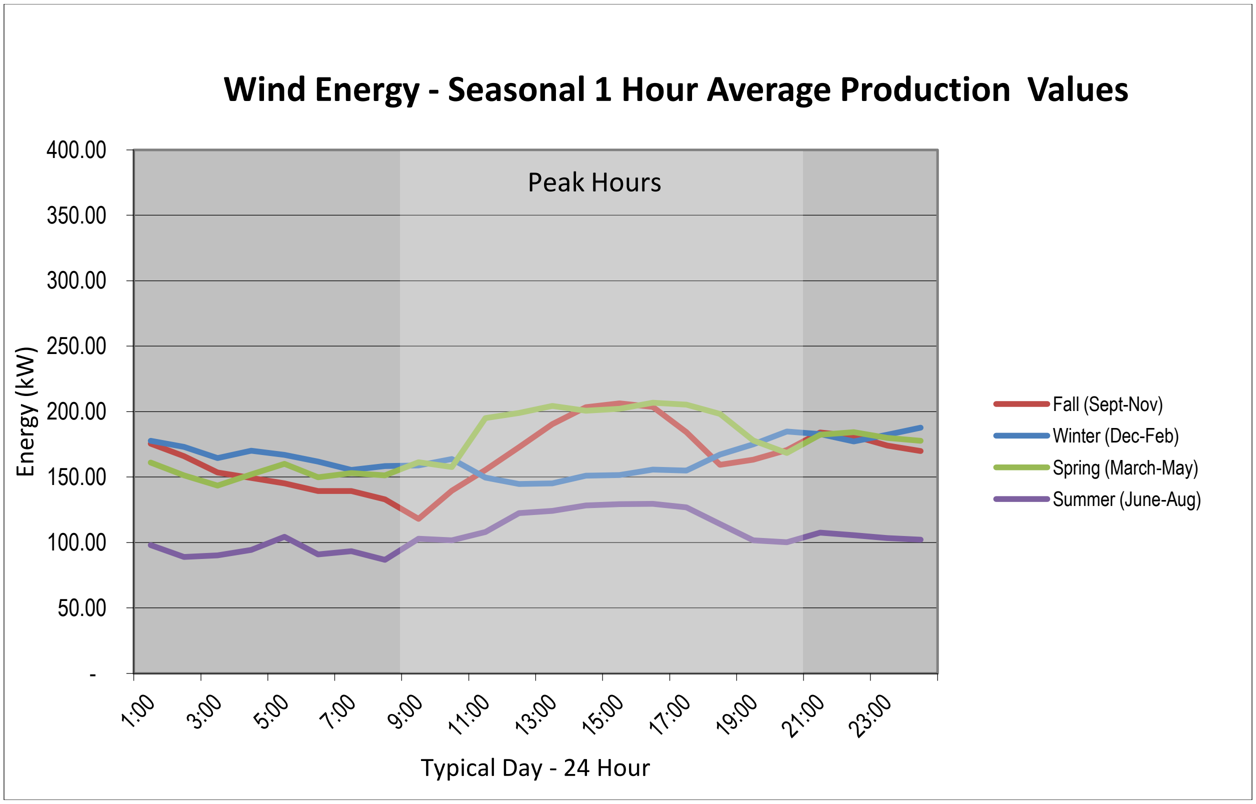

Figure 4-3

Subtracting the estimated energy produced by the WTG, the new predicted Casino usage can be plotted. Using 2011 as a model year, Figure 4-4 below shows that by implementing the proposed wind energy solution there will be an approximate 25% reduction annually in Utility-supplied energy needed by the casino. As Table 4-2 shows, the month-to-month load reduction varies from a low of 8% in August to nearly 35% of the monthly consumption in November.

[7] Note that Figure 4-3 has a different scale than the previous two figures, to better illustrate variations in seasonal production.

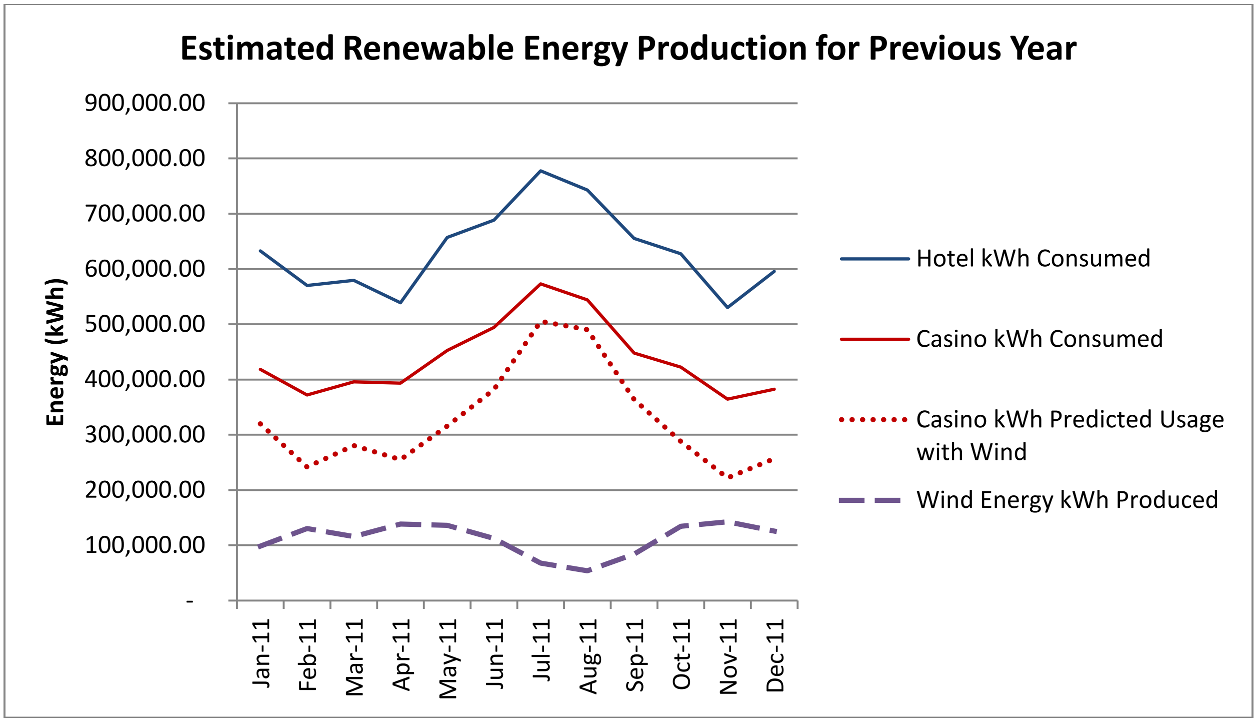

Figure 4-4

Month	Hotel Energy Consumed	Casino Energy Consumed	Wind Energy Produced	Hotel Energy with Wind	Casino Energy with Wind	Hotel Energy Reduction	Casino Energy Reduction
Jan-11	632,916.99	418,107.24	88,511.93	544,405.06	329,595.31	13.98%	21.17%
Feb-11	570,313.32	371,880.00	117,444.43	452,868.89	254,435.57	20.59%	31.58%
Mar-11	579,224.34	395,884.47	104,024.93	475,199.41	291,859.54	17.96%	26.28%
Apr-11	539,172.06	393,230.16	124,410.60	414,761.46	268,819.56	23.07%	31.64%
May-11	657,033.54	452,293.47	122,680.67	534,352.87	329,612.80	18.67%	27.12%
Jun-11	688,535.97	494,440.62	101,208.45	587,327.52	393,232.17	14.70%	20.47%
Jul-11	777,860.40	573,318.24	61,071.66	716,788.74	512,246.58	7.85%	10.65%
Aug-11	742,926.78	544,136.88	48,546.99	694,379.79	495,589.89	6.53%	8.92%
Sep-11	655,656.03	447,721.53	75,502.28	580,153.75	372,219.25	11.52%	16.86%
Oct-11	627,563.85	422,591.55	120,937.65	506,626.20	301,653.90	19.27%	28.62%
Nov-11	529,938.69	364,637.78	128,277.47	401,661.22	236,360.31	24.21%	35.18%
Dec-11	595,438.65	382,379.73	113,292.23	482,146.42	269,087.50	19.03%	29.63%
Annual Total	**7,596,580.62**	**5,260,621.67**	**1,205,909.29**	**6,390,671.33**	**4,054,712.37**	**15.87%**	**22.92%**

Table 4-2

4.3.4. Energy Export Estimate

Wind energy is highly variable, changing from month to month, season to season, and day to day. Although monthly and seasonal averages show that the wind energy produced by the Facility Project will contribute to a percentage of the facility's baseload without exceeding monthly needs, it is understood that on certain days, and indeed within certain hours, the energy produced by the WTG may exceed the needs of either the Casino or the Hotel. This energy could be fed back to the utility through the existing grid connection.

Again considering the Casino as the ideal interconnection point, a majority of the wind energy production days are below the Casino's historic daily loads. However some wind energy production days match or exceed the Casino's daily load. Using a comparison of 15-minute wind energy production and Casino energy usage bins for the year 2011, Westwood determined the amount of energy that could be exported to the grid, and the highest single datum where wind power production exceeded Casino power demand.

Westwood observed that the most wind power production exceeded hourly Casino power demand was by 156.5 kW. The total estimated energy that could be exported to the grid in a single year is about 1550 kWh. To put this in perspective, this is 0.12 percent (0.12%) of the wind turbine's annual energy production, and 0.02 percent (0.02%) of the Casino's annual energy needs, about two to three days' worth of energy for the Casino.

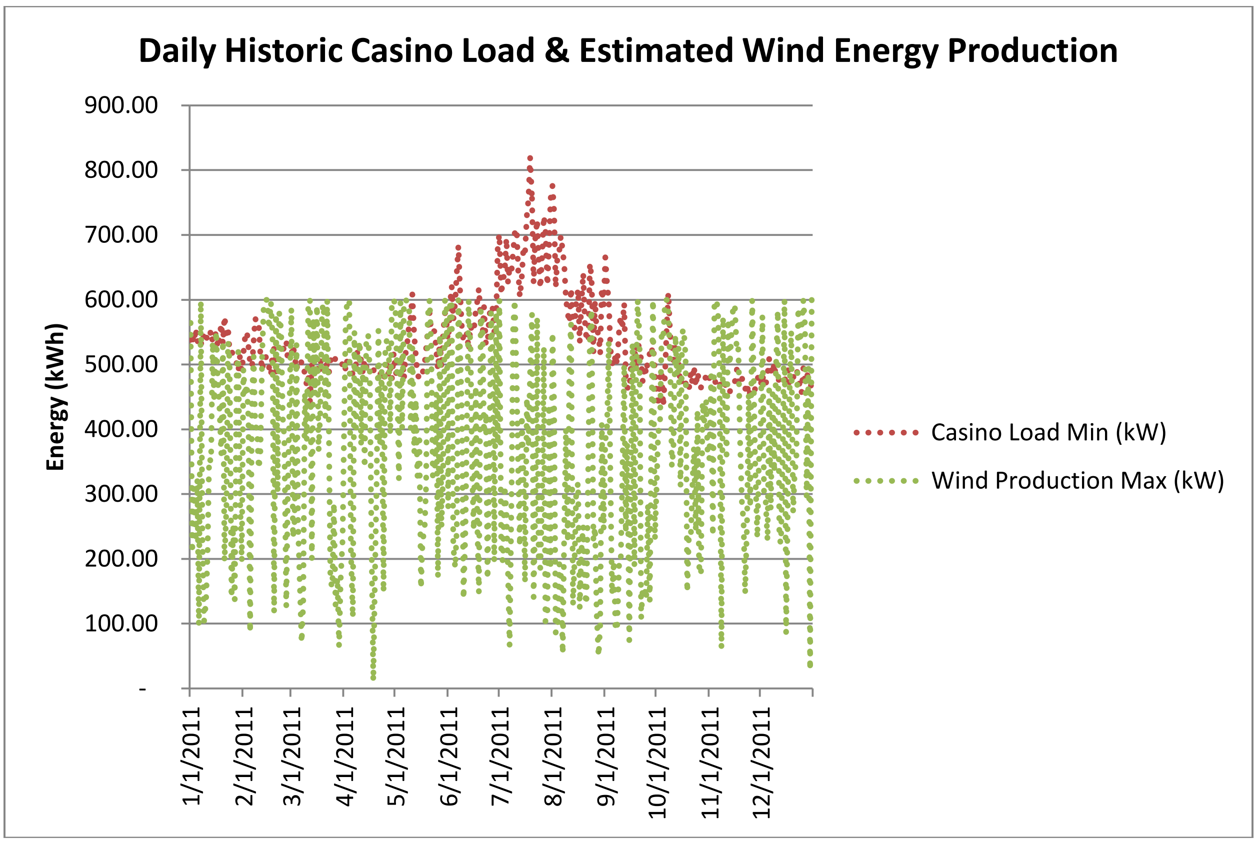

Figure 4-5

If the WTG exported energy to the grid, the Community should not expect to receive monetary compensation from the Utility. A BTM project's goal is to offset power, not sell it; therefore Xcel would not support the infrastructure needed to monetize power exported from a BTM project, which typically requires interconnection under a net-metering tariff and special metering equipment. Currently Xcel caps net metering projects at 40kW, meaning the Facility Project would be too large to qualify.

If the Community wished to sell power to the Utility, it would directly connect the WTG to the distribution line and sell power at wholesale under a power purchase agreement (PPA). As Section 5 shows, offsetting power at retail rates with a BTM project is potentially more profitable than a PPA project, even if a minor amount of power is exported to the grid and effectively unused.

4.3.5. Utility Bill Analysis

Currently the Casino and Hotel purchase power and energy from Xcel under a specific retail rate called Peak Controlled Tiered Time of Day Service (Rate Code A24).[8] This rate is available to large Xcel customers that agree to maintain a minimum controlled load. The tiered rate provides two levels of power purchase costs, a lower cost for off-peak power and a higher cost for on-peak power (between 9AM and 9PM). Additional factors that impact power purchases under this rate including seasonal demand (kW) charges and additional fees, charges and riders associated with those different factors. Utility base rates and riders are highly variable as utilities vary and balance the fuel sources and blends they deliver to customers. To arrive at the rates used in the Study, Westwood made a "snapshot" of the retail rates for the month of February 2012 and used those rates to estimate the retail rate to which the WTG would be subject.[9] The off-peak and on-peak retail energy rates per kilowatt-hour are shown below.

Rate[10]	On-Peak	Off-Peak
Base Energy Charge[11]	$0.03806	$0.02252
Fuel Cost Charge	$0.03476	$0.01859
Environmental Improvement Rider	$0.001654	$0.001654
Renewable Development Fund Rider	$0.000479	$0.000479
State Energy Policy Rider	$0.000065	$0.000065
Conservation Improvement Rider	$0.002648	$0.002648
Final Blended Rate	**$0.077666**	**$0.045956**

Table 4-3

The base rates and riders are subject to change, and their applicability to the A24 tariff is not guaranteed into the future.

The change in energy consumption is the first and simplest estimate of utility bill savings. The rate charged per kilowatt-hour (kWh) is applied to the power drawn from Xcel each month. If that power draw decreases due to power supplied from on-site renewable energy, the resulting difference is the money saved per month. A fine-grain analysis looks at energy consumption in 15-minute intervals and tallies the savings in each category. Westwood has estimated on-peak and off-peak energy savings per month based on 2011 historic information and February 2012

[8] "Minnesota Electric Rate Book – MPUC No. 2," Section 5. Northern States Power Company, a division of Xcel Energy. August 25, 2011.
[9] "Minnesota Rates, Rights and Service Rules." http://xcelenergy.com/About_Us/Rates_&_Regulations/Rates,_Rights_&_Service_Rules/MN_Regulatory_Rates_and_Tariffs
[10] Additional rates which are attached to demand charges, rather than energy charges, are not included.
[11] This rate incorporates the rate shown in the Minnesota Electric Rate Book multiplied by the 7.58% interim rate increase approved by Xcel Energy.

energy rates. These savings are shown in Tables 4-4 and 4-5. As the tables show, the premium price attached to peak power means that, although less wind energy is produced during the on-peak period, that power produced is nearly twice as valuable to the Community. Estimates assume that all power is used on-site and none is exported to the Utility.

Month	On Peak Wind Energy Produced	On Peak Energy Rate ($/kWh)	Estimated On Peak Energy Savings
Jan-11	28,693.24	$ 0.07767	$ 2,228.49
Feb-11	42,544.76	$ 0.07767	$ 3,304.28
Mar-11	42,294.94	$ 0.07767	$ 3,284.88
Apr-11	50,146.54	$ 0.07767	$ 3,894.68
May-11	51,575.08	$ 0.07767	$ 4,005.63
Jun-11	47,446.49	$ 0.07767	$ 3,684.98
Jul-11	19,996.69	$ 0.07767	$ 1,553.06
Aug-11	25,996.05	$ 0.07767	$ 2,019.01
Sep-11	30,261.55	$ 0.07767	$ 2,350.29
Oct-11	49,243.40	$ 0.07767	$ 3,824.54
Nov-11	36,814.44	$ 0.07767	$ 2,859.23
Dec-11	35,210.31	$ 0.07767	$ 2,734.64
TOTAL	**460,223.49**		**$ 35,743.72**

Table 4-4

Month	Off Peak Wind Energy Produced	Off Peak Energy Rate ($/kWh)	Estimated Off Peak Energy Savings
Jan-11	59,818.69	$ 0.04596	$ 2,749.03
Feb-11	74,899.67	$ 0.04596	$ 3,442.09
Mar-11	61,729.99	$ 0.04596	$ 2,836.86
Apr-11	74,264.07	$ 0.04596	$ 3,412.88
May-11	71,105.59	$ 0.04596	$ 3,267.73
Jun-11	53,761.96	$ 0.04596	$ 2,470.68
Jul-11	41,074.97	$ 0.04596	$ 1,887.64
Aug-11	22,550.94	$ 0.04596	$ 1,036.35
Sep-11	45,240.72	$ 0.04596	$ 2,079.08
Oct-11	71,694.25	$ 0.04596	$ 3,294.78
Nov-11	91,463.03	$ 0.04596	$ 4,203.27
Dec-11	78,081.92	$ 0.04596	$ 3,588.33
TOTAL	**745,685.80**		**$ 34,268.74**

Table 4-5

The most difficult utility bill factor to define is the reduction in peak demand. Currently, Xcel searches through 1-hour or 15-minute demand data and finds the highest kW period for the billing cycle (around one month). This period defines the peak demand charge for that billing cycle. If that specific high period of the billing cycle was reduced below all other high periods, Xcel would then search for the next highest period to re-determine the peak demand. The issue with this formula, from a distributed generation perspective, is that the peak demand may occur during a moment when no renewable energy is being produced (i.e., a moment with no wind), thus the peak demand does not change. For example, the 600kW WTG could offset the highest peak load of the Facility by 400kW for 29 days of the billing cycle, but not on the 30th. Xcel would set the demand charge based on the peak on the 30th day, as it would become the new highest load out of all the days in the cycle. In this case, even though the WTG effectively provides demand reduction for the Facility (and the utility), the demand charge from the utility will remain the same. Given the unpredictability of wind energy generation, demand reduction is nearly impossible to accurately define under this model.

Due to the unpredictable nature of the wind resource and wind production, Westwood may only provide an estimate of utility bill savings based on historical data. Westwood provides no guarantee in this Study of utility bill savings.

4.4. Commercial Project Transmission and Interconnection

In addition to Xcel Energy, interconnection opportunities with Great River Energy's (GRE) 69kV transmission line near the Site were researched.

Westwood contacted GRE in April 2011. It was determined that access to the line is covered under GRE's membership in the Midwest Independent System Operation (MISO) and all requests for interconnection would have to be researched by MISO.

MISO has operational control over the transmission facilities of its members, including Xcel and GRE. MISO manages the Midwest transmission grid and an agreement must be reached to have access to the transmission grid. The agreement requires studies to make sure that there is room for the power and determine the power destination. MISO has 93,600 miles of transmission lines under its direction.

MISO approval is not required for behind the meter interconnections or an interconnection to the 23.9kV distribution line that Xcel reviewed for the 600kW system. MISO application and review is required for interconnection to the GRE 69kV transmission line near the Community, the proposed tie-in point for the Commercial Project.

Westwood engaged Power System Engineering, Inc., (PSE) to review the capacity of the transmission lines adjacent to the Community lands and also provide an overview on the MISO process and application should the Community pursue the 14.4MW Commercial Project. PSE prepare two reports: (1) a screening study to review the local transmission line capacity (Screening Study); and (2) The MISO Generation Interconnection Process. Both Reports are available in Appendices P and Q.

(1) The Screening Study

The Screening Study identified the Franklin-Redwood Falls Tap 69kV line that is approximately a mile south of a potential Commercial Project collection substation on the Site. This transmission line would be the preferred point of interconnection. In reviewing the limits of the transmission line's capacity, PSE determined that there is approximately 35MW of outlet capacity and is therefore currently able to accommodate the Commercial Project's 14.4MW without requiring local upgrades. MISO may require upgrades outside the local area as part of the interconnection process. It should be noted however that several assumptions were made regarding whether or not additional wind projects could come on line and load up the transmission lines.

(2) The MISO Generation Interconnection Process

As stated above, should the Community move forward with the Commercial Project, it will need the Project to interconnect to local transmission lines. The MISO Generation Interconnection Process determines what can safely and reliably interconnect to the grid. As detailed in the report in Appendix Q, new interconnection requests are evaluated in a Feasibility Study as they are received. Projects are then divided into two project tracks:

- The fast track Definitive Planning Phase (DPP) if they have few obstacles to interconnection, or
- System Planning and Analysis (SPA) for further analysis.

New DPP groups are formed every four months, while SPA groups are formed yearly. Projects in a given group are then studied in a System Impact Study (SIS) to determine the interconnection, local and regional upgrades that would be required for successful interconnection, including the costs estimates for these upgrades.

If a specific project decides to move forward based on the SIS results, a more detailed Facility Study is performed to identify the detailed interconnection requirements and provide more precise cost estimates. At the conclusion of the Facility Study, a Generation Interconnection Agreement (GIA) will be offered providing a detailed schedule for the construction of the interconnection facilities and network upgrades and payment schedule.

Technical milestones and monetary deposits are required at various points in the process. Moreover, finding a purchaser for the energy output is the responsibility of the project owner.

5. Project Structure and Economics

To analyze the potential Facility and Commercial Projects' structures and economics, Westwood prepared studies in three areas:

1. Project Implementation: Westwood completed Commercial Project preliminary budgeting and design documents for the Community's use as bidding tools.
2. Project Ownership: an analysis of the various opportunities for structuring a potential wind energy project within the Community. Westwood identified potential funding sources and project ownership structures in partnership with a legal subconsultant.
3. Project Economics: Westwood assessed project costs and paybacks under a series of funding scenarios. The payback analyses incorporate energy production, power purchase revenues, and capital expenses (such as initial construction and O&M).

5.1. Project Implementation

Westwood completed a preliminary Request for Proposals (RFP), a 30% Civil Plan Set, and a One-Line Electrical diagram for the Commercial Project. The purpose of these documents is to provide the Community with an opportunity to understand the bidding process by preliminarily engaging EPC (engineering, procurement and construction) companies that may show an interest in building the project. The documents may be used by the Community and by contractors to budget, estimate, and design the Project.

The files may be found in Appendix R. The Plan Set and One-Line are included as separate appendices to the RFP.

5.2. Project Ownership

It is our understanding that the Lower Sioux Community would own and operate the potential Facility and Commercial Projects, but could be open to third-party ownership or the development of a for-profit, taxable entity to assume ownership. If the Community moves forward with ownership as a tax-exempt tribal entity, it may be able to secure specific tribal grant funding, but it would not be able to take advantage of federal tax incentives.

Westwood reviewed project economics in Section 5.3 under two scenarios: (1) a tax-exempt tribal entity without financial assistance; and (2) as a tax-exempt tribal entity with grant assistance.

A third ownership opportunity would be through a for-profit taxable entity to take advantage of federal tax incentives. Again, the key consideration for the federal tax incentives is that they are not available to tax-exempt or government entities. Moreover, even if an entity is a qualifying taxpayer, with regard to two tax credits – the Investment Tax Credit and Production Tax Credit – a qualifying applicant must also have sufficient tax liability to utilize the credits.

(1) Investment Tax Credit

The "Investment Tax Credit," is a tax credit against federal income tax equal to 30% of the cost basis of the energy property (wind turbines and other qualifying equipment) placed in service during that year. To avoid recapture of all or a portion of the tax credit, a qualified taxpayer must own the property for five years after placing it in service, or may transfer the property to another eligible owner. A taxpayer who claims this credit must have sufficient U.S. tax liability to absorb the credit, which is received entirely in the year the property is placed in service.

(2) Production Tax Credit

The Production Tax Credit is based on the kilowatt hours produced by the taxpayer during a 10-year period starting on the date the project was placed in service (which must be prior to January 1, 2013). To qualify for the credit in a given year, the energy must be sold to an unrelated person during the taxable year. An unrelated person is a person who owns less than 50% of the taxpayer, and IRS guidance looks through to the ultimate end user of the energy to determine who "uses" the energy and whether the end user is a related party. The taxpayer must have sufficient U.S. tax liability to absorb the credits over 10 years, but is allowed to sell the property during the 10-year period without recapture.

Westwood engaged its legal subconsultant, Fredrikson & Byron, P.A. (Fredrikson), to review the impact of potential taxable entity ownership structures on the Commercial Project economics with regard to federal tax incentives. A summary of Fredrikson's project ownership analysis is included as Appendix R (Fredrikson Memorandum). Three potential ownership scenarios are reviewed in the Fredrikson Memorandum:

(1) Direct Ownership through a Blocker Corporation
    a. The Community would form an entity taxed as a C Corporation that would either directly own the wind energy equipment or own interests in a limited liability company which directly owns the equipment.

(2) Sale-Leaseback
    a. The Community could secure a third-party investor and structure a sale-leaseback of the energy property where the Community would construct and sell the energy equipment to the investor.
    b. The investor would in turn lease the project back to the Community, which would operate it and either use the energy or sell it to a utility.
    c. Once the investor achieves its targeted rate of return, the Community would have an option to purchase the project at fair market value.

(3) Partnership Flip
    a. The developer sells part of its interest in the energy property to the investor.
    b. The partnership is structured so that the investor receives 90% or more (usually 99%) of the cash flow from operations, tax credits, depreciation and other incentives until the investor has achieved its targeted internal rate of return on investment.
    c. The structure flips (typically 5% investor and 95% developer) and the developer receives a larger share of the remaining benefits and has an option to purchase the investor's interest at fair market value.
    d. In this Partnership Flip situation, the Community would be the developer. However, ownership by the Community would constitute "tax-exempt use"

and make tax credits unavailable. Fortunately, the Community can participate in this structure if it uses a blocker corporation.

Together with Westwood, the Community and Fredrikson met in the fall of 2011 to review potential third-party taxable ownership structures and economic opportunities under federal tax incentives, including the Investment Tax Credit and the Production Tax Credit.

At that time of the conference with Fredrikson, one of the available funding options was the Section 1603 Cash Grant in lieu of Investment Tax Credit and this Grant is discussed in the Fredrikson Memorandum. Note that the Cash Grant expired on December 31, 2011, and is no longer available. There have, however, been efforts at the Congressional level to reinstate the Grant. While these efforts have not yet been successful, it is still helpful to understand that the Grant components in the event it could be applicable in the future. It should also be noted that the federal Production Tax Credit expires this year, December 31, 2012.

5.3. Indicative Project Pricing

Westwood has compiled an analysis of indicative pricing for the 600kW Facility Project and the 14.4MW Commercial Project. The indicative prices are nominal estimates which are neither firm nor binding. These are general estimates subject to change in further stages of study. The pricing includes equipment procurement, design and engineering, construction, interconnection, and support costs. Estimated project costs for each system are calculated using national and local estimates of labor and material, combined with previous experience on similar projects, and direct quotes from suppliers, general contractors, and EPC contractors. Indicative pricing is provided only for comparative purposes. The table below provides conceptual cost estimates of the primary wind system components, construction labor, and other costs defined below the table. Union wages have been used for labor in this pricing, and materials are estimated using current pricing.

5.3.1. Installed Cost

Cost per kilowatt of wind power installed (Cost/kW) is shown in the table. This metric normalizes project costs between the two projects and provides a useful comparison tool to understand relative costs.

Project	600kW Wind	14.4MW Wind
WTG/Tower	$ 1,100,000	$ 20,700,000
EPC	$ 777,000	$ 9,750,350
Total	$ 1,877,000	$ 30,450,350
Cost/kW	$ 3,128	$ 2,115

Table 5-1

The indicative pricing may be broken out into the following categories and tasks:

WTG (Wind Turbine Generator)

- WTG Procurement
  - Facility: one turbine; Commercial: nine turbines

- Tower Procurement
- WTG and Tower Transportation to Site

Engineering/Surveying
- Staking turbine site
- Civil Engineering
- As-Built (Record) Drawings
- Quality Assurance/Quality Control

Sitework
- Public road upgrades
- Turbine site access roads
- Turbine site graded for component laydown
- Construct Crane Pad
- Restore site

Foundations
- Geotech and Foundation Engineering
- Install foundation
- Grounding and Conduit
- Soil mitigation

WTG Installation
- Unload Components
- Install per WTG Manual
- Tower Wiring
- Wind Day Costs Included

Collection System
- Engineering
- Survey, clearing & restoration
- Trench, backfill & compact
- Furnish and install (F&I) Interconnection Cable
    - Facility: 480V; Commercial: 69kV
- F&I Fiber Optic
- F&I Trench Grounding
- Wetland Bores
- Road Bores
- F&I Padmount Transformer and Foundation
- The substation is located near the tie in point to maximize efficiencies and cost savings.

Substation
- Engineering
- Civil Work

- F&I Main Power Transformer
- F&I 69kV Substation (Commercial Project)
- F&I 69kV Tie In (Commercial Project)

O&M Building (Commercial Project)
- F&I 2,500 Sq. Ft. Building

Met Tower
- F&I Met Tower and Instruments

Project Management/Misc. Overhead
- Site team and project management
- Fees and Permits
- Insurance
- Tools, rigging and accessories
- Office/Trailer Complex With Utilities
- Mobilization/Demobilization

The estimate for the Facility Project assumes an interconnection at the Jackpot Junction Casino, with the Casino Service. The estimate for the Commercial Project assumes an interconnection with the GRE 69kV transmission line, with a substation and interconnection cabling as shown in the 30% Civil Plan Set.

5.3.2. Installed Cost and Energy Production

Westwood estimated the project cost versus lifetime production using the base project costs shown above divided by energy production (in kWh) over the system's estimated 20-year lifetime. Table 5-2 shows the estimate of lifetime kWh production, and the cost of the system per kWh produced. This estimate is based only on project capital and EPC costs and does not incorporate lifecycle costs, which are discussed below.

Typical wind turbines carry warranties from 5-10 years and have an industry-standard design life of 20 years. Because they are mechanical in nature, the lifetime of a wind turbine is highly variable; for example, a turbine operating in a high-wind, high-turbulence environment has a higher chance of early failure than a turbine operating in low-speed, consistent winds. The turbine's lifetime also depends on the quality of maintenance it receives. It is assumed that maintenance will be sufficient to provide consistent energy production throughout the 20-year life of the project.

Estimates incorporate production losses that account for inefficiencies in the generation and transmission of energy from the source to the point of interconnection. Refer to Section 3 for a discussion of loss factors.

Project	600kW Wind	14.4MW Wind
Total EPC Cost	$ 1,877,000	$ 30,450,350
Lifetime Energy (kWh)	24,118,180	834,564,000
EPC Cost/Lifetime Energy (kWh)	$ 0.0776	$ 0.0363

Table 5-2

Most notable in this comparison is the 53% reduction in cost/kWh from the smaller to the larger project. This is due to two factors:

1. Capacity Factor: The larger GE turbines produce more energy per kW than the smaller RRB turbine. This is in part due to the hub height of the GE turbine, which at 80 meters is nearly 20m higher than the RRB, and in part due to the efficiencies of the turbine itself which can capture energy more efficiently in a wider range of wind speeds. The GE's capacity factor is 33%, while the RRB's is 23%. Note that this is specific to the Community and is based on data collected by the met tower in 2011.
2. Construction Economics: Conventional economies of scale allow the multi-turbine project to be constructed at a lower cost/watt than the single turbine project. In a comparison of the WTGs themselves, the GE turbine – one of the most popular turbines in the world – is less expensive to produce per watt than the RRB.

5.4. Simple Payback Analysis

Westwood has prepared a set of simple payback analyses for each project that incorporates project capital costs, O&M costs, and projected revenues based on typical energy output. The purpose of this Study in providing this payback analysis is not to demonstrate each project's profitability in exact terms, but to show, under certain scenarios, the general viability of each project and the *potential* to generate positive returns.

All payback scenarios assume the project is a Community-owned asset and that all costs, initial and ongoing, are paid in cash. The simple payback analysis is calculated by subtracting expenses from revenue each year for the lifetime of the system, assuming that:

- Revenue equals the energy produced by a project multiplied by the going electricity rate, plus grant revenue where applicable.
- Expenses equal EPC costs in the first year and ongoing O&M costs for all years.
- Revenue and expenses are escalated each year to account for inflation.

5.4.1. Payback Factors

To quantify revenues and expenses, Westwood established a series of payback factors to analyze each project scenario. The payback factors are defined as:

1. *System Installed Cost:* Upfront cost of constructing the wind project.
2. *Energy Production:* Energy produced by the wind turbine each year, in kilowatt-hours.
3. *Energy Rate:* The rate, in dollars per kWh, at which the wind project sells power.
4. *Energy Rate Inflation:* The rate at which the above energy cost inflates each year.
5. *Standard Inflation:* The rate at which standard (non-energy) costs inflate each year.
6. *Operations and Maintenance:* Annual operations and maintenance costs, measured in dollars per kW-year. O&M costs are subject to standard inflation.

Installed Cost and Energy Production are defined in Sections 5.3.1 and 5.3.2 above. Energy Rate, Inflation, O&M, and Incentives are defined below.

5.4.1.1. Energy Rate

Where the energy rate is set by a PPA, the cost of energy is negotiated between the power producer and the power purchaser. The Facility Project purchaser would be Xcel Energy, and the Commercial Project purchaser would be another utility yet to be named but may also be Xcel Energy. Through discussions with utilities and PPA advisors, Westwood confirmed that estimated PPA prices currently range from $0.03 to $0.05 per kWh of energy delivered. There are three payback scenarios for the Commercial Project, to show the value of the project over the range of given PPA prices.

The Facility Project was given an estimated PPA price of $0.03 per kWh. This is based primarily on Xcel Energy's pricing structure for their Small Wind Distributed Generation Tariff. The tariff has three rates for on- and off-peak power and for summer power, which average out to three cents. Discussion with PPA advisors confirmed that a smaller wind project would typically receive a minimum PPA agreement.

Facility Project payback was also estimated in a scenario where turbine power offsets utility power in a behind-the-meter project. A rate of $0.05806 cents was set for this scenario. This rate is factored from the weighted average on- and off-peak base energy rates plus additional service riders which are added to the base. Westwood used rate and rider costs from February 2012.

5.4.1.2. Inflation

Energy rates and costs are adjusted annually for inflation. Standard inflation is set at three percent. This rate is a published standard rate by the Metropolitan Council of the Twin Cities in its Financial Analysis Requirements and Guidelines.[12] This rate applies specifically to O&M costs.

For PPA projects, the wholesale energy rate inflation is set at two percent based on Westwood's review of local negotiations with industry PPA advisors. In the Facility Energy Offset scenario, the retail energy rate inflation is set at four percent which is the energy rate inflation established by the Met Council and is not subject to PPA negotiations as energy offset. Because the cost of retail electricity is influenced by additional factors above and beyond the cost of wholesale power, the rate of inflation is set at a higher value.

5.4.1.3. Operations and Maintenance

All projects incorporate a Year 1 capital investment - the initial construction of the project - and ongoing operations and maintenance (O&M) costs throughout the lifetime of the project. O&M costs for both projects are a yearly investment based estimates and discussions with O&M providers and project owners. O&M costs are adjusted annually to incorporate the Standard inflation rate of three percent as noted above.

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[12] Source: Metropolitan Council website
http://www.metrocouncil.org/environment/ratesbilling/FinancialAnalysis.htm

O&M consists primarily of plant operating labor, regular plant maintenance, insurance, reaction to major events such as plant failure or loss of grid power, periodic inspection, replacement, and repair of system components, including consumables.

According to a recent report by Black & Veatch (BV) for the National Renewable Energy Laboratory (NREL), O&M costs can be estimated as factors of annual energy production.[13] The report provides a fixed O&M costs for utility wind installations, calculated in dollars per kilowatt-year (one kW-yr = 8,760 kWh).

For the O&M of wind turbines over 1MW in size, the BV report establishes a fixed O&M cost of $60/kW-yr. This cost grew out of BV's research on over 10,000MW of wind engineering and design. For the purposes of this Study, Westwood will use this figure for the Commercial Project. Real O&M costs may vary from the cost established here.

Due to its small size, the Facility Project is less economical in its O&M, with a higher cost per kW-yr than the Commercial Project. Through discussions with O&M providers and project owners familiar with the PS-600 turbine and other similarly-sized turbines, Westwood established an O&M cost of $100/kW-yr for the Facility Project. This includes $8,000 annually for insurance coverage, a figure provided by Windustry, a regional windpower advocacy group.[14]

5.4.1.4. Incentives

For each project Westwood ran an additional payback analysis using a potential financial incentive, assumed to be some form of a cash grant available to tax-exempt entities. The application of a grant at the project's outset is to show the amount of additional funding required for each project to reach a six percent internal rate of return. None of Westwood's scenarios reached a six percent IRR without a financial incentive such as a grant.

As sovereign entity with tax-exempt status, the Community is not eligible for the wind industry's most common tax-based incentives provided by the Federal government, such as the Production Tax Credit or the Investment Tax Credit which are often used to fund privately-owned wind facilities. Should the Community explore an alternative third-party ownership structure as outlined in this Study, those tax incentives could become available.

An example of a potentially available incentive is the Federal government's Renewable Energy Production Incentives (REPI) funding. This is a proposed policy of the Department of Energy (DOE) to make incentive payments for electric energy generated and sold by a qualifying renewable energy facility (in this case, a facility owned by an Indian tribal government). Under this program the DOE will make incentive payments to a qualified facility for 10 consecutive fiscal years, beginning with the year the facility applies for the incentive. When the program began in 1993, the incentive payment was 1.5 cents per kWh. The rate is adjusted each year with inflation. The REPI program is used here as an example of the type of incentive or grant that may be available to the Lower Sioux Indian Community. We should note that the REPI grant

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[13] "Cost and Performance Data for Power Generation Technologies." Black and Veatch, February 2012.

[14] "Community Wind Toolbox 8: Costs Associated with Community Wind Development." Windustry website, March 2012. http://windustry.org/your-wind-project/community-wind/community-wind-toolbox/chapter-8-costs/community-wind-toolbox-chapt

program has not been funded in recent years and there is no guarantee of future funding. Nonetheless, it is important to consider grant opportunities in evaluating the financial feasibility of the projects.

5.4.1.5. Additional Factors

The Casino also incurs demand charges per kW of peak power. However, as described in Section 4, peak demand savings from an on-site renewable energy system cannot be definitively forecasted. Additionally, service riders such as a Standby Service Rider will affect potential savings and would need to be analyzed to determine the impact on this project. Therefore, for the purposes of this report, demand charge savings are not included in the analysis.

5.4.2. Payback Analysis Results

The payback analysis scenarios are as follows. Table 5-3 describes the actual values of the payback factors for each scenario.

Facility Project:

1. *Power Purchase Agreement (PPA) at $0.03/kWh:* Project sells power to a third party at a rate of $0.03 per kWh.[15]
2. *Energy Offset at $0.058/kWh:* Project offsets the Casino's energy load at the Casino's effective energy purchase rate of $.05806 per kWh.[16]
3. *Energy Offset at $0.058/kWh with Incentive:* Westwood assumed that the project would sell power at the most profitable rate (Energy Offset) and receive a one-time cash incentive of $1,150,000 at the time of construction in order for the project to reach 6% internal rate of return (IRR) over 20 years.

Commercial Project:

1. *PPA at $0.03/kWh:* Project sells power to a third party at a rate of $0.03 per kWh.[17]
2. *PPA at $0.045/kWh:* Project sells power to a third party at a rate of $0.045 per kWh.
3. *PPA at $0.05/kWh:* Project sells power to a third party at a rate of $0.05 per kWh.
4. *PPA at $0.05/kWh with Incentive:* Westwood assumed that the project would sell power at the most profitable rate ($0.05/kWh) and receive a one-time cash incentive of $6,600,000 at the time of construction in order for the project to reach 6% IRR over 20 years.

[15] This rate is a simplified average of the peak, off-peak, and summer rates at which Xcel buys wind power under the Small Wind Distributed Generation Tariff. The rate correlates well to the industry-standard minimum PPA rate.
[16] See Section 4 for an explanation of this rate.
[17] In consultation with regional industry analysts, Westwood found that recent Power Purchase Agreements are ranging from $0.03 to $0.05 per kWh.

The following table shows the value of each factor in each scenario:

Payback Factor	Facility $0.03 PPA	Facility $0.058 Offset	Facility 6% IRR	Commercial $0.03 PPA	Commercial $0.045 PPA	Commercial $.05 PPA	Commercial 6% IRR
System installed cost	$1,877,000	$1,877,000	$1,877,000	$30,450,350	$30,450,350	$30,450,350	$30,450,350
Energy Production (kWh)	1,205,909	1,205,909	1,205,909	41,728,200	41,728,200	41,728,200	41,728,200
Energy Rate ($/kWh)	$0.03	$0.05806	$0.05806	$0.03	$0.045	$0.05	$0.05
Energy Rate Inflation	2%	4%	4%	2%	2%	2%	2%
Standard Inflation	3%	3%	3%	3%	3%	3%	3%
O&M ($/kW-yr)	$100.00	$100.00	$100.00	$60.00	$60.00	$60.00	$60.00
Incentive	N/A	N/A	$1,150,000	N/A	N/A	N/A	$6,000,000

Table 5-3

Westwood created a payback analysis spreadsheet for each scenario, projecting gross revenue, gross expenses, net revenue, and IRR over the 20-year lifetime of the wind project. Westwood also projected the actual year of simple payback, which varied widely across the seven scenarios. The full spreadsheets are located in Appendix S.

System	Gross Revenue	Gross Expenses	Net Revenue	IRR	Payback
FACILITY PROJECT					
$0.03 PPA	$879,013	$2,246,900	-$1,367,887	-9.9%	Year 60
$0.058 Offset	$2,084,914	$2,246,900	-$161,985	-0.8%	Year 22
$0.058 Offset	$3,054,914	$2,246,900	$808,015	6.0%	Year 13
COMMERCIAL PROJECT					
$0.03 PPA	$30,416,565	$38,130,161	-$7,713,596	-2.5%	Year 26
$0.045 PPA	$45,624,848	$38,130,161	$7,494,687	2.1%	Year 17
$0.05 PPA	$50,694,275	$38,130,161	$12,564,115	3.3%	Year 15
$0.05 PPA	$57,294,275	$38,130,161	$19,164,115	6.0%	Year 12

Table 5-4

Westwood found that the Facility Project nearly broke even when offsetting the energy costs of the Casino at $0.05806/kWh over 20 years. Although this outcome is preliminary and cannot be considered to be inclusive of all expenses and revenues affecting a wind project, it reflects a potentially strong opportunity for wind development in the Community. This favorable outcome could merit additional study, with a further analysis of turbine production and Xcel's rate structures, including possible demand charge savings.

By comparison, the Facility Project's $0.03 PPA scenario has a negative return over the project's lifetime, showing that, at this time, the behind-the-meter option is the stronger of the two interconnection options. The going rate of PPAs for small commercial wind projects could affect this scenario. With a cash incentive at the time of construction, the Facility Project reached a 6% IRR with its break-even point in Year 13.

The Commercial Project had positive returns under three scenarios, all with higher PPA rates. These results also show potentially strong opportunities for wind development in the Community. Notably, the Commercial Project can achieve positive returns without incentives. This is primarily due to the Project's advantages in capacity factor and construction economics as discussed in Section 5.3.2. With a $0.05/kWh PPA and a cash incentive at the time of construction, the Commercial Project reached a 6% IRR with its break-even point in Year 12.

As previously stated, the purpose of this Study is not to demonstrate each project's profitability in exact terms, but to show, under common scenarios, the general viability of each project and the *potential* to generate positive return.

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June 1, 2010

Mr. Nathan Franzen
Westwood Renewables, Inc.
7699 Anagram Drive
Eden Prairie, MN 55344

Re: Lower Sioux Wind Turbine
Draft Feasibility Study – Phase I, Task 1
Redwood County, Minnesota

Westwood completed a preliminary land usage, constraint and permitting analysis for the Lower Sioux Wind Turbine Project area as directed by Westwood Renewables, Inc. for the purpose of identifying potential site constraints. Westwood's analysis of the project area located in Redwood County, south of Morton, Minnesota (Exhibit 1) was based on the completion of constraints mapping using GIS and analysis of applicable permitting and setback requirements.

The GIS mapping analysis consisted of assembling available GIS data layers obtained from federal, state, and local government sources. These data layers were used to create maps for understanding environmental, physical and logistical constraints in the project area (Exhibits 2 to 5). Some of the physical constraints evaluated include: infrastructure, water resources, land usage, land cover, and wind resources. According to Minnesota Department of Commerce wind data (2003), wind speeds in the project area, at an 80m height, range from 6.5 to 8 meters/second.

This GIS-level analysis did not identify fatal flaws that would typically preclude permitting of a wind energy facility. However, Westwood identified several elements that could present challenges to the development of portions of the overall project area that may need to be further explored depending upon the preferred turbine locations being considered. Approval of certain locations may require special negotiation or mitigation coordination with federal, state, and local agencies. While these issues may require some additional coordination and permitting, Westwood does not anticipate them rising to the level of fatal flaws. Identified issues include:

- Wetlands, Public Waterbodies and Watercourses
- Forested Areas and Grasslands (possibly native grasslands)
- Conservation Easement Lands (WRP, CRP, RIM, etc.)
- MnDNR Lands and Wildlife Management Areas
- Cultural Resources
- Setbacks from occupied structures
- Airports/Air Safety Hazards (e.g. Redwood Falls Municipal Airport)

In addition to GIS mapping analysis, Westwood completed an evaluation of potentially developable parcels and land use constraints such as applicable turbine setbacks (Exhibit 6). Based on this analysis, Westwood found that approximately 190 acres of the overall 1,987 acres found in the Project Area are likely suitable for wind development. Wind setbacks are governed by the State and Redwood County for the areas surrounding the Project. Though the Project will take place on sovereign land, a few setbacks exist that either protect the residences in or near the project or protects the land adjacent to the project, which are likely not necessary but are recommended by Westwood. A summary of the setback review is provided below.

Considering the distribution and abundance of the above-listed potentially applicable setback requirements, the southern and western portions of the project area appear to have the fewest constraints for wind development as shown on Exhibit 6.

Most states and county governments throughout the US mandate that turbines be sited at a distance far enough away from residences so that noise levels attenuate to the 45 - 50 decibel (dB(A)) level at the residence location. This setback distance is necessary so that the noise emitted from the turbines isn't noticeable during operation. This distance for most 1.5 MW turbine models ranges from 500 – 750 feet. Being that the setback is dependent upon the model the more conservative figure of 750 feet was used in the analysis to represent a worst case scenario.

Additionally setbacks from non participating landowners and road right-of-way lines protect adjacent properties and vehicles while minimizing the liability of the turbine owner should the structure fail. A setback of 1.25 fall distances (fd), which is used by Redwood County for projects under 5 MW, was used for the analysis. Setbacks of this nature cannot be determined without the exact specifications of the turbine being used so specifications of a typical 1.5MW turbine were assumed for the analysis. A hub height of 262 feet and a rotor diameter of 262 feet were used to produce a total height of 394 feet (hub height + ½ rotor diameter). When multiplied by 1.25 the overall setback of 500 feet (figure rounded from 492) was used in the analysis.

The Redwood County Ordinance indicates a wind rights setback of "5 rotor diameters from any other wind tower project." Wind right setbacks were not incorporated into the analysis, based on the assumption that there are no existing turbines within 5 rotor diameters of the property on adjacent land. Typically this rule applies to any non-participating landowner, though the way it is stated in this ordinance it would only apply to existing structures. This is likely not a requirement on sovereign land, but would also be something to consider if a turbine is erected on adjacent land prior to the construction of a turbine on the project area.

We have initiated the cultural resource record review. A preliminary assessment of cultural resource issues will be completed and submitted to you next week.

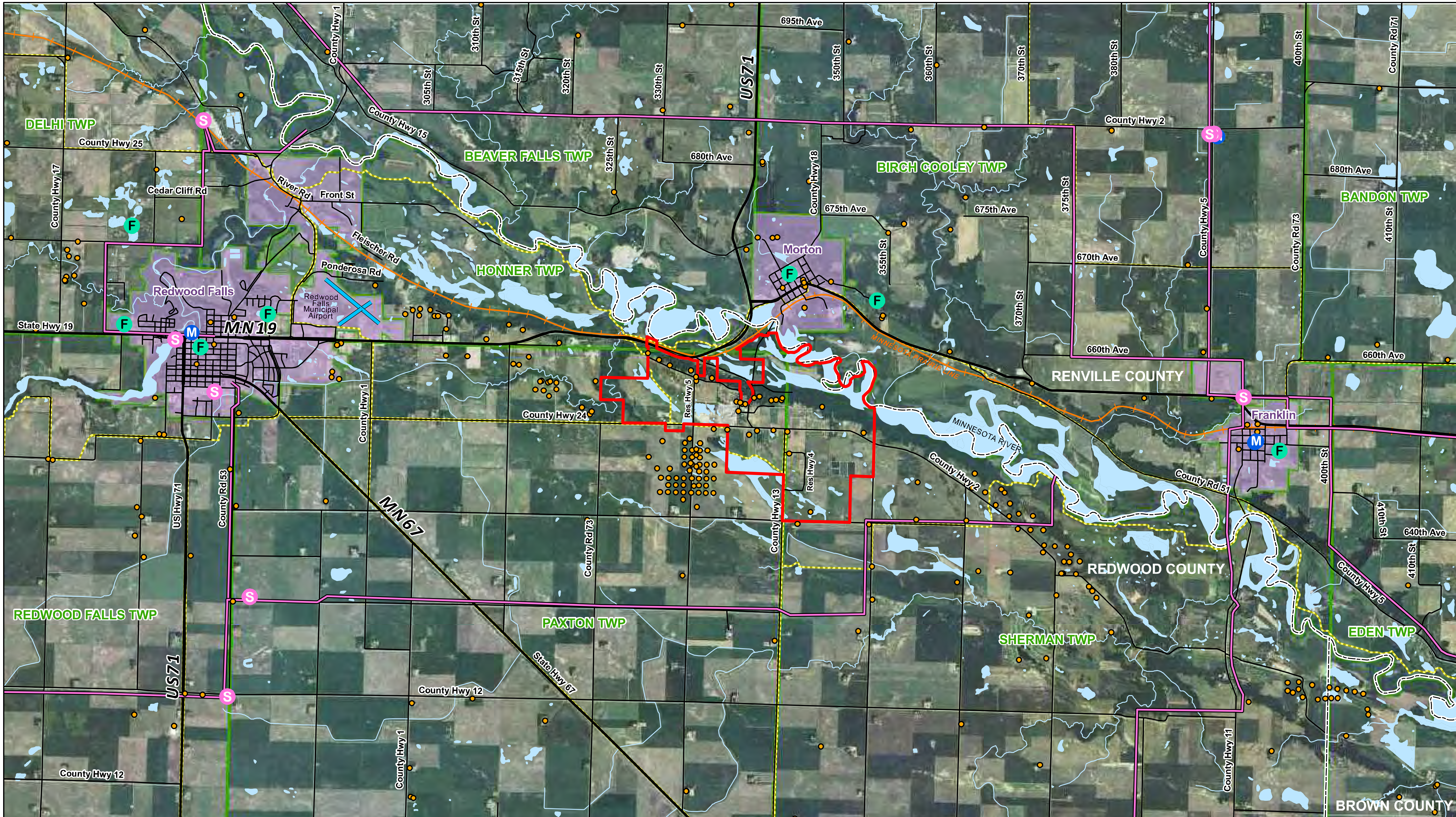
We are awaiting your authorization to complete the FAA studies, as well as the communications studies that will be completed by COMSEARCH. Let us know if you have questions regarding the scope of these services.

Feel free to contact me if you have questions regarding the results of this preliminary site evaluation.

Sincerely,

WESTWOOD PROFESSIONAL SERVICES

Michele Jackson Caron, PE, LEED AP
Director



Data Source(s): National Geographic Society i-Cubed Topo (2008); Mn/DOT BaseMap Counties (2008); Trunk Highways (2008); Civil Townships and Railroads (2008); USGS/LMIC GNIS (1990); FCC Microwave Towers (2009); LMIC Transmission Lines and Substations (2008); USGS NHD Water Features (2010; USFWS Wetlands (1991); and Westwood (2010).

Legend

- Lower Sioux Boundary
- County Boundary
- Municipality
- Township Boundary
- Wetland/Waterbody
- Stream/River/Ditch
- Major Road
- Local Road
- Railroad
- Snowmobile Trail
- Runway
- Transmission Line
- Substation
- FAA Registered Towers
- Microwave Tower
- County Well

N

0 1 Miles

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Dakota Futures and the Lower Sioux Indian Community

Redwood County, Minnesota

Surrounding Infrastructure

EXHIBIT 1

Map Document: (\\IGIS\Public\Proposals\2010\EnergyWind\Lower SiouxInfr013.mxd)
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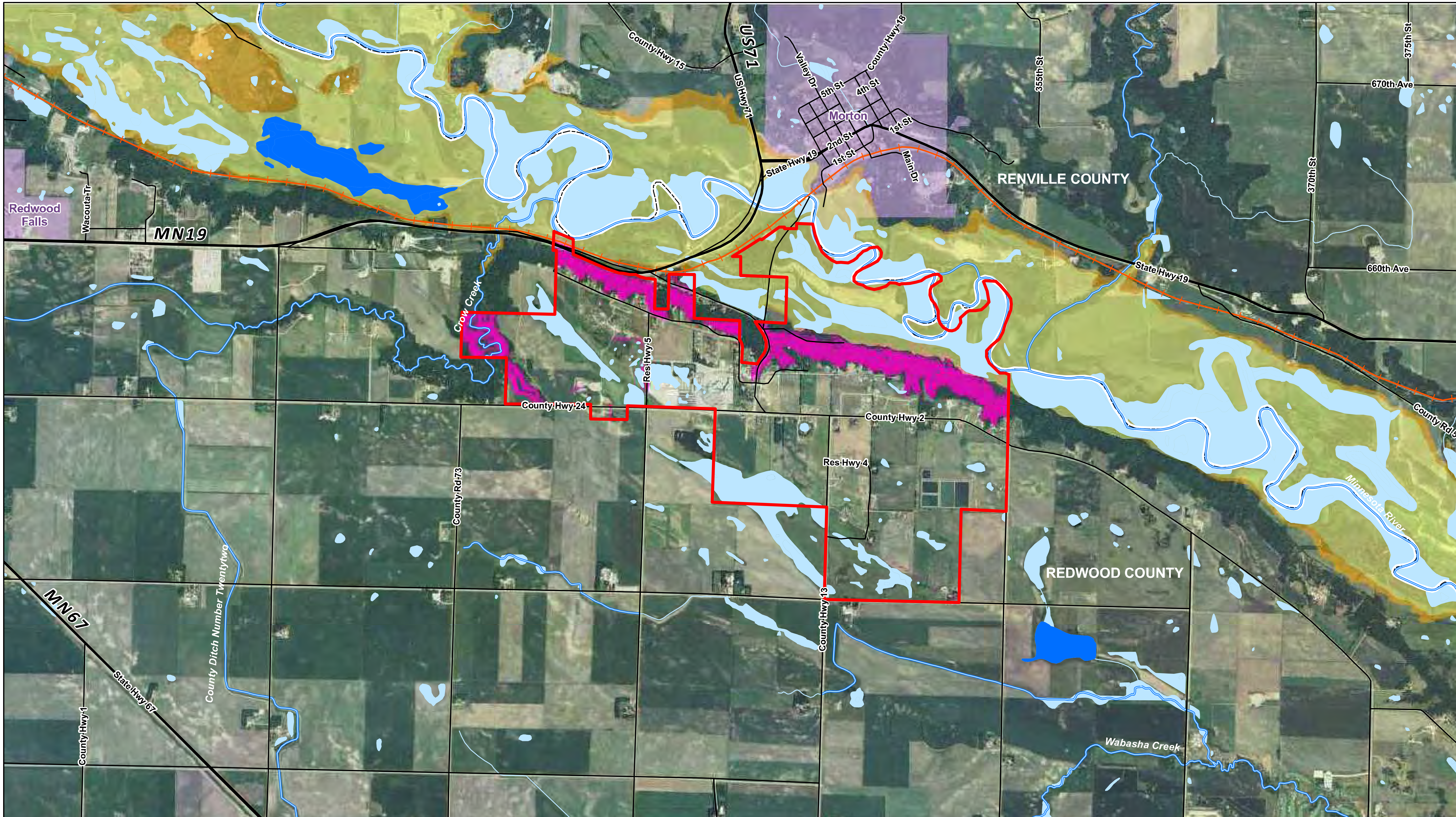

Data Source(s): USDA NAIP AFPO (2008); MnDOT BaseMap Counties, Roads, Railroads (2008); USFWS NWI Wetlands (1991); USGS NED DEM (2010); FEMA Q3 Floodways (1996); USGS/EPA NHD Rivers and Waterbodies (2010); MN DNR PWI (2008); and Westwood (2009).

Legend

- Lower Sioux Boundary
- County Boundary
- Municipality
- Major Road
- Local Road
- Railroad
- Wetland/Waterbody
- Protected Waters: Basins and Wetlands
- Stream/River/Ditch
- Protected Waters: Watercourse
- Steep Slopes (>=10%)
- **FEMA Floodplain**
  - 100-year
  - 500-year

N

0 — 0.5 Miles

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Dakota Futures and the Lower Sioux Indian Community

Redwood County, Minnesota

Water Resources

EXHIBIT 2

Map Document: (I:\GIS\Public\Proposals\2010\EnergyWind\Lower Sioux\wtr02B.mxd)
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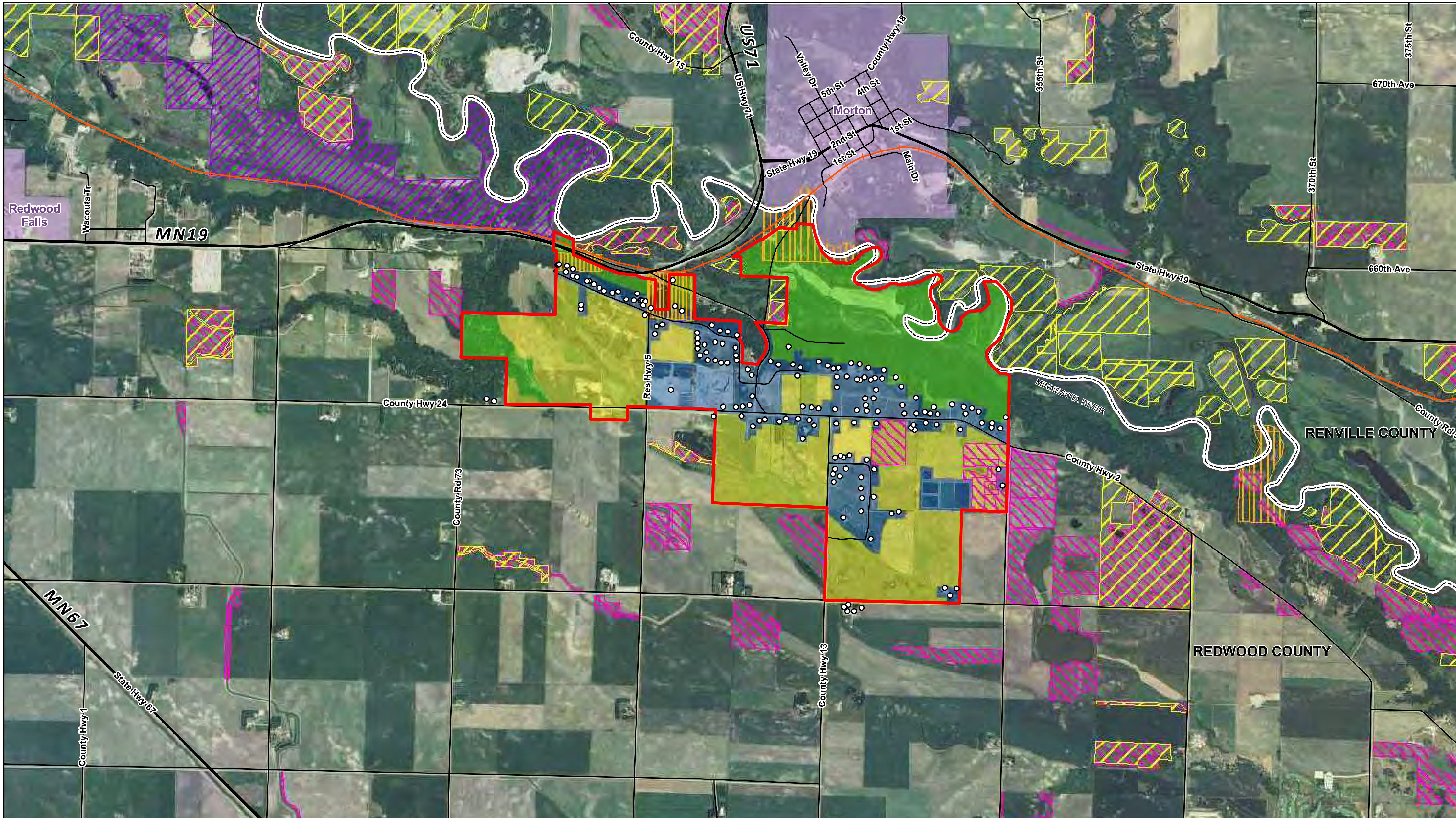

Data Source(s): USDA NAIP AFPO (2008); MnDOT BaseMap Counties, Roads, Railroads (2008); USFWS NWI Wetlands (1991); USGS NED DEM (2010); FEMA Q3 Floodways (1996); USGS/EPA NHD Rivers and Waterbodies (2010); MN DNR PWI (2008); and Westwood (2009).

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Land ownership and land use were not field verified.

N

0 0.5 Miles

Legend

- Lower Sioux Boundary
- County Boundary
- Municipality
- Major Road
- Local Road
- Railroad
- State Funded Conservtion Easement (e.g. WRP, RIM, CRP)
- MnDNR Land
- Wildlife Management Area
- Conservation Reserve Program
- Structure/Residence

Land Use

- Open Space
- Developed
- Trees

Dakota Futures and the Lower Sioux Indian Community

Redwood County, Minnesota

Land Ownership and Land Use

EXHIBIT 3

Map Document: (I:\GIS\Public\Proposals\2010\Energy\Wind\Lower Sioux\own02B.mxd)
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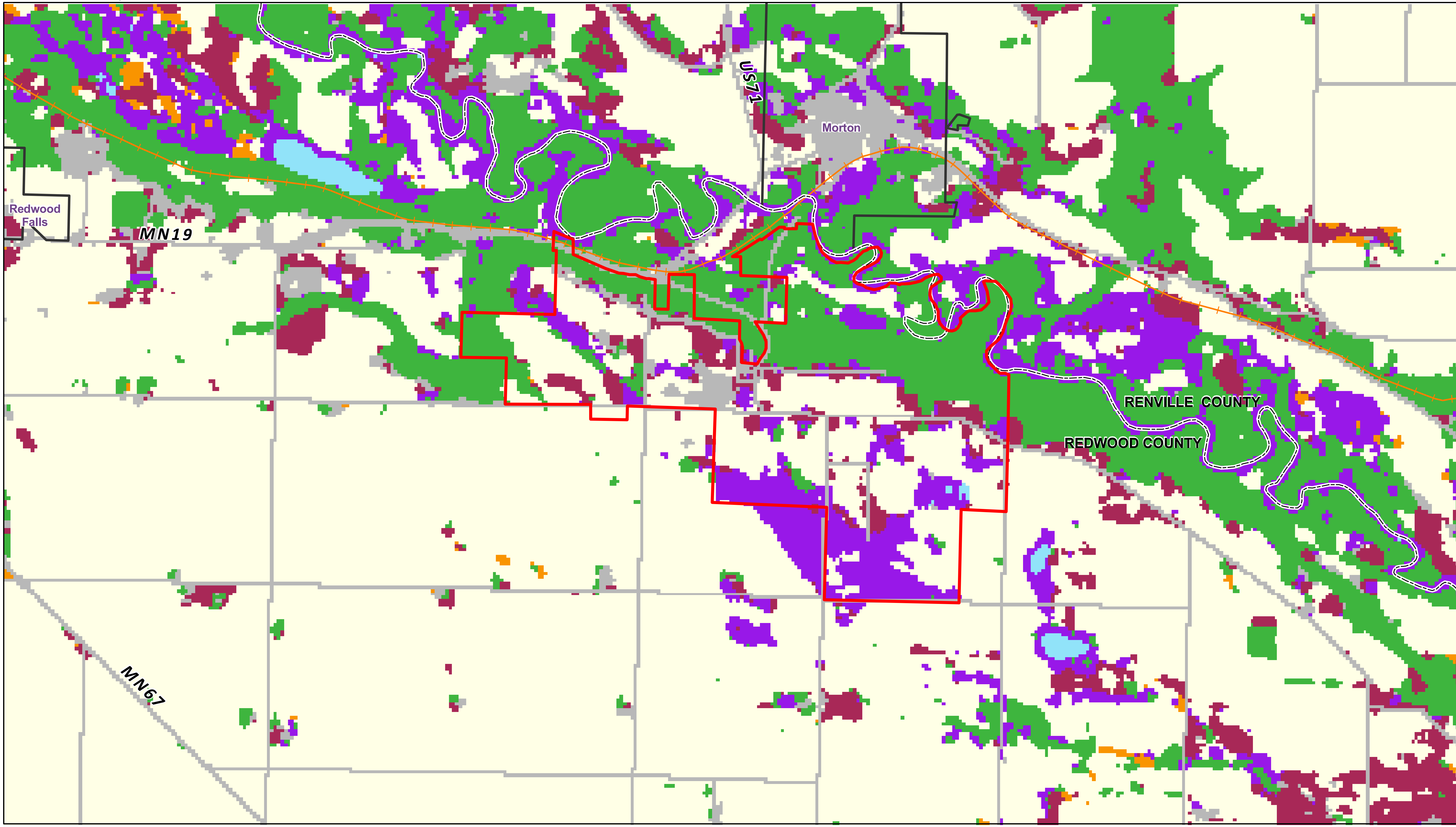

Data Source(s): University of Minnesota (2005); Mn/DOT BaseMap (2008); and Westwood (2010).

Legend

- Lower Sioux Boundary
- County Boundary
- Municipality
- Railroad

Land Cover Types

- Urban/Developed (8.07%)
- Agricultural (37.1%)
- Grassland (8.71%)
- Forest (27.6%)
- Water (0.2%)
- Wetland (18.2%)
- Shrubland (0.02%)

N

0 0.5 Miles

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Dakota Futures and the Lower Sioux Indian Community

Redwood County, Minnesota

Land Cover

EXHIBIT 4

Map Document: (I:\GIS\Public\Proposals\2010\Energy\Wind\Lower Sioux\lulc01B.mxd)
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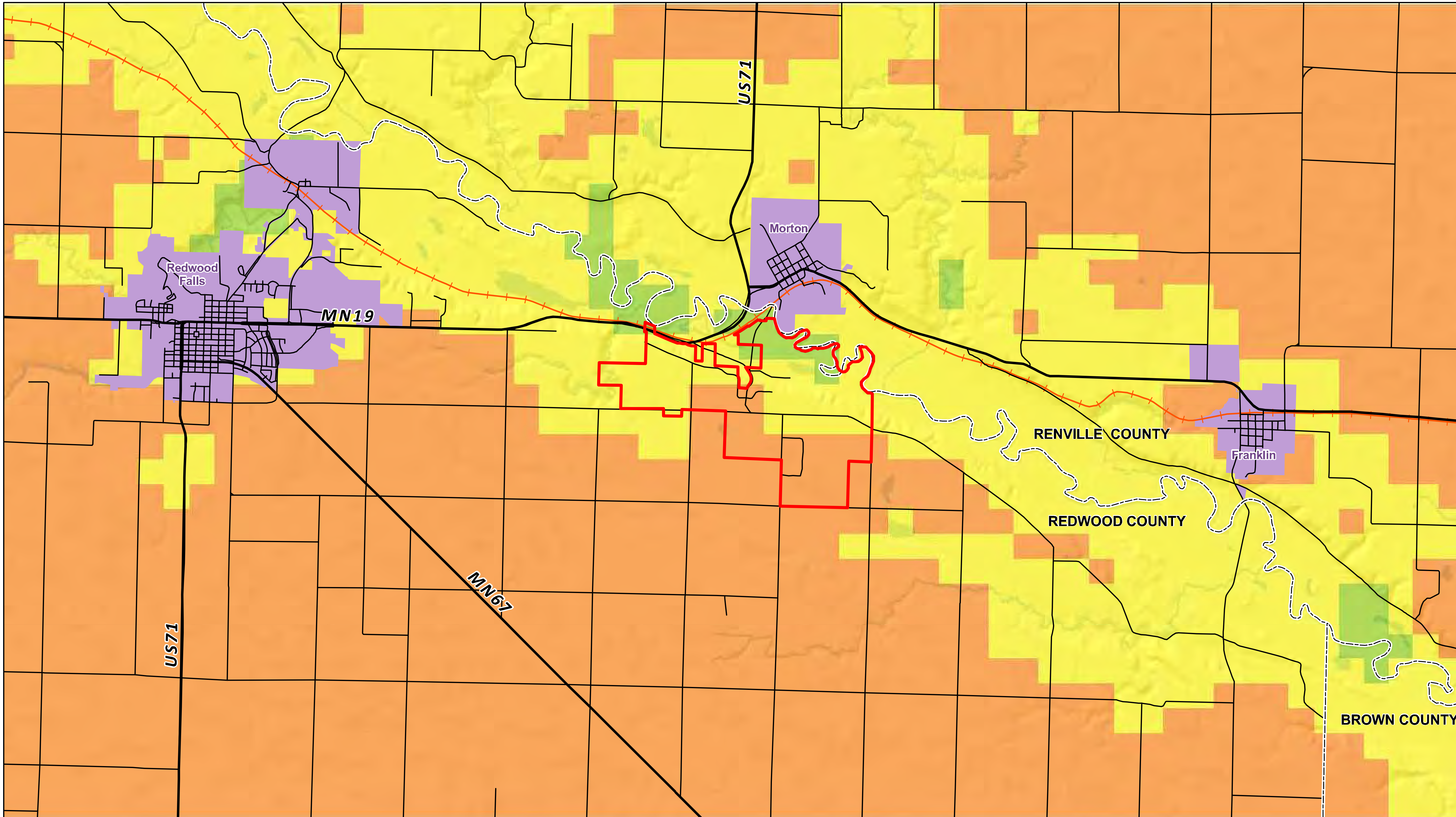

Data Source(s): Minnesota Department of Commerce and WindLogics (2003); ESRI (2009); MnDOT BaseMap Counties, Roads, Railroads (2008); and Westwood (2009).

Legend

- Lower Sioux Boundary
- County Boundary
- Municipality
- Major Road
- Local Road
- Railroad

Wind Speeds (80m height in m/s)

- 6.0 - 6.5
- 6.5 - 7.0
- 7.0 - 7.5
- 7.5 - 8.0
- 8.0 - 8.5

N

0 1 Miles

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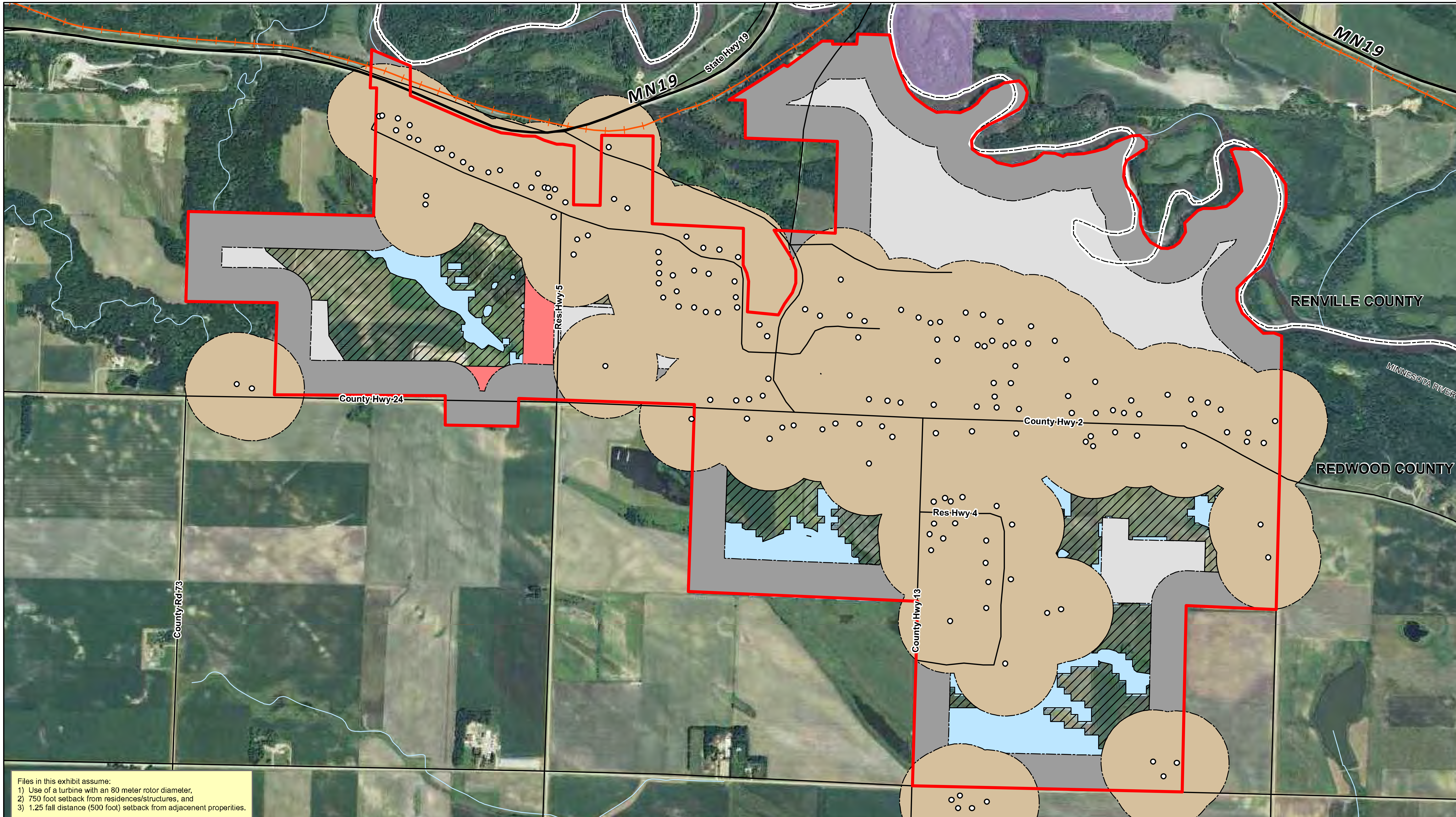
Dakota Futures and the Lower Sioux Indian Community

Redwood County, Minnesota

Wind Resources (At 80m)

EXHIBIT 5

Map Document: (I:\GIS\Public\Proposals\2010\Energy\Wind\Lower Sioux\wind01B.mxd)
5/26/2010 -- 9:56:25 PM



Data Source(s): USDA NAIP AFPO (2008); MnDOT BaseMap Counties, Roads, Railroads (2008); USFWS NWI Wetlands (1991); USGS NED DEM (2010); FEMA Q3 Floodways (1996); USGS/EPA NHD Rivers and Waterbodies (2010); MN DNR PWI (2008); and Westwood (2009).

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Land ownership and land use were not field verified.

N

0 0.25 Miles

Legend

- Lower Sioux Boundary
- County Boundary
- Municipality
- Major Road
- Local Road
- Railroad
- Structure/Residence
- Wetland/Waterbody
- Stream/River/Ditch
- Land Use: Developed & Trees
- Approximate Road Setback = 500 Feet
- Approximate Residence Setback = 750 Feet
- Approximate Adjacent Property Setback = 500 Feet
- Preliminary Developable Area (About 190 Acres)

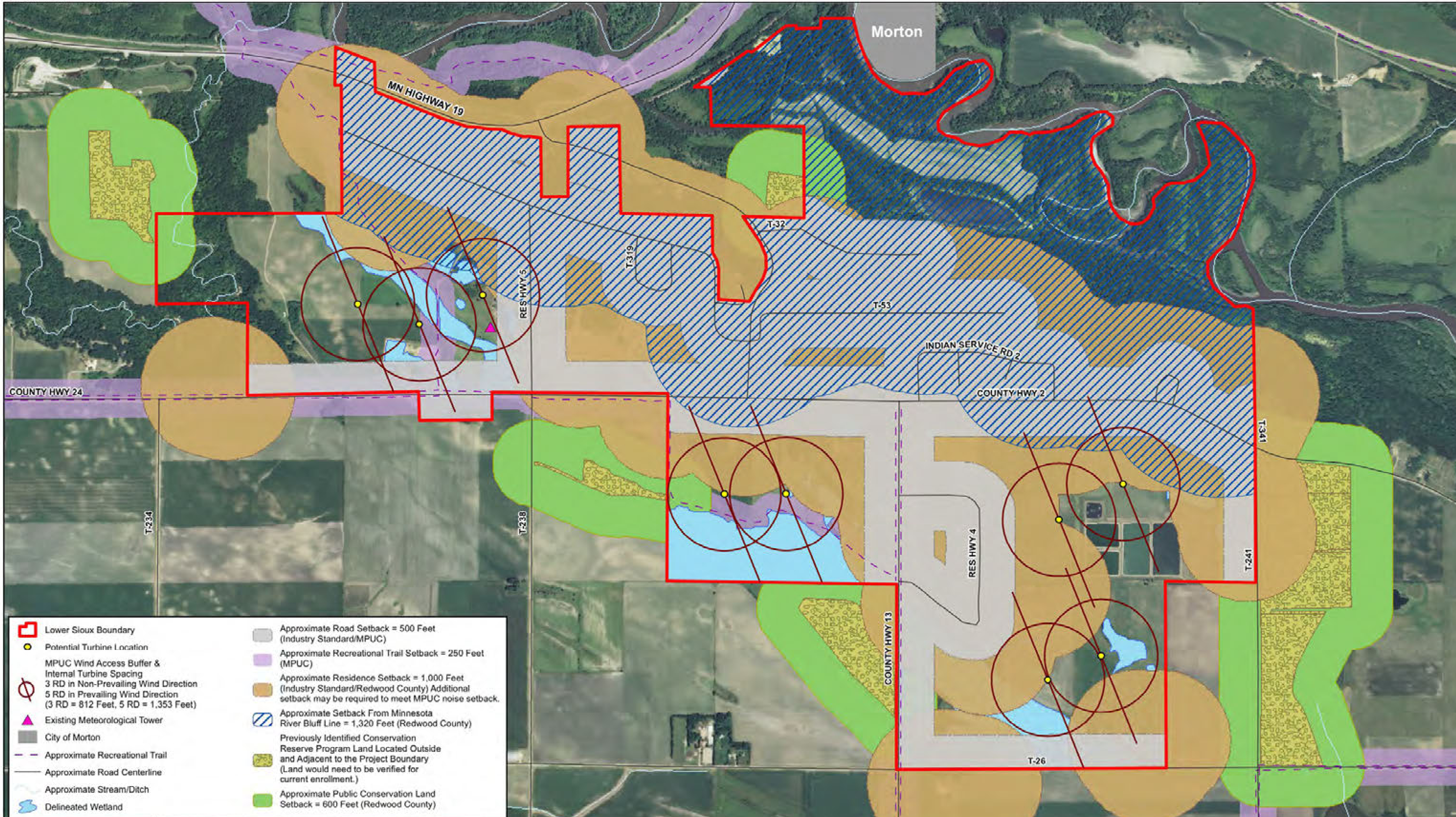
Dakota Futures and the Lower Sioux Indian Community

Redwood County, Minnesota

Preliminary Developable Areas

EXHIBIT 6

Map Document: (P:\20101122\gis\20101122dev01B.mxd)
6/2/2010 -- 11:39:27 AM



Data Source(s): USDA NAIP AFPO (2009); MnDOT BaseMap Counties, Roads and Snowmobile Trails (2010); MnDNR CRP Land (2000), USGS/EPA NHD Watercourses (2011); and Westwood (2011).

Map Document: (P:/20101210/gis/20101210outs028_116725.mxd)
1/23/2012 4:40:39 PM

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N

0 0.25 Miles

Note:
Most setbacks were applied using approximate and potentially incomplete GIS datasets. All setbacks should be re-evaluated following a complete land survey of the site. Additional features and setbacks will may need to be incorporated upon further review of the project area.

Dakota Futures and the Lower Sioux Indian Community

Preliminary Turbine Locations
Assumes 82.5m Rotor Diameter (RD)

1/23/2012

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1.0 PREVIOUS CULTURAL RESOURCES INVESTIGATIONS AND IDENTIFIED SITES

In June 2010 followed by an update in January 2012, Westwood Cultural Resource Specialist Ryan Grohnke conducted a background literature search of the project area and a one-mile buffer at the Office of the State Archaeologist (OSA) located at Fort Snelling in St. Paul, MN and the Minnesota State Historic Preservation Office (SHPO) located at the Minnesota History Center in St. Paul, MN. Archaeological site and historic/architectural resource files were examined to obtain a list of all previously recorded archaeological and historic/architectural sites within the proposed project area. Cultural resource investigation summary reports for the county were reviewed to determine if previous surveys have been conducted within the project area.

1.1 Archaeological Resources

A review of records at the MN SHPO and OSA indicated that 18 previously recorded archaeological sites have been identified within the project area and a one-mile buffer. Eight sites are located within the project area and the additional 10 are located within the one-mile buffer. Two of the sites within the buffer are alpha sites (i.e. 21RWg). An alpha site is a reported, but unverified archaeological site. These sites are identified through either historical documentation or an informant's report, but have not yet been verified by a professional archaeologist.

The Lower Sioux Agency (21RW0011) located within the buffer, is listed on the National Register of Historic Places (NRHP). This site consists of structural ruins and artifacts related to the historic reservation agency. Jackpot Junction (21RW0053) located within the project area is eligible for listing on the NRHP, is an artifact scatter relating to the Archaic Tradition. The majority of sites are prehistoric sites. One cemetery (21RWam) is identified as possibly being in the buffer. Site types identified as earthworks may also be burials. The list of recorded archaeological sites is summarized in **Table x-1.**

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Table x-1: Previously Recorded Archaeological Sites					
Site Number	**Site Name**	**Site Type**	**Location**	**Project/Buffer**	**NRHP Eligibility**
21RW0006	none	Earthworks	T112N, R34W, Sec. 6	Project	Unevaluated
21RW0007	none	Earthworks	T112N, R35W, Sec. 2	Project	Unevaluated
21RW0008	none	Earthworks	T112N, R35W, Sec. 3	Buffer	Unevaluated
21RW0011	Lower Sioux Agency	Structural Ruins/Artifact Scatter	T112N, R34W, Sec. 5 & 8	Buffer	Listed
21RW0052	Crow Creek	Artifact Scatter	T113N, R35W, Sec. 35	Buffer	Unevaluated
21RW0053	Jackpot Junction	Artifact Scatter	T112N, R35W, Sec. 1 & 2	Project	Eligible
21RW0054	Sulphur Lake	Artifact Scatter	T112N, R35W, Sec. 1	Buffer	Unevaluated
21RW0060	none	Artifact Scatter	T112N, R35W, Sec. 1	Project	Unevaluated
21RW0061	none	Artifact Scatter	T112N, R35W, Sec. 1	Project	Unevaluated
21RW0063	none	Lithic Scatter	T112N, R35W, Sec. 2	Project	Unevaluated
21RW0065	none	Single Artifact	T112N, R34W, Sec. 6	Project	Unevaluated
21RW0067	none	Single Artifact	T112N, R35W, Sec. 1	Project	Unevaluated
21RWg	Little Crow Village	Possible Village learned through Historic Documentation	T112N, R35W, Sec. 3	Buffer	Unevaluated
21RN0005	None	Earthworks	T113N, R34W, Sec. 32	Buffer	Unevaluated
21RN0012	Redwood Ferry	Artifact Scatter	T112N, R34W, Sec. 5	Buffer	Unevaluated
21RN0031	Granite Valley Quarry #1	Artifact Scatter	T113N, R35W, Sec. 35	Buffer	Unevaluated

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Table x-1: Previously Recorded Archaeological Sites

Site Number	Site Name	Site Type	Location	Project/Buffer	NRHP Eligibility
21RN0032	Granite Valley Quarry #2	Single Artifact	T113N, R35W, Sec. 35	Buffer	Unevaluated
21RNam	None	Cemetery	T113N, R34W, Sec. 33	Buffer	Unevaluated

Key: Site Number = site designation applied by State Archaeologist; Site Name = name given to site; Site Type = defined site use type; Location = amended legal description of recorded property; NRHP Eligibility = status of site evaluation in regards to listing on NRHP: Unevaluated, Not Eligible, Eligible, or Listed.

1.2 Historic/Architectural Resources

A review of records at the MN SHPO indicated that 30 historic/architectural resources have been previously inventoried within the project area and the one-mile buffer. The majority of resources (21) are located within the city limits of Morton, MN. Four historic/architectural resources have been previously inventoried within the project area itself. Two resources, St. Cornelia's Episcopal Mission (RW-LSC-001) and the Birch Coulee School (RW-LSC-002) are listed on the NRHP. Both of these resources are located within the project area. The James McGowen House (RW-MRC-014), located within the buffer, is eligible for listing on the NRHP. The list of recorded Historic/Architectural resources is summarized in **Table x-2.**

Table x-2: Previously Recorded Historic/Architectural Resources

SHPO Number	Description	Location	Project/Buffer
RW-PAX-008	Roadside Parking Area	T112N, R35W, Sec. 1	Project
RW-HON-002	Minneapolis & St. Louis Bridge	T113N, R34W, Sec. 31	Buffer
RW-HON-003	Bridge No. 4666	T113N, R35W, Sec. 36	Buffer
RW-HON-004	Bridge No. 4667	T113N, R35W, Sec. 36	Buffer
RW-HON-005	Bridge No. 4479	T113N, R35W, Sec. 35	Buffer
RW-LSC-001	St. Cornelia's Episcopal Mission	T112N, R35W, Sec. 1	Project
RW-LSC-002	Birch Coulee School	T112N, R35W, Sec. 1	Project
RW-PAX-006	Bridge No. 4668	T112N, R35W, Sec. 1	Project

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Table x-2: Previously Recorded Historic/Architectural Resources			
SHPO Number	**Description**	**Location**	**Project/Buffer**
RW-SRM-003	Lower Sioux Agency Historic District	T112N, R34W, Sec. 8	Buffer
RW-MRC-001	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-002	Church of St. John	T113N, R34W, Sec. 31	Buffer
RW-MRC-003	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-004	house	T113N, R34W, Sec. 30	Buffer
RW-MRC-005	school	T113N, R34W, Sec. 31	Buffer
RW-MRC-006	commercial building	T113N, R34W, Sec. 31	Buffer
RW-MRC-007	P.H. Galle Building	T113N, R34W, Sec. 31	Buffer
RW-MRC-008	commercial building	T113N, R34W, Sec. 31	Buffer
RW-MRC-009	commercial building	T113N, R34W, Sec. 31	Buffer
RW-MRC-010	commercial building	T113N, R34W, Sec. 31	Buffer
RW-MRC-011	commercial building	T113N, R34W, Sec. 31	Buffer
RW-MRC-012	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-013	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-014	James McGowen House	T113N, R34W, Sec. 31	Buffer
RW-MRC-015	school	T113N, R34W, Sec. 31	Buffer
RW-MRC-016	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-017	United Methodist Church	T113N, R34W, Sec. 31	Buffer
RW-MRC-018	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-019	house	T113N, R34W, Sec. 31	Buffer
RW-MRC-020	Zion Evangelical Lutheran Church	T113N, R34W, Sec. 31	Buffer
RW-MRC-021	house	T113N, R34W, Sec. 31	Buffer

Key: SHPO Number = inventory number for recorded property in SHPO files; Description = name of historic structure or description of type of structure; Location = amended legal description of recorded property; Project Area / Buffer = denotes if listed site is within the defined project area or within the one-mile buffer.

Upon review of the archaeological sites and historic properties inventories compiled for the defined project area, Westwood concludes that the archaeological and historic investigations executed to date have not examined the entire potential for existence of cultural resources in the area. While several investigations have been carried out in the project area, many of these have been limited in scope and concentrated on relatively small property

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parcels or immediate right-of-ways. Due to its proximity to the Minnesota River and the historic Lower Sioux Agency, the project area has high potential for cultural resources.

Based upon the result of the investigations reported here, Westwood recommends a Phase I cultural resources survey be conducted within the defined construction area for the project. Attention should be paid to the location of the recorded archaeological and architectural properties identified during this investigation and those potentially identified in subsequent field investigations to ensure that negative impacts to the properties can be avoided during the construction phase of the project. Ultimately, the project should follow the guidelines for cultural resource investigations as defined by the MN SHPO.

As the project is located within the boundaries of the Lower Sioux Indian Community, it is recommended that the Lower Sioux Tribal Historic Preservation Office (THPO) be contacted in reference to the project. Should the project be located on tribally owned lands, the THPO office should be contacted to ascertain if tribal laws and regulations in regards to cultural resources may be relevant. If the project will be reviewed for cultural resources under Section 106 of the National Historic Preservation Act or NEPA, the Lower Sioux THPO will assume the duties of the MN SHPO in regards to review and compliance.

Wind Farm / Microwave Link Analysis

Redwood Falls, MN

Solutions in radiocommunications

Table of Contents

1. Introduction

Background

Wind turbine generators, with their metallic construction, large proportions, and moving parts are potential interferers for fixed communications links and air traffic control and navigational aids. Due to their unique physical characteristics, the turbines may have negative impacts upon these wireless communications channels, including licensed microwave links.

The two main types of terrestrial microwave stations are those that communicate with satellites and those that communicate with each other, in a point-to-point fashion. Satellite communications links are not likely to be affected by wind turbines because of the high angle of inclination of the parabolic antenna. Terrestrial point-to-point links may be affected by wind turbines because of the low altitudes that their transmission paths occupy.

Point-to-point microwave links are communications systems that transmit their signals via beams of radio waves. They are used to transmit anything from data to audio and video information in the microwave frequency range from 1 to 30 gigahertz. Such links are often used as backhaul systems due to their vast bandwidth (ability to carry large amounts of information); long distance telephone calls, sports broadcasts, and cellular network backbone transmission are common microwave transmissions.

Figure 1: Mast with terrestrial microwave antennas

Most terrestrial microwave links feature two highly-directional parabolic antennas situated several miles from each other, forming a fixed radio link. These two parabolic antennas must be in line-of-sight, otherwise transmission quality may be degraded or not at all possible. Since the transmission path is usually within several hundred feet of ground level, any structures or vegetation that fully or partially impinge upon the electromagnetic energy that is transmitted between two microwave antennas will lower the quality and reliability of transmission.

For unlicensed transmission, a certain amount of degradation of service must be tolerated, as long as the object responsible for the degradation does not emit electromagnetic waves of too much power, within the unlicensed frequency range. Point-to-point microwave paths mainly consist of licensed links. This means that a user purchases a certain frequency range in a given area and thus becomes the sole user of that frequency [in that area], greatly decreasing the probability of electromagnetic interference.

When a user pays for a radio frequency in a certain area, they are in essence paying for a guarantee of little to no interference to their transmission system. Licensed transmission paths are also often operated by government and safety agencies, like weather reporting entities and police and fire departments. In most jurisdictions, interfering with such transmission links is prohibited by law.

Wind Turbine Effects on Point-to-Point Microwave Links

Obstacles located between the transmitter and the receiver in a microwave link, including wind turbines, affect the received signal strength in wireless communication. Wind turbines can also generate electromagnetic noise which may interfere with communication signals. The resulting effect can be a decrease of reliability and in some cases the inability to communicate. Point-to-point microwave links rely on line of sight to establish communication. The signal is subject to refraction in the atmosphere and diffraction from obstructions in the Fresnel zone volume.

A Fresnel zone is an elliptical volume around a direct radio path that contains a certain amount of electromagnetic energy. While the energy nearest the direct radio path (within the first Fresnel zone) contributes to the total amount of energy received at the receiving station, energy within the second Fresnel zone may sum destructively at the receiver, lowering the total amount of power received and potentially negatively effecting the quality of transmission. Microwave operators usually try to maintain 60% of the first Fresnel zone cleared from obstructions when designing their links. As a conservative measure, second Fresnel zone clearance is considered to avoid any harmful effects caused by the energy contained in that volume.

2. Objective

The objective of this report is to utilize the optimal cartographic data in ATDI's ICS Map Server and ICS Telecom RF planning software to most efficiently analyze any potential interference effects of the projected site area where the wind turbines will be located close to Redwood Falls, MN, supported by a comprehensive technical database containing licensed microwave systems while using theoretical calculations based on formulas from commonly available literature.

The Redwood Falls Wind Project Information

The proposed wind farm turbines have the following specifications:

Table 1: Wind Turbine Specifications

Wind Turbines	
Number of Turbines	9
Hub Height (m)	80
Rotor Diameter (m)	82.5
Turbine Height (m)	121.25

The proposed location of the Wind Farm Project is South of Olivia, MN:

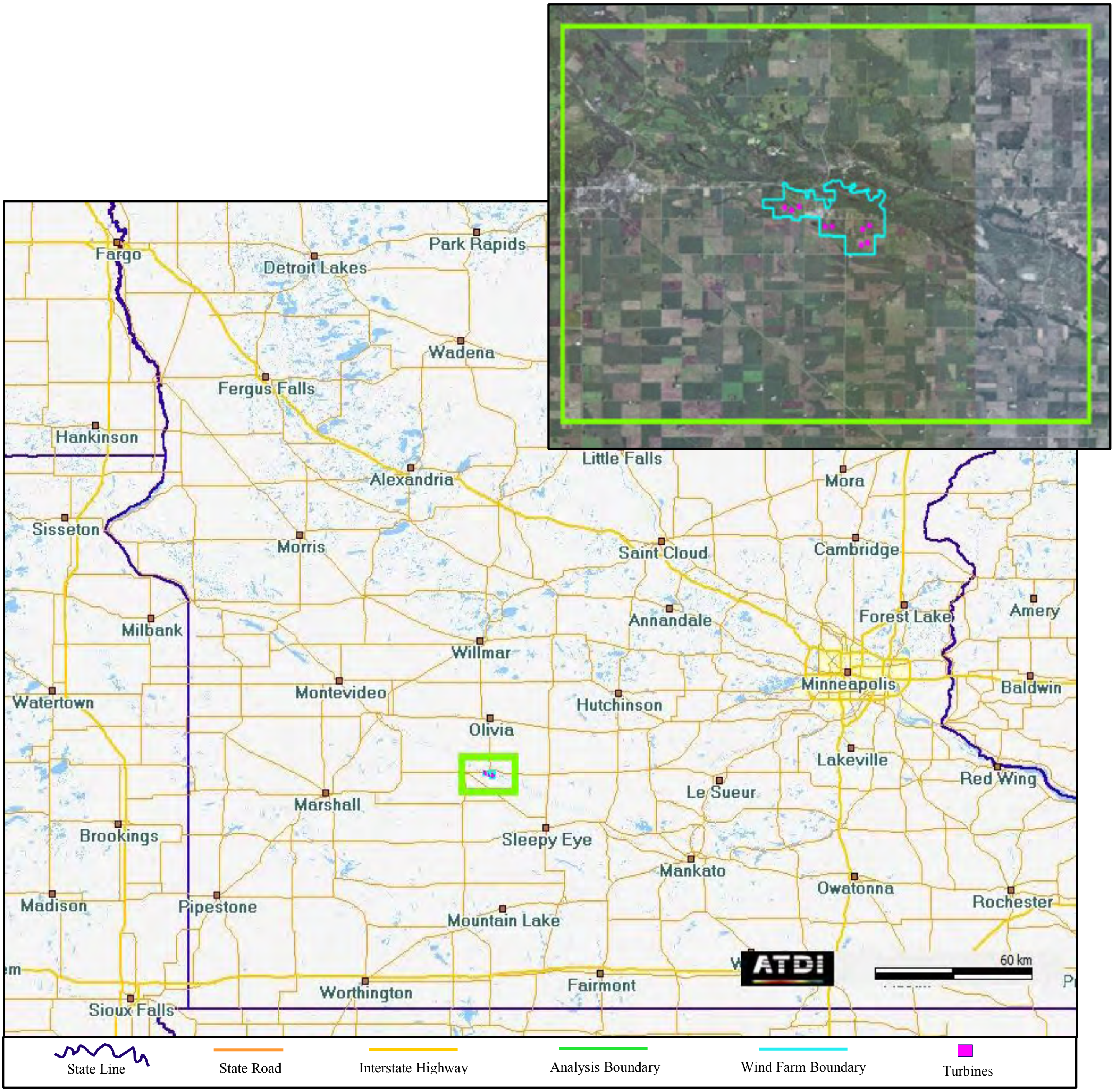

Figure 2: Area of Interest for the Redwood Falls Wind Farm Project

3. Methodology

The accepted second Fresnel zone clearance method is applied to determine the protected width of the microwave beam paths:

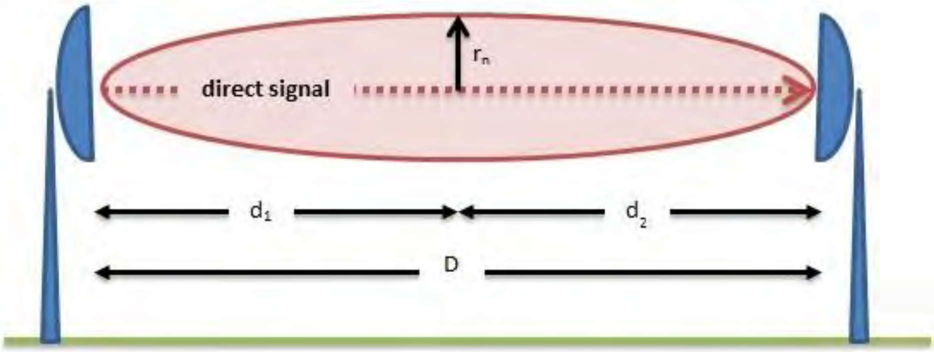

Figure 3: Fresnel zone calculation

The Fresnel zone size depends on the frequency and distance from the microwave stations, given by the generic formula:

$$r_n = \sqrt{\frac{n\lambda d_1 d_2}{d_1 + d_2}}$$

where:

rn is the radius of the nth Fresnel zone in meters
n is the Fresnel zone number
λ is the wavelength of the microwave signal in meters
d1 and d2 are the distances to the microwave stations from the point in question

The second Fresnel zone is the largest at the midpoint between the two antennas where d1 = d2. Its radius is defined by:

$$\mathrm{r_{WCFZ2}} = 12.243\sqrt{\frac{\mathrm{D}}{\mathrm{f}}}$$

where:

rWCFZ2 is the radius of the second Fresnel zone in meters
f is the frequency in gigahertz
D is the total link distance in kilometers

This radius is commonly called the Worst Case Fresnel Zone and can be abbreviated as WCFZ2. When applied to a microwave link, it should provide enough clearance for the link to continue functioning without a drop in quality or reliability of transmission. The wind farm and existing microwave links are now imported into the ATDI ICS tools for beam path analysis.

4. Beam Path Analysis

To accomplish the beam path analysis required to determine whether or not microwave radio link infringement is possible, a database search is first conducted for microwave links in existence in the area of the proposed wind farm. The FCC Universal Listing System repository is searched for any microwave links intersecting the bounds of the proposed wind farm. If there are none, the analysis is complete and there is no need for further investigation. The analysis uses the information available from the weekly download dated 5/20/2011.

Ten (10) microwave links in active or pending status have been found to be near the area of interest. Figure 4 shows the proximity of the microwave links to the wind farm turbine model:

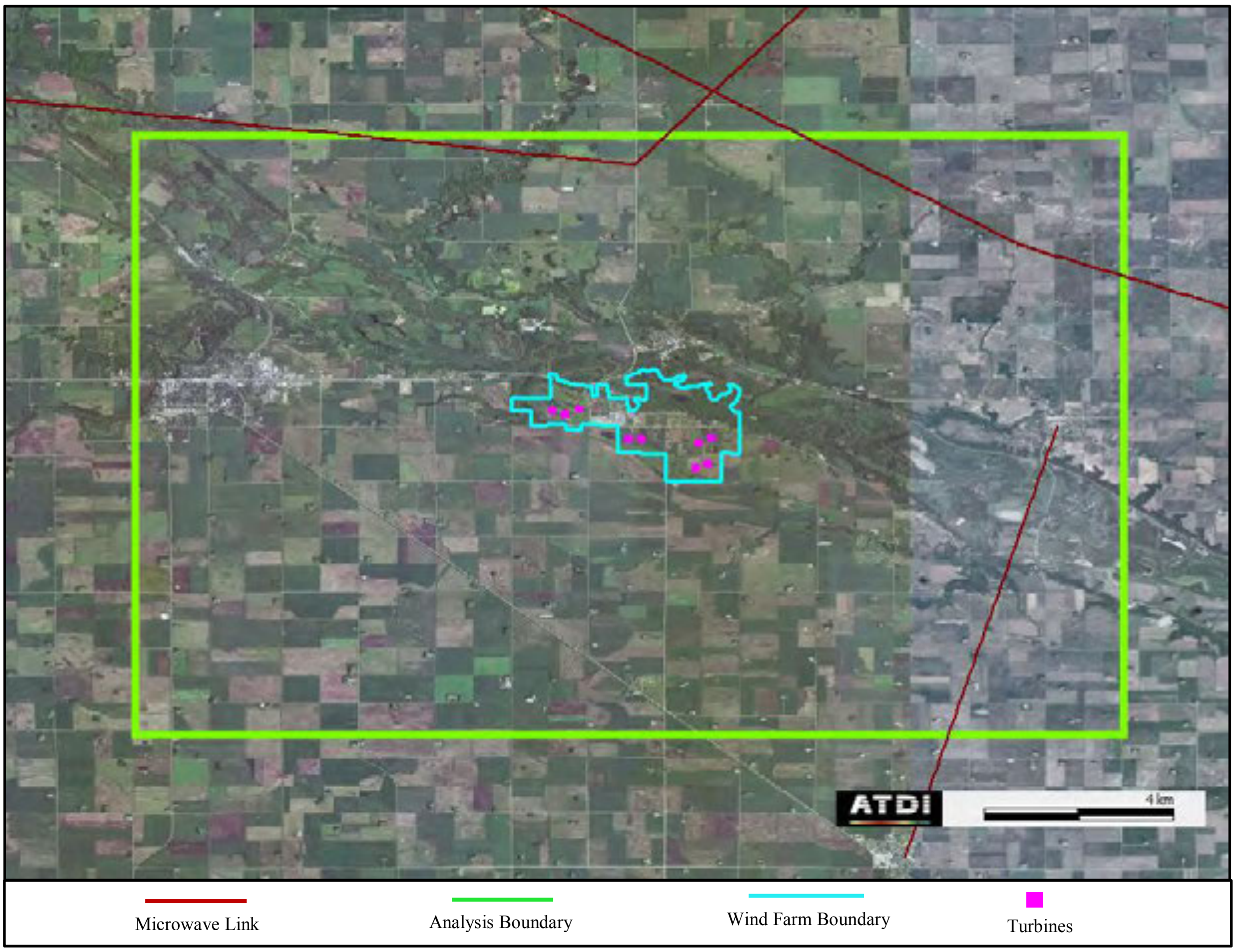

Figure 4: Wind Farm Project Area

Table 2 includes the licensed microwave links retrieved from the FCC Universal Licensing System repository for microwave links near the Redwood Falls Wind Farm area (database retrieval date 5/20/2011):

Table 2: Licensed Microwave Links near Projected Wind Farm Project Area

Callsign	Site_A	Site_B	Licensee	MHz	WCFZ2
WNEN470	Henryville	Birch Coole	East River Electric Power Cooperative Inc.	6551	19.0
WNEN471	Birch Coole	Henryville	East River Electric Power Cooperative Inc.	6718	18.7
WNEN471	Birch Coole	Cairo	East River Electric Power Cooperative Inc.	6718	20.0
WNEN472	Cairo	Birch Coole	East River Electric Power Cooperative Inc.	6541	20.2
WQGE380	Cedar Mtn HS	Cedar Mtn ES Tower	Trillion Partners Inc.	11035	13.3
WQGE400	Cedar Mtn ES Tower	Cedar Mtn HS	Trillion Partners Inc.	19680	9.9
WQJE635	Echo	Morton	Minnesota State of	6805	28.3
WQMI442	Hector	Morton	Minnesota State of	6855	26.1
WQMI446	Morton	Hector	Minnesota State of	6615	26.5
WQMP682	Morton	Echo	Minnesota State of	6645	28.6

**Please click on each Callsign for details about Licensee contact information*

Table 3 shows the clearance distance between each wind turbine (including rotor volume) and the closest microwave link second fresnel zone for the wind turbines:

Table 3: All Wind Turbine Locations Are Clear From the MW beam paths

Wind Turbine ID	MW Callsign	3D Distance(m)
3	WQGE380	6815.3
1	WQGE380	6905.7
4	WQGE380	7014.6
2	WQGE380	7139.0
9	WQMP682	7240.9
7	WQMP682	7353.1
8	WQMP682	7404.5
5	WQMI442	8027.3
6	WQMI442	8027.5

Figure 5 displays the zoomed view of wind farm along with the proposed wind turbine locations. The case plotted below shows no active or pending status of microwave links intersecting the wind farm boundary.

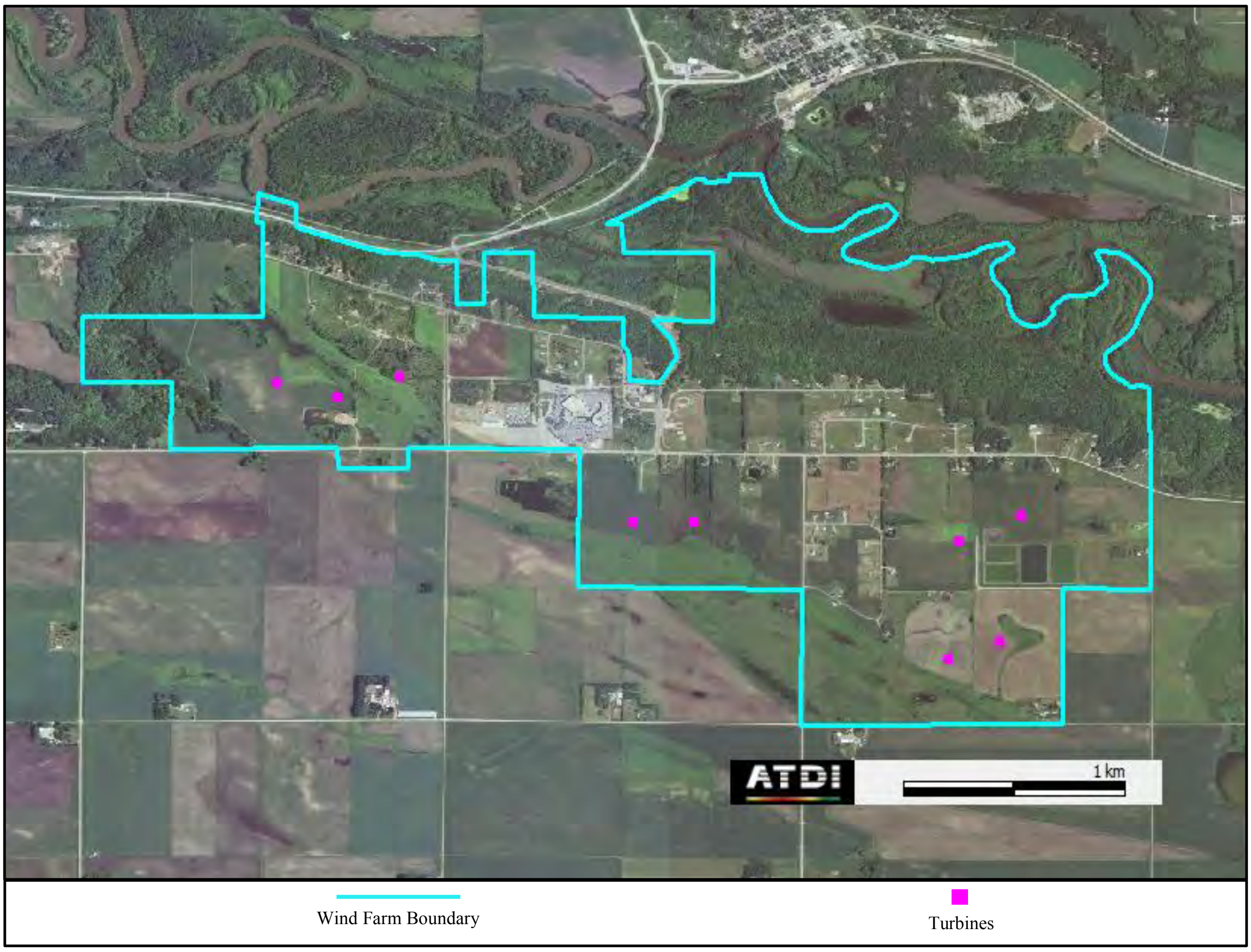

Figure 5: Zoomed view of Wind Farm Layout – Redwood Falls

5. Conclusion

Point-to-point microwave links are communications systems that transmit their signals via beams of radio waves. Obstacles located between the transmitter and the receiver in a microwave link, including wind turbines, affect the received signal strength in wireless communication.

Microwave deployment users, such as government and safety agencies, pay for a radio frequency in a certain area. Essentially their frequency purchase additionally guarantees a level of little to no interference to their transmission system. In most jurisdictions, interfering with such transmission links is prohibited by law.

The accepted second fresnel zone clearance method was applied to determine the protected width of the microwave beam paths. The wind farm and existing microwave links were imported into ATDI's ICS tools to determine whether or not microwave radio link infringement is possible. A database search in the FCC Universal Listing System repository revealed no clearance issues with the microwave links in the area of the proposed wind farm.

All wind turbines are clear of the microwave link second fresnel zones. No interference is to be expected with the current layout.

Report prepared on behalf of **Westwood Professional Services.**

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Lower Sioux Wind Project
Obstacle Evaluation Study

Summary

Capitol Airspace Group conducted a comprehensive airspace and obstacle evaluation for the Lower Sioux Wind Project. The purpose for this study was to identify obstacle clearance surfaces established by the Federal Aviation Administration (FAA) that would limit the height or location of proposed wind turbines. At the time of this study, the location of individual wind turbines had not been determined. Therefore, this study assessed the height limitations over a 2.35 square mile "study area" to aid the developer in locating optimal turbine sites.

14 CFR Part 77 requires that all structures that exceed 200 feet above ground level (AGL) be submitted to the FAA so that an aeronautical study can be conducted. The FAA's objective in conducting aeronautical studies is to ensure that proposed structures do not have an effect on the safety of air navigation and the efficient utilization of navigable airspace by aircraft. The end result of an aeronautical study is the issuance of a determination of 'hazard' or 'no hazard' that can be used by the proponent to obtain necessary local construction permits. It should be noted that the FAA has no control over land use in the United States and cannot enforce the findings of its studies.

Based on the findings of this study, Capitol Airspace determined that height limits do exist over the study area. These height limits are the result of visual flight rules (VFR) operations at Redwood Falls Municipal airport (RWF), instrument departure procedures and an en-route airway that overlays the study area. It was determined that the most restrictive height limitations occur over the western portions of the study area and range from 1,374 to 1,500 feet above mean sea level. The remainder of the study area will be restricted to a height of 1,500 feet. It should be noted that these height restrictions do not take into consideration limitations caused by potential electromagnetic interference on FAA and Department of Defense communications, navigation and surveillance systems.

Methodology

Capitol Airspace studied the proposed wind turbines based upon location and elevation information provided by Westwood Professional Services for the planned study area. Using the latitude and longitude coordinates for the boundaries of the study area, Capitol Airspace generated graphical overlays of the study area to determine proximity to public and military airports, published instrument procedures, military operational areas, en-route airways and military training routes.

Capitol Airspace evaluated all 14 CFR Part 77 imaginary surfaces, published instrument approach and departure procedures, visual flight rules and en-route operations. All formulas, headings, altitudes, bearings and coordinates used during this study were derived from the following documents and data sources:

- 14 CFR Part 77 "Object Affecting Navigable Airspace"
- FAA Order 8260.3B (Change 21) "United States Standard for Terminal Radar Procedures (TERPS)"
- FAA Order 7400.2G "Procedures for Handling Airspace Matters"
- United States Government Flight Information Publication, US Terminal Procedures
- National Airspace System Resource Aeronautical Data

Study Findings

En-Route Airways

Capitol Airspace assessed potential height limitations due to en-route airways. These airways provide pilots a means of navigation when flying from airport to airport and are defined by radials between Very High Omni-directional Radio Beacons (VOR). The FAA publishes minimum en-route altitudes for airways to ensure clearance from obstacles and terrain. The FAA requires that each airway have a minimum of 1,000 feet of obstacle clearance in non-mountainous areas.

The Lower Sioux study area is located within the obstacle evaluation area for VOR Airway V-26 which has a minimum en-route altitude of 2,500 feet. Considering 1,000 feet of required obstacle clearance, the maximum developable height, based on the limitations from this airway is 1,500 feet (depicted in grey in Figure 2).

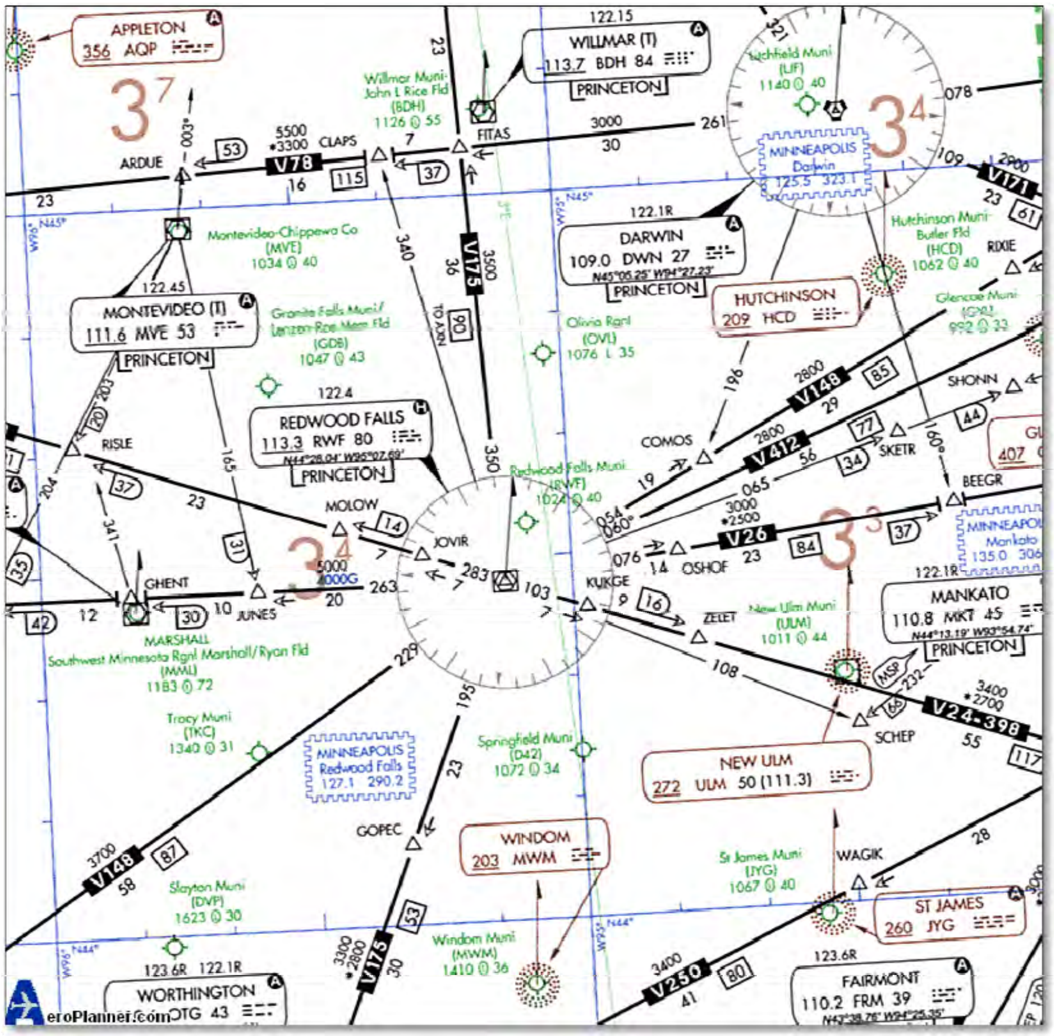

Figure 1: Low Altitude IFR Chart

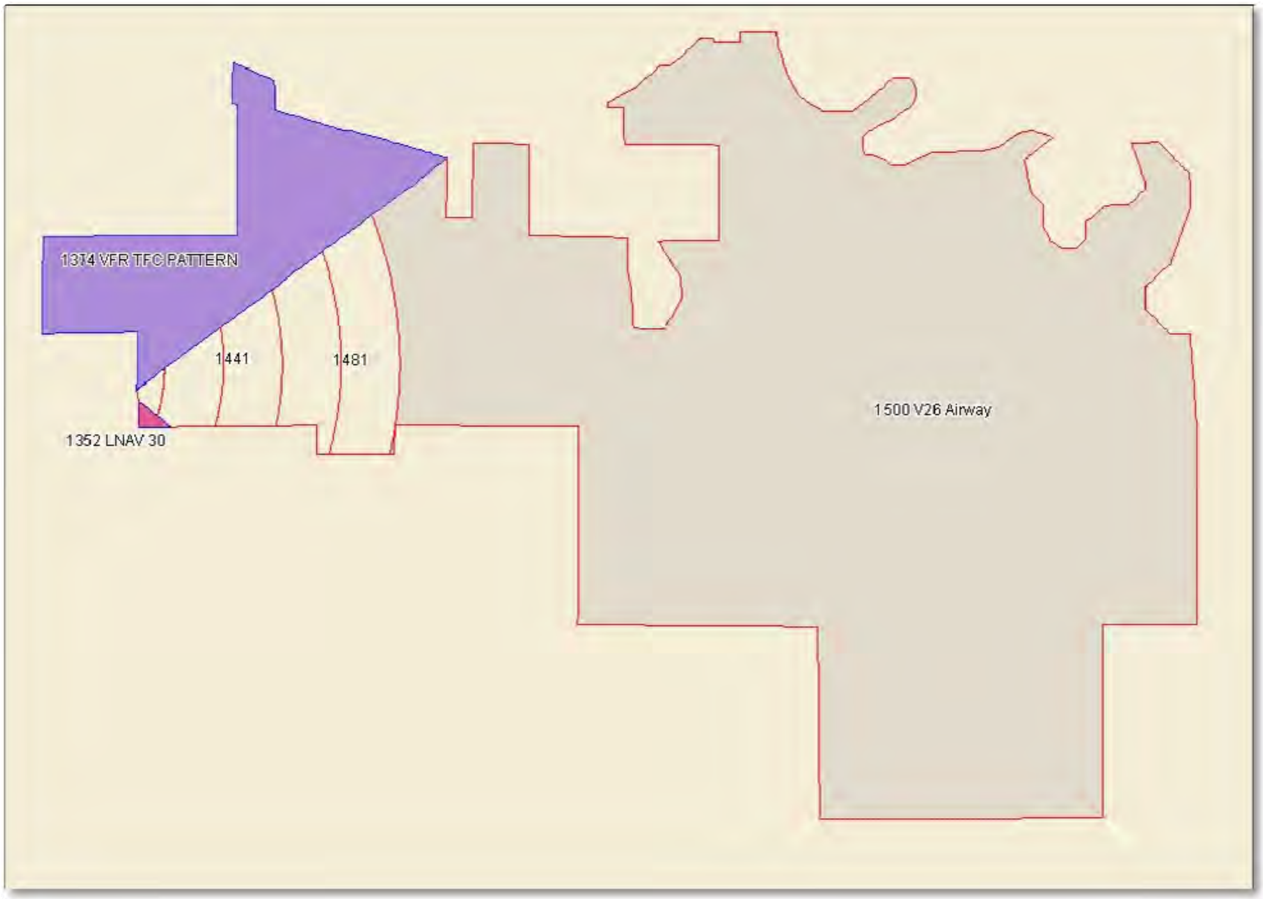

Figure 2: Composite of height limiting obstacle clearance surfaces

Departure Procedures

Capitol Airspace assessed departure procedures for Redwood Falls Municipal. In order to ensure that aircraft departing during marginal weather conditions do not fly into terrain or obstacles, the FAA has established an obstacle clearance surface that extends upward and outward from the end of the runway. Based on the published departure procedures for Redwood Falls Municipal, the FAA has established standard 200 ft/nm climb gradients for all runways. When calculated, this climb gradient equates to a sloping obstacle clearance surface height ranging from 1,410 feet AMSL at the western boundary of the study area and increasing in height to 1,500 feet (depicted as red contour lines in Figure 2).

Non-Precision Approaches

Pilots operating during periods of reduced visibility and low cloud ceilings rely on terrestrial and satellite based navigational aids (navaids) in order to navigate from one point to another and to locate runways. The FAA has established published instrument approach procedures that provide horizontal guidance to on-board avionics that aid the pilot in locating the runway. Redwood Falls Municipal has two published non-precision approaches. They are:

- RNAV (GPS) LNAV approach to Runway 30
- VOR-A

Capitol Airspace determined that the obstacle evaluation area for the RNAV (GPS) Approach to Runway 31 overlays the southwestern tip of the study area and will limit turbine development to a height of 1,352 feet (depicted in red in Figure 1).

Capitol Airspace determined that the study area is outside of the obstacle evaluation area for the VOR-A approach to Runway 22. Turbines located within the study area will not likely be limited in height based on this procedure

Precision Approaches

Precision approaches offer both course (horizontal) and glide path (vertical) guidance directly to the aircraft. Redwood Falls Municipal has two published precision approach.

- RNAV (GPS) LPV approach to Runway 30
- RNAV (GPS) VNAV approach to Runway 30

Capitol Airspace determined that the study area is located outside of the obstacle evaluation area for the RNAV (GPS) LPV approach. Therefore, this procedure will not likely impact the developable height within the study area. The study area is located within the obstacle assessment area for the RNAV (GPS) VNAV approach. However, the obstacle clearance heights for this approach are greater than the limiting heights established for other segments of airspace. Therefore, turbine development will not be restricted based on proximity to this approach procedure.

Visual Flight Rules Operations

In addition to assessing obstacle identification surfaces, Capitol Airspace also considered the impact of the proposed turbines on Visual Flight Rules (VFR) operations. The FAA has established guidelines for determining impact on VFR operations that include the assessment of VFR routes and VFR traffic patterns at airports. Capitol Airspace found no VFR routes in proximity to the proposed wind turbines but did consider potential impacts to VFR traffic patterns at Redwood Falls Municipal. Capitol Airspace determined that a section of the study area along the western border will be located within the lateral boundaries of the VFR traffic patterns at the airport. This area (depicted in purple in Figure 1) will be limited to a height of 1,374 feet above mean sea level.

Long Range Radar

Capitol Airspace utilized the FAA/DOD preliminary screening tool to determine likely electromagnetic interference on long range radars. According to the Long Range Radar tool, the study area is located in an area designated as ‘GREEN’ (Figure 3). The FAA defines this area as having “no anticipated impact to Air Defense and Homeland Security radars”. It should be noted that the preliminary screening tool does not take into consideration turbine height nor does it consider the cumulative impact of existing or approved turbines in proximity to the area studied. Capitol Airspace therefore recommends against making any financial, planning or investment decisions based solely on findings from this tool.

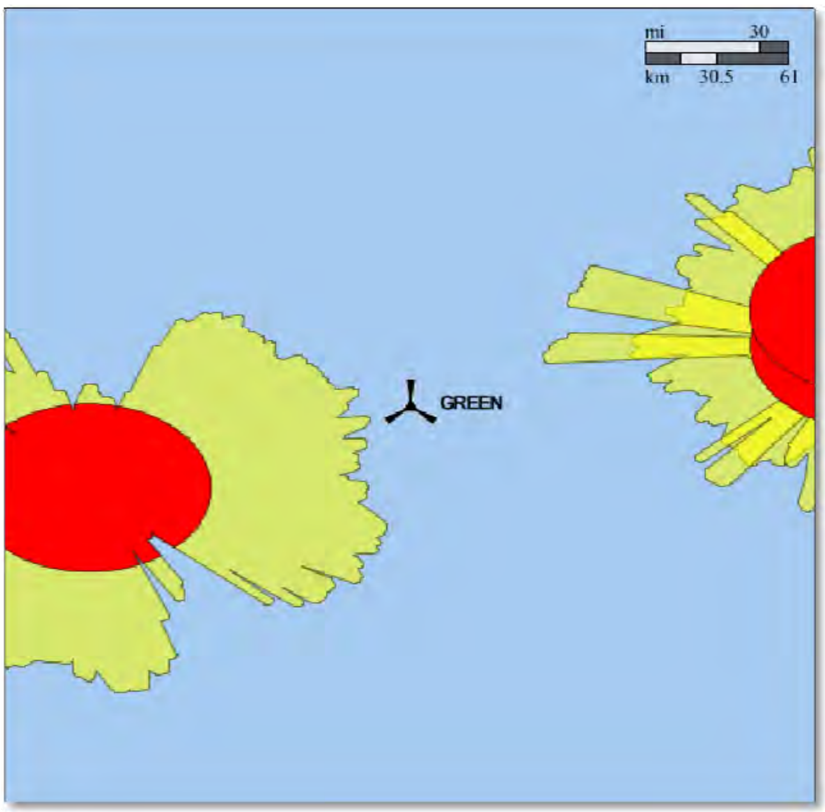

Figure 3: FAA/DOD preliminary screening tool

Conclusion

The results of this study show that turbine development below 1,500 feet above mean sea level in the eastern portion of the study area would not likely result in a hazard determination assuming the FAA finds no substantial electromagnetic interference with communications, navigation or surveillance systems. Structures ranging in height between 1,352 and 1,500 feet are likely to be approved for locations within the western segment of the study area. All turbines above 200 feet will be subject to an FAA aeronautical study. Turbines that exceed the heights outlined in this report are likely to be issued determinations of hazard by the FAA.

Given the uncertainty today in dealing with the long range radar uses for homeland security, it is recommended that the proposed wind turbine locations be submitted to the FAA as quickly as possible. Turbines found to have potential impact on radar may take as long as a year to be resolved by the FAA and the Department of Defense. If you have any questions regarding the findings in this study, please contact Benjamin Doyle at (703) 243-1001 or via email at ben.doyle@capitolairspace.com.

Prepared by Benjamin Doyle on June 27, 2010.

0' 300' 600'

Date: 11/30/10 Sheet: 1 OF 1

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Westwood

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Designed:	MRS
Checked:	.
Drawn:	MRS
Record Drawing by/date:	.

Prepared for:

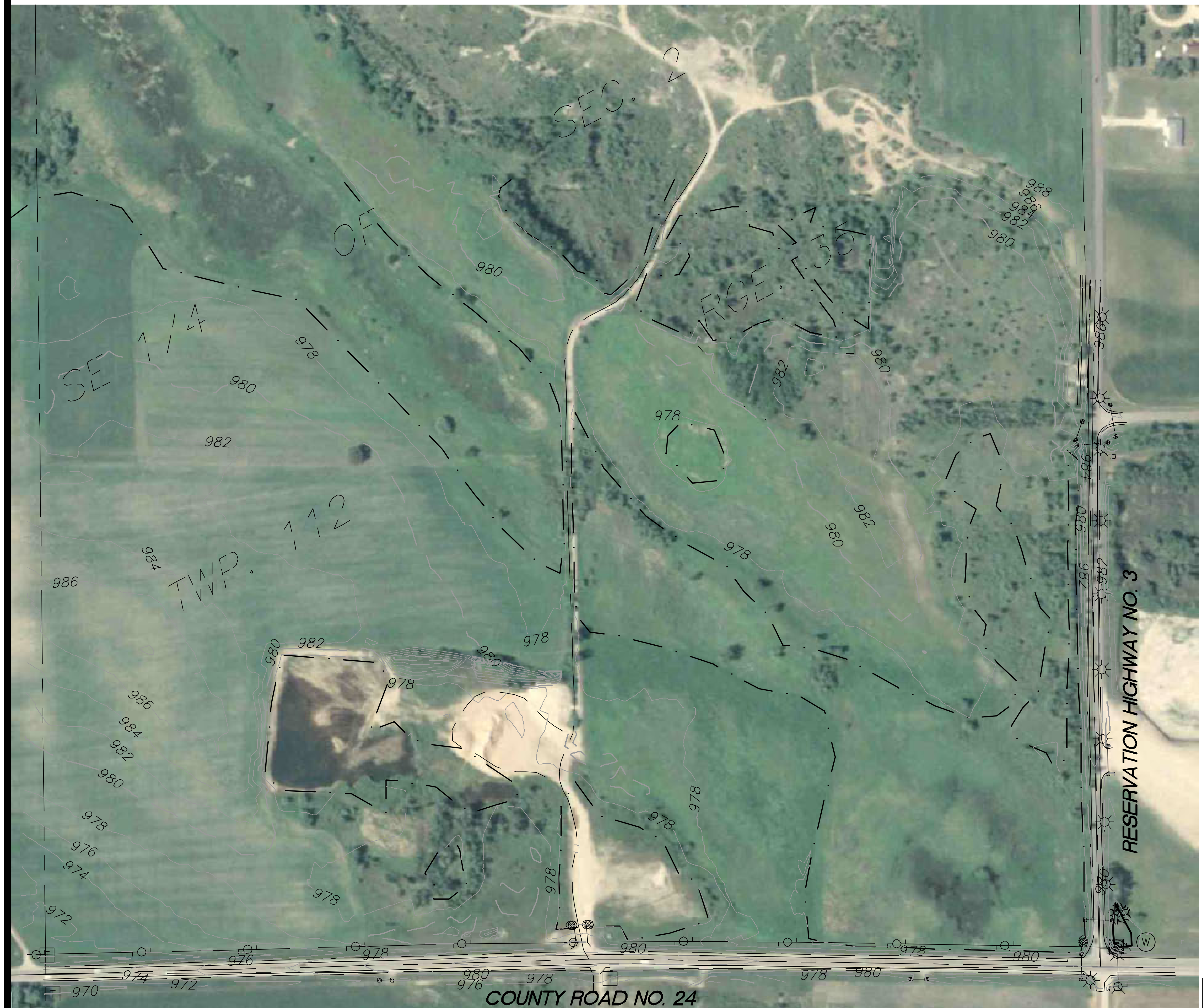
Dakota Futures, Inc.

Redwood Falls, Minnesota 56283

Lower Sioux Wind Project

Redwood County, Minnesota

Proposed Meteorological Tower Site



LEGEND

MONITORING WELL	TELEPHONE BOX
STREET LITE	WELL
GUY WIRE	POWER OVERHEAD
POWER POLE	STORM SEWER
ELECTRIC BOX	DECIDUOUS TREE LINE
ELECTRIC METER	WETLAND
FLARED END SECTION	STEEL/WOOD POST
	SIGN–TRAFFIC/OTHER

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Date: 11/30/10 Sheet: 1 OF 1

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Prepared for:

Dakota Futures, Inc.

Redwood Falls, Minnesota 56283

Lower Sioux Wind Project

Redwood County, Minnesota

Meteorological Tower Site Study Area

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MEMORANDUM

Date: April 5, 2012

Re: Dakota Lower Sioux-Wetland Delineation
File: 20101210

To: Joey Vossen, Westwood

From: Kelly Kunst

This memo serves as a summary of wetland delineation activities conducted on the Dakota Lower Sioux properties near Morton, Minnesota. A wetland delineation was conducted on behalf of Dakota Futures, Inc. as part of preliminary planning and siting activities associated with a potential wind energy project.

The Subject Properties were identified as Site 1 and Site 2 in the Wetland Delineation Reports. Site 1 is approximately 125-acres in size and is located in the SE ¼ of S. 2, T.112N, R. 35W, Paxton Township, Redwood County, MN. Site 1 was delineated on November 8, 2010. A total of eight wetlands were identified on Site 1. Site 2 is approximately 740-acres in size and is located in S. 12, T. 112N, R. 35W of Paxton Township and S. 7, T. 112N, R. 34W in Sherman Township, both in Redwood County. Site 2 was delineated on July 25 and 26, 2011. A total of 19 wetlands were delineated on Site 2.

One Wetland Delineation Report (Report) was completed for each Site, both dated September 30, 2011. The Reports were submitted to the U.S. Army Corps of Engineers (USACE) for the approval of the delineated wetland boundaries and to receive a preliminary jurisdictional determination for the subject properties.

A copy of each report was also submitted to Deb Dirlam with the Office of the Environment with the Lower Sioux Indian Community.

On October 26, 2011, Kelly Kunst from Westwood Professional Services met with representative Eric Hanson from the USACE to review the delineated boundaries in the field.

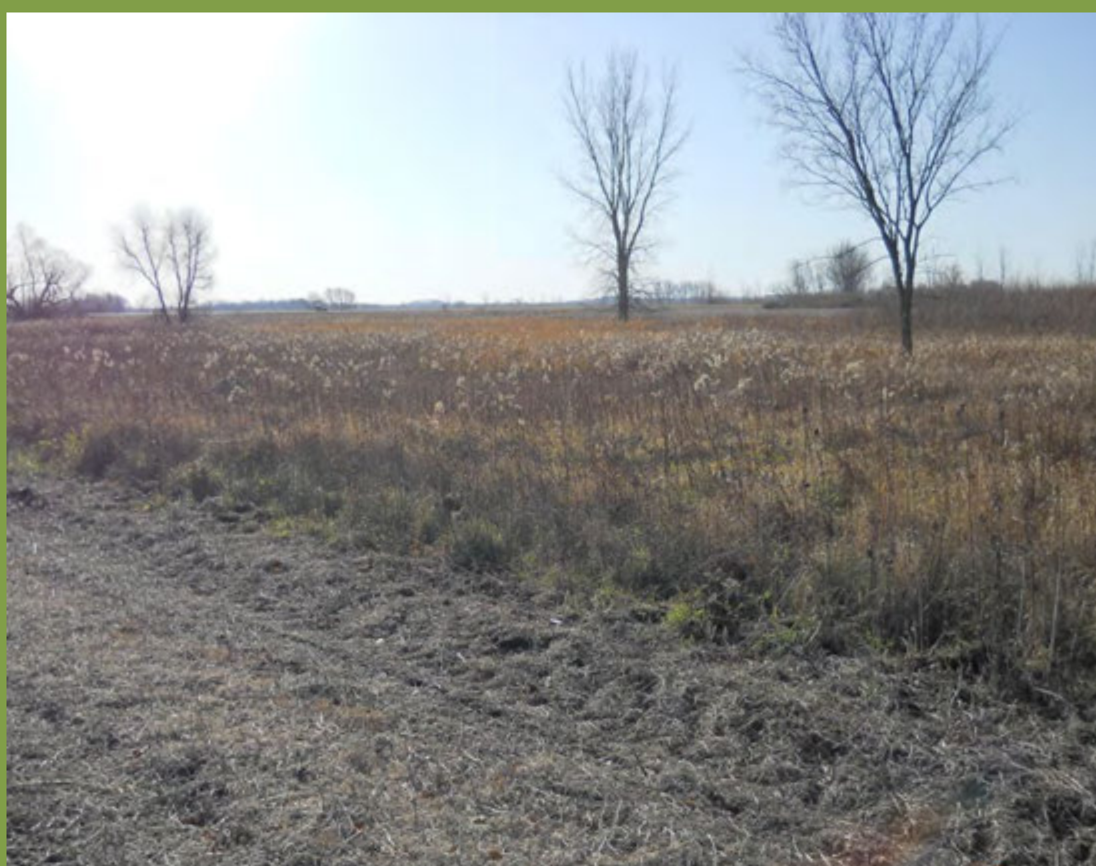
On November 8, 2011, the USACE issued a preliminary jurisdictional determination for Site 1 and Site 2 and provided concurrence that the wetland boundaries on Site 1 and 2 were established in accordance with the Corps of Engineers Wetland Delineation Manual (1987 Manual) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region.

WETLAND DELINEATION REPORT

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

September 30, 2011



Prepared For:

Dakota Futures, Inc.
39375 County Highway 24
Morton, MN 56270

Prepared By:

Westwood

Wetland Delineation Report

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

Prepared for:

Dakota Futures, Inc.
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Prepared by:

Westwood Professional Services, Inc.
7699 Anagram Drive
Eden Prairie, MN 55344
(952) 937-5150

Project Number: 20101210.00

September 30, 2011

CONTENTS

EXHIBITS

APPENDICES

1.0 PURPOSE

This delineation report, the attached exhibits, and data forms constitute the wetland delineation report for the Dakota Lower Sioux Site 1 located in Paxton Township, Redwood County, Minnesota (heretofore referred to as the Site). Because the Lower Sioux Indian Community is a sovereign nation, it is not subject to the Minnesota State Wetland Conservation Act (WCA) but is subject to the Federal Clean Water Act. This delineation report provides the required documentation for wetland boundary determinations in conformance with the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory, Waterways Experiment Station, 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Midwest Region (US Army Engineer Research and Development Center, 2010).

On behalf ofDakota Futures, Inc., Westwood requests that the USACE provide a preliminary jurisdictional determination on the property and written confirmation that the delineated wetland boundaries are acceptable for Clean Water Act permitting purposes.

2.0 SITE LOCATION AND DESCRIPTION

The Site is located at in the SE ¼ of S. 2, T. 112N, R. 35W, Paxton Township, Redwood County, Minnesota (**Exhibit 1**) and approximately 1 mile southwest of Morton, Minnesota. The property is bounded by CSAH 24 to the south and Reservation Highway 5 (T-238) to the east with unnamed property boundaries to the north and west. The 125-acre Site consists primarily of agricultural land with a large wetland extending diagonally northwest to southeast through the center of the site. A disturbed area of rolling meadow with scattered trees and shrubs and pockets of wetland occupy the northeast corner where gravel mining likely occurred in the past. An active gravel mining area is located in the south-central part of the site and a field road bisects the site north to south.

3.0 WETLAND DELINEATION METHODOLOGY

Prior to delineating wetland boundaries in the field, Westwood reviewed National Wetland Inventory (NWI) mapping (**Exhibit 2**), the Natural Resource Conservation Service (NRCS) Soil Survey Geographic database (SSURGO2) for Redwood County (2006) (**Exhibit 3**), and the *Minnesota Department of Natural Resources* (MnDNR*) Public Waters and Wetlands Inventory* (PWI) for Redwood County (**Exhibit 4**).

On November 8, 2010, Westwood delineated the wetlands using the level two routine determination method set forth in the USACE Wetlands Delineation Manual (Environmental Laboratory, Waterways Experiment Station, 1987) and the supplemental methods set forth in the Regional Supplement to the USACE Wetland Delineation Manual: Midwest Region (US Army Engineer Research and Development Center, 2010). Methods included establishment of sampling transects in a representative transition zone of the identified wetland. Each transect consisted of one sampling point in upland and one point in wetland. Soils, vegetation, and hydrology data were recorded on data forms and are included in **Appendix A** of this report. Species dominance for vegetation measurements was based on the percent coverage visually estimated within a 30-foot radius of the sample point location for the tree and vine layers, a 15-foot radius for the shrub layer, and a five-foot radius for the herbaceous layer.

Wetlands were classified according to Wetlands of the United States (U.S. Fish and Wildlife Service Circular 39; Shaw and Fredine; 1971) and Wetlands and Deepwater Habitats of the United States (FWS/OBS Publication 79/31; Cowardin et. al. 1979) (see the Classification Systems Table in **Appendix B**). Common names and scientific names for vegetation identified in this report and on the attached data forms generally correspond with the nomenclature used in the National List of Plant Species that Occur in Wetlands: North Central (Region 3) (USFWS, Reed, 1988).

Delineated wetland boundaries were marked in the field using pink pin flags. Wetland boundaries were surveyed by Westwood Professional Services, Inc. using standard land survey methods.

4.0 RESULTS

4.1 Mapping

NWI mapping (Exhibit 2) depicts a portion of one large PEMF/PEMAd wetland extending diagonally through the center of the site from the northwest, one PEMFx wetland in the southeast corner, nine PSS1Cx wetlands in the northeast corner, one PEMAd wetland in the north-central portion, and one PEMC wetland in the south-central part of the site.

The NRCS SSURGO2 for Redwood County indicates that the soils listed in **Table 1** are mapped within the Site (Exhibit 3). Mayer loam and Biscay loam are listed as hydric in the NRCS SSURGO2 database. In general, NRCS mapped hydric soils are consistent with the central wetlands on the site but inconsistent with the remainder.

Table 1. Soil Summary Table

Map Symbol[1]	Map Unit Name[2]	Map Unit Type[3]	Rating[4]	Percent Hydric Soil[4]
27A	Dickinson fine sandy loam, 0 to 2% slopes	Consociation	Not Hydric	0
39A, B	Wadena loam, 0 to 2 and 2 to 6% slopes	Consociation	Not hydric	0
41A, B	Estherville sandy loam, 0 to 2 and 2 to 6% slopes	Consociation	Not hydric	0
247	Linder loam	Consociation	Not hydric	0
255	**Mayer loam**	**Consociation**	**All hydric**	**85**
399	**Biscay loam, depressional**	**Consociation**	**All hydric**	**85**
1029	Pits, gravel	Consociation	Unknown hydric	N/A

[1] – Soils determined using GIS geospatial query clipping the NRCS Spoil Survey Geographic (SSURGO2) spatial data by Project boundaries.

[2] – As indicated in the SSURGO2 database

[3] – As indicated in the SSURGO2 Database. All soil map units can include minor amounts of contrasting soils (called inclusions) that are not identified in the map unit name.

Consociations are dominated by a single soil series and similar soils. The total amount of dissimilar inclusions of other components in a map unit generally does not generally exceed about 15 percent.

Complexes and Associations consist of two or more dissimilar major soils occurring in a regularly repeating pattern. The total amount of inclusions in a map unit that are dissimilar to any of the major components does not exceed about 15 percent.

Undifferentiated Groups consist of two or more soils that are not consistently associated geographically and may not always occur together in the same map delineation. These soils are included as the same named map unit because use and management are the same or very similar for common uses.

[4] – As indicated in the SSURGO2 database. Where percentages are small (e.g. > 15 %) the hydric soil is likely an inclusion that is not recognized in the map unit name. The absence of a value does not necessarily indicate the absence of hydric soils, but that the relative percentages of included minor soils has not been determined.

The MnDNR PWI (Exhibit 4) for Redwood County depicts two Public Watercourses to the west and north of the site. Crow creek is approximately ¼ mile west of the site and the Minnesota River is ½ mile north of the site.

4.2 Delineated Wetland Descriptions

Westwood completed a wetland delineation on the Site and identified one Type 3/2 (PEMFx/C/B) shallow marsh/wet meadow (**Wetland A**), one Type 1 (PEMAd) seasonally flooded basin (**Wetland B**), two Type 3/6 (PEMCx/SS1Cx) shallow marsh/shrub-carr wetlands (**Wetlands C** and **D**), two Type 5 (PUBFx) shallow open water wetlands (**Wetlands E** and **F**), and two Type 2 (PEMBx) fresh wet meadow wetlands (**Wetlands G** and **H**) (**Exhibit 5**). Detailed data collected for these wetlands are provided on data forms included in Appendix A. Table 2 summarizes the delineated wetlands.

Table 2: Delineated Wetlands

Wetland	Classification		NWI Mapped	Connected to Navigable Water on NWI	Dominant Vegetation (≥ 20% cover)
ID	**Circ. 39**	**Cowardin**	**Yes/No**	**Yes/No**	**Wetland**
A	Type 3/2	PEMFx/C/B	Yes	No	Cattail, lake sedge
B	Type 1	PEMAd	Yes	No	Curly dock, giant ragweed, lady's thumb
C	Type 3/6	PEMCx/PSS1Cx	No	No	Sandbar willow, cattail
D	Type 3/6	PEMCx/PSS1Cx	Yes	No	Sandbar willow, cattail
E	Type 5	PUBFx	No	No	Unvegetated
F	Type 5	PUBFx	No	No	Unvegetated
G	Type 2	PEMBx	Yes	No	Reed canary grass
H	Type 2	PEMBx	No	No	Reed canary grass

Wetland A was 24.1 acres of Type 3/2 (PEMFx/C/B) shallow marsh/wet meadow complex that extended diagonally northwest to southeast through the center of the site, and was bisected in the center by a field road extending north to south through the site. Wetland A also extended north along the east edge of the site in the roadside ditch and into an area likely previously mined for gravel. This eastern portion of the wetland was generally dominated by sandbar willow with subdominants of reed canary grass and red-osier dogwood. Overall, Wetland A was dominated by cattail and lake sedge with subdominants of Canada bluejoint, red-osier dogwood, sandbar willow, giant goldenrod, prairie cordgrass, fowl bluegrass, box elder, eastern cottonwood, curly dock, golden Alexander's, black willow, and reed canary grass. Soils observed in the wetland sample plot met the A12 field indicator for hydric soils (thick dark surface). The primary indicator of hydrology was free water observed 12 inches below the soil surface at the sample plot.

Adjacent upland consisted of plowed cropland without vegetation. Soils observed in the upland sample plot did not meet a field indicator for hydric soils and no primary or secondary indicators of wetland hydrology were observed.

The delineated boundary followed a change in topography and the edge of cropped areas. Wetland A corresponded to one NWI-mapped PEMF/PEMAd wetland complex, one PEMFx wetland, one PSS1Cx wetland and areas of mapped hydric soil (Mayer loam and Biscay loam).

Wetland B was a 0.40-acre Type 1 (PEMAd) seasonally flooded basin within cropland in the north-central part of the site. Dominant vegetation consisted of curly dock, giant ragweed and smartweed. Soils observed below the wetland boundary met the A12 field indicator for hydric soils (thick dark surface). Primary indicators of wetland hydrology consisted of sediment deposits and drift deposits.

Adjacent upland consisted of plowed cropland without vegetation. Soils observed in the upland sample plot did not meet a field indicator for hydric soils and no primary or secondary indicators of wetland hydrology were observed.

The delineated boundary followed a slight change in topography and the edge of plowed cropland. Wetland B corresponded to an NWI-mapped PEMAd wetland and mapped hydric soil (Mayer loam).

Wetlands C and ***D*** were Type 3/6 (PEMCx/SS1Cx) shallow marsh/shrub-carr complex wetlands in the north part of the site, which extended north off of the subject property. Wetland C was 1.2 acres in size and Wetland D was 3.1 acres. Wetlands C and D were likely the result of past gravel mining activities as the local topography included abrupt wetland edges, random berms, mounds of soil and gravel, and soil profiles that consisted of a mix of sand and gravel to 18 inches. Dominant vegetation consisted of sandbar willow and cattail with subdominants of reed canary grass, eastern cottonwood, lake sedge, and giant goldenrod. No field indicators for hydric soils were observed in the sample plot; however, soils were assumed to be hydric because a hydrophytic plant community and evidence of wetland hydrology were observed. Both wetlands were identified as having problematic hydric soil situations as they likely recently developed as a result of mining activities. The primary indicator of wetland hydrology at the wetland sample locations was inundation over approximately 50 percent of the plot.

Adjacent upland consisted of a narrow wooded fringe and plowed cropland to the south and a seemingly active gravel mine area to the north. Soils observed in the upland sample plots did not meet a field indicator for hydric soils and no primary or secondary indicators of wetland hydrology were observed.

The delineated boundary followed a distinct change in topography. Wetlands C and D corresponded, in part, to two NWI-mapped PSS1Cx wetlands, but were not mapped with hydric soil (pits, gravel).

Wetlands E and ***F*** were Type 5 (PUBFx) shallow open water basins in the south-central part of the site adjacent to a more recently active gravel mining area. Wetlands E and F are 2.1 acres and 3.2 acres in size, respectively, and are likely the result of excavation from gravel mining activities. The wetlands consisted primarily of unvegetated open water with abrupt edges. Vegetation consisted of a narrow band along the upper wetland edge dominated by sandbar willow with subdominants of reed canary grass, eastern cottonwood, cattail and sedge. Soils observed below the wetland boundary consisted of a shallow layer of mixed clay, sand and gravel, underlain by sand and gravel. No field indicators for hydric soils were observed in the sample plot; however, soils were assumed to be hydric because a hydrophytic plant community and evidence of wetland hydrology was observed. Both wetlands were identified as having problematic hydric soil situations, as they likely recently developed as a result of mining activities. The primary indicator of wetland hydrology was inundation over portions of the wetland sample plots.

Adjacent upland consisted primarily of cropland on all sides but included an active gravel mining area north of the two wetlands. Soils observed in the upland sample plot were similar to those observed for the wetland. No primary or secondary indicators of wetland hydrology were observed.

The delineated boundary followed an abrupt change in topography. The wetlands were not indicated on the NWI map and were not mapped with hydric soil (pits and gravel).

Wetlands G was a 0.24-acre Type 2 (PEMBx) wet meadow wetland dominated by reed canary grass with subdominants of black willow, sandbar willow, giant goldenrod and sedge. Soils observed below the wetland boundary were disturbed, mixed clay, sand, rocks and gravel and did not meet a field indicator for hydric soil; however, soils were assumed to be hydric because a hydrophytic plant community and evidence of wetland hydrology was observed. Wetland G was identified as having a problematic hydric soil situation, as it likely recently developed as a result of mining activities. The primary indicator of wetland hydrology was inundation of a portion of the sample plot.

Adjacent upland consisted of disturbed woods dominated by eastern cottonwood, Kentucky bluegrass and smooth brome with subdominants of silver maple, Canada goldenrod, and box elder. Upland soils were without redoximorphic features and no primary or secondary indicators of wetland hydrology were observed.

The delineated boundary followed a change in plant community and topography. The wetland corresponded in part to an NWI-mapped PEMC wetland but was not mapped with hydric soil (pits, gravel).

Wetland H was a 0.14-acre Type 2 (PEMBx) wet meadow wetland dominated by reed canary grass with subdominants of black willow and sandbar willow. Soils observed below the wetland boundary were disturbed, mixed clay, sand, rocks and gravel and did not meet a field indicator for hydric soil; however, soils were assumed to be hydric because a hydrophytic plant community and evidence of wetland hydrology was observed. Wetland H was identified as having a problematic hydric soil situation, as it likely recently developed as a result of mining activities. No primary indicators of wetland hydrology were observed. Secondary indicators included geomorphic position and the FAC-Neutral Test.

Adjacent upland consisted of plowed cropland. No field hydric soil indicators were observed in the upland sample plot and no primary or secondary indicators of wetland hydrology were observed.

The delineated boundary followed a distinct change in topography. The wetland was not indicated on the NWI map and was not mapped with hydric soil (pits, gravel).

5.0 CONCLUSIONS

Westwood delineated and flagged one Type 3 (PEMFx/C/B) shallow marsh/fresh wet meadow complex, one Type 1 (PEMA) seasonally flooded basin, two Type 3/6 (PEMCx/PSS1Cx) shallow marsh/shrub carr complexes, two Type 5 (PUBFx) shallow open water wetlands, and two Type 2 (PEMBx) fresh wet meadow wetlands. It is likely that all delineated wetlands, with the exception of Wetlands A and B, were created as a result of past gravel mining activities which left excavated areas with relatively impermeable substrates causing sustained inundation in excavated areas. The northeastern part of Wetland A was also likely created from mining activities.

Based on the review of mapping resources and field observations, all delineated wetlands appear isolated. Although two jurisdictional watercourses are within a half mile of the site, there does not appear to be a significant nexus between those watercourses and wetlands within the subject property. Furthermore, none of the delineated wetlands are connected to the watercourses via mapped hydric soil units.

Westwood requests that the USACE provide a preliminary jurisdictional determination (JD) and wetland boundary determination for the wetlands identified on the site. A completed Request for Corps of Engineers Wetland Delineation Review form accompanies this request to facilitate the wetland boundary and jurisdictional determination.

6.0 LITERATURE CITED

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7.0 CERTIFICATION

I certify that, to the best of my knowledge and belief, the wetland delineation completed for this Site is consistent with current wetland delineation practices and guidelines. I have the specific qualifications, education, training, and experience to complete wetland delineations and determinations in accordance with federal and state requirements.

Sincerely,

WESTWOOD PROFESSIONAL SERVICES

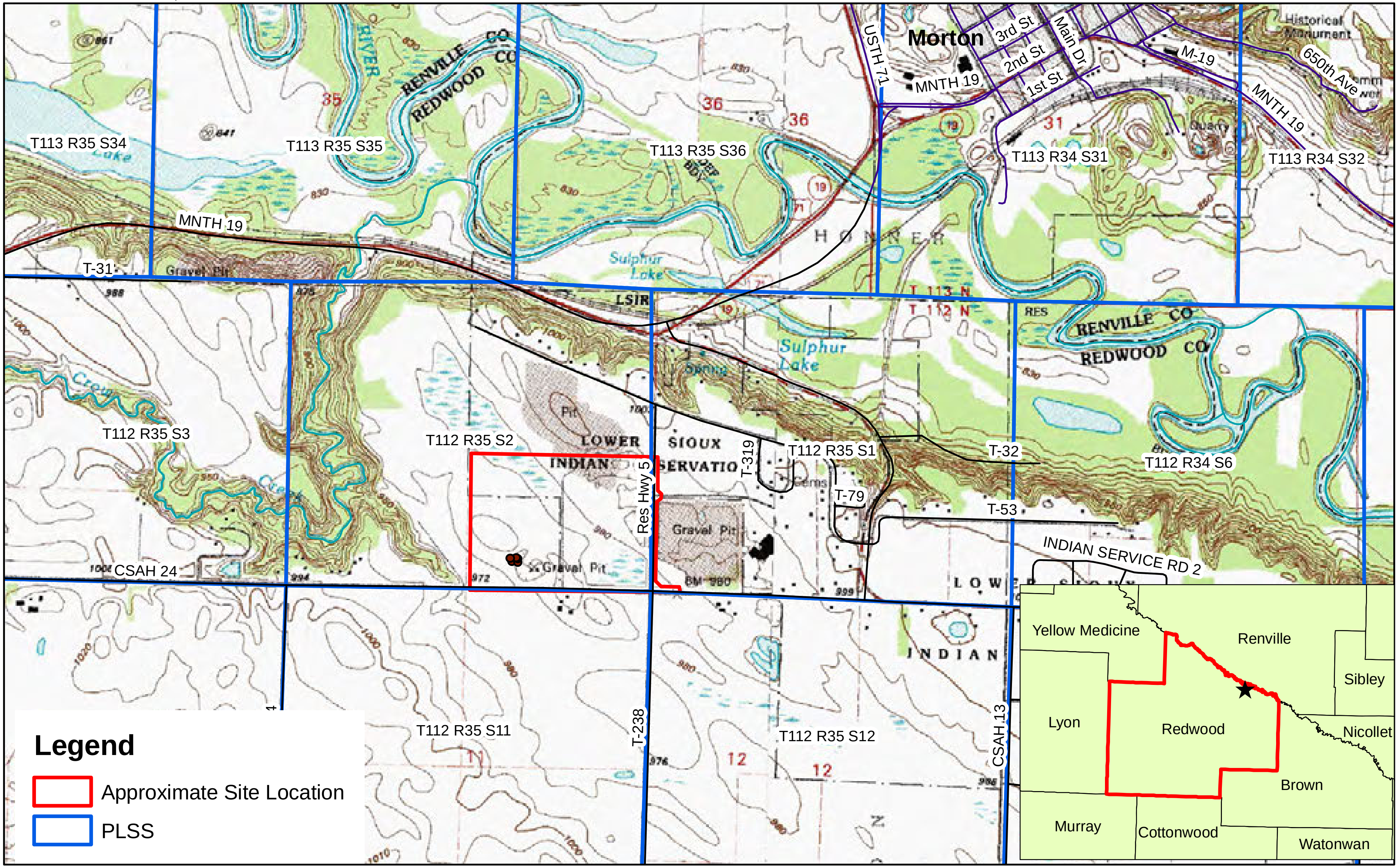
Kelly S. Kunst
Environmental Scientist
Professional Wetland Scientist No. 1757
MN Certified Wetland Delineator No. 1114

Exhibits

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

Map Document: (P:/20101210/gis/20101210loc01A.mxd)
9/30/2011 10:40:50 AM



Data Source(s): USDA-NRCS (2002), MnDOT Base Map Roads (2004), Westwood (2011).

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N

0 2,000 Feet

Lower Dakota Sioux-Site 1

Paxton Township, Redwood County, Minnesota

Site Location and USGS Topography

Exhibit 1

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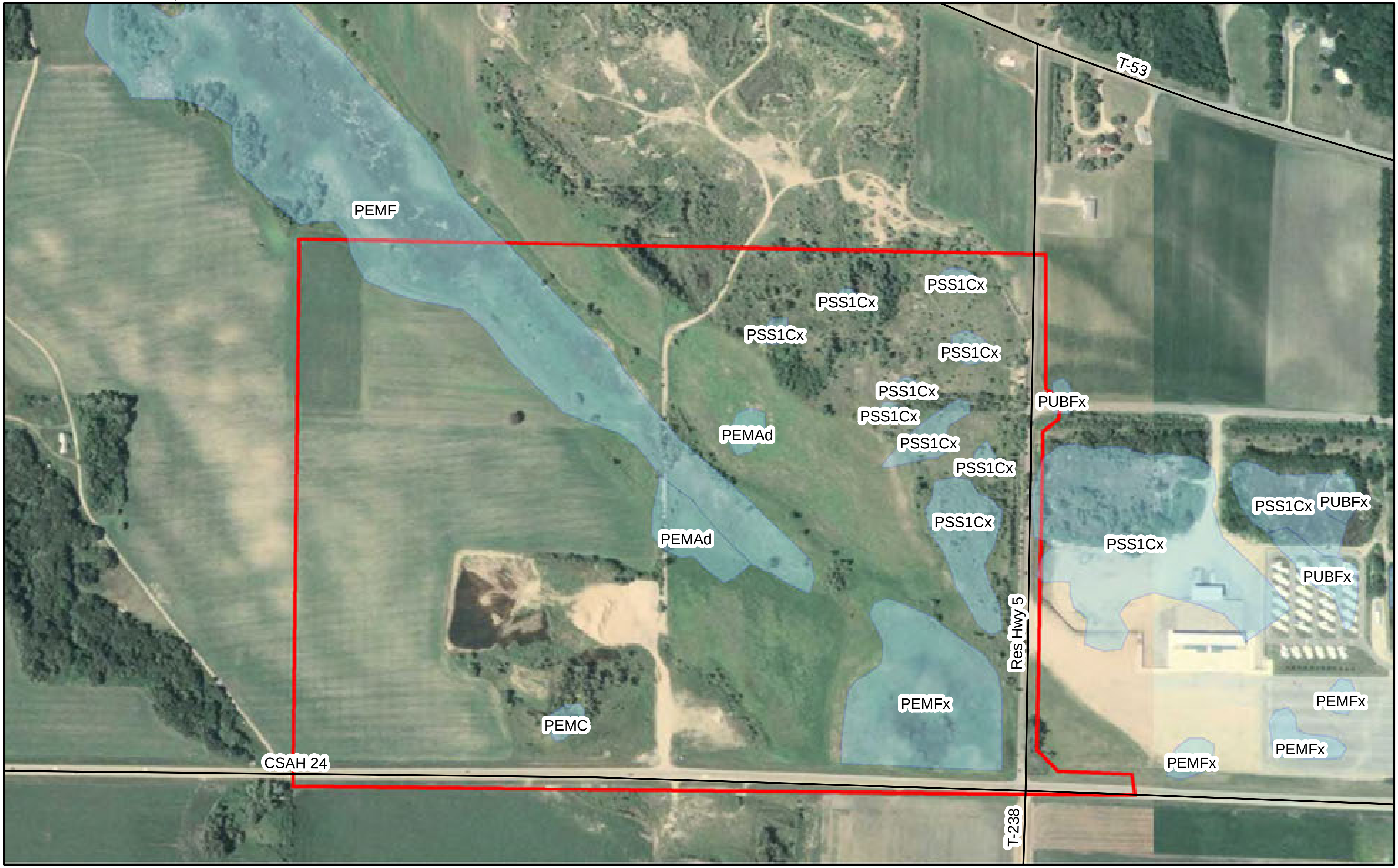

Data Source(s): USFWS (2009), LMIC (2009), MnDOT Base Map Roads (2004), Westwood (2011).

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

National Wetlands Inventory

Exhibit 2

Legend

National Wetlands Inventory

Approximate Site Location

N

0 500 Feet

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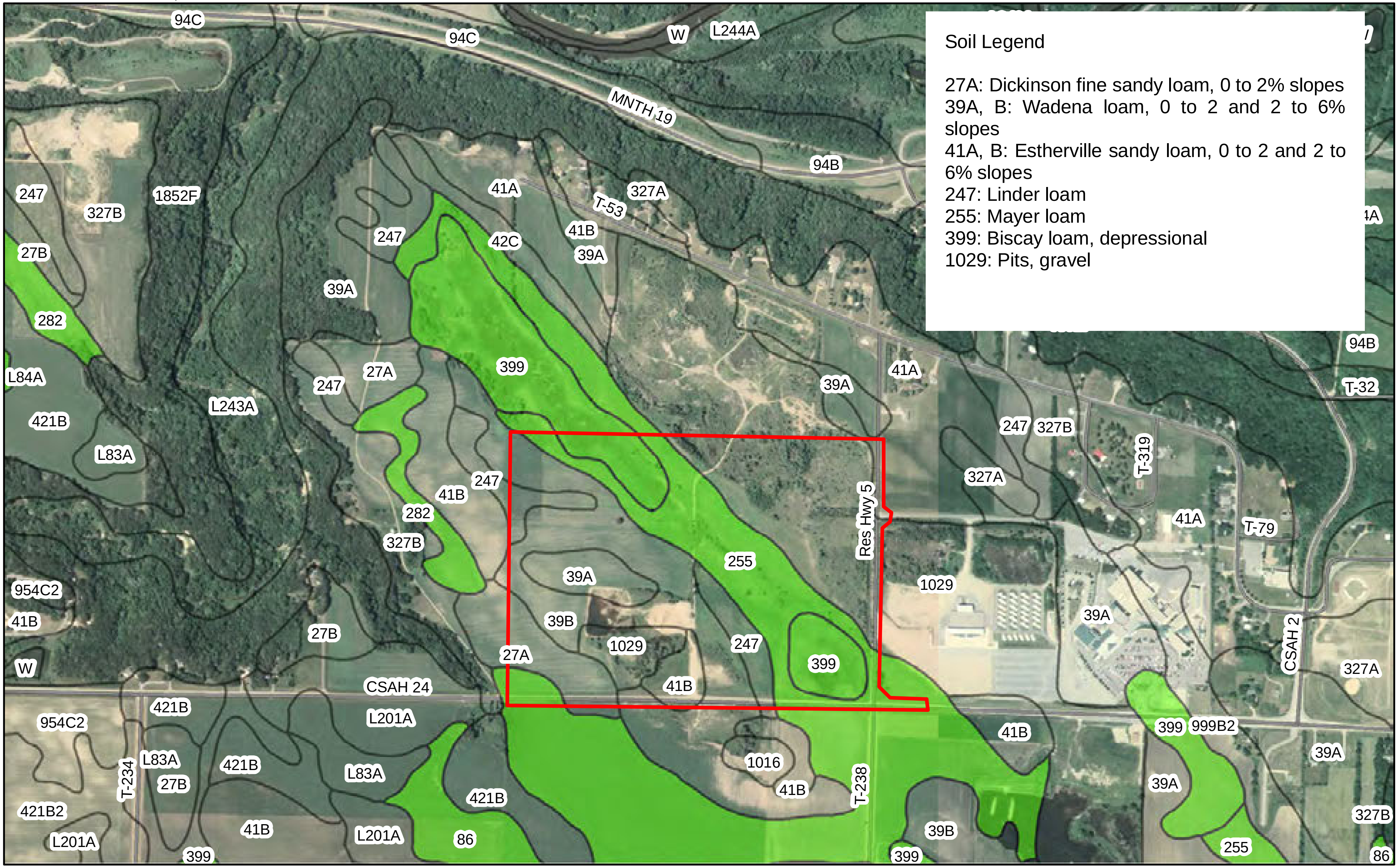

Data Source(s): LMIC (2009), MnDOT Base Map Roads (2004), Westwood (2011), USDA NRCS SSURGO database for Redwood County (2008).

Legend

Soil Unit
Hydric Soil
Approximate Site Location

N

0 1,000 Feet

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

Digital Soils

Exhibit 3

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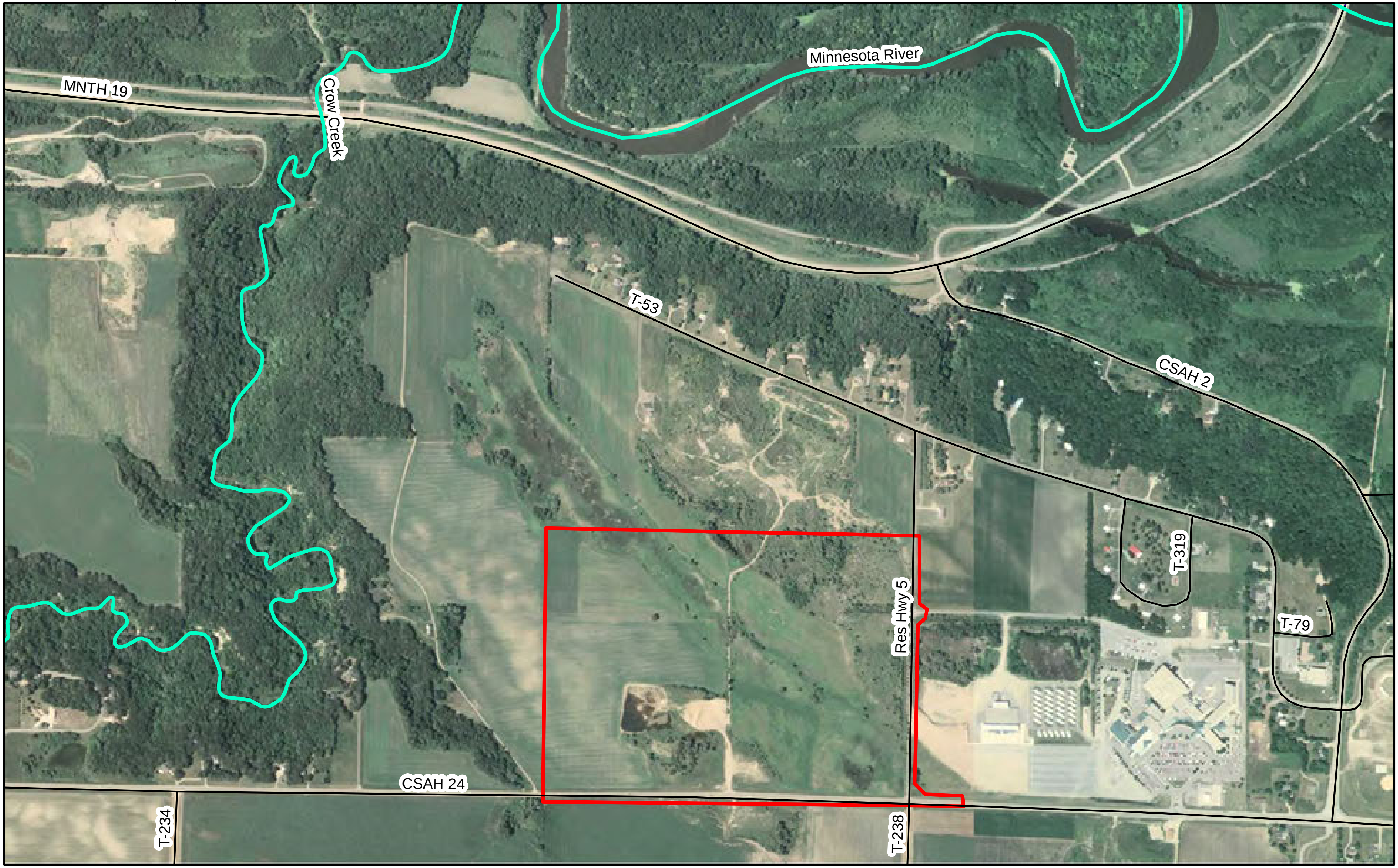

Data Source(s): USFWS (2009), LMIC (2009), MnDOT Base Map Roads (2004), Westwood (2011).

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N

0 1,000 Feet

Legend

MnDNR Public Watercourse

Approximate Site Location

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

MnDNR Public Waters & Wetlands

Exhibit 4

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Data Source(s): LMIC (2009), MnDOT Base Map Roads (2004), Westwood (2011), USDA NRCS SSURGO database for Redwood County (2008).

Dakota Lower Sioux-Site 1

Paxton Township, Redwood County, Minnesota

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N

0 500 Feet

Legend

Delineated Wetland Boundaries

Approximate Site Location

Delineated Wetland Boundary Map

Exhibit 5

WETLAND DELINEATION REPORT

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Redwood County, Minnesota
September 30, 2011

Prepared For:

Dakota Futures, Inc.
39375 County Highway 24
Morton, MN 56270

Prepared By:

Westwood

Wetland Delineation Report

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Redwood County, Minnesota

Prepared for:

Dakota Futures, Inc.
39375 County Highway 24
Morton, MN 56270

Prepared by:

Westwood Professional Services, Inc.
7699 Anagram Drive
Eden Prairie, MN 55344
(952) 937-5150

Project Number: 20101210.00

September 30, 2011

CONTENTS

EXHIBITS

APPENDICES

1.0 PURPOSE

This narrative, the attached exhibits, and data forms constitute the wetland delineation report for the Dakota Lower Sioux-Site 2 located in Paxton and Sherman Townships, Redwood County, Minnesota (heretofore referred to as the Site). Because the Lower Sioux Community is a sovereign nation, it is not subject to the Minnesota State Wetland Conservation Act (WCA) but is subject to the Federal Clean Water Act. This delineation report provides the required documentation for wetland boundary determinations in conformance with the United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory, Waterways Experiment Station, 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Midwest Region (US Army Engineer Research and Development Center, 2010).

On behalf of Dakota Futures, Inc., Westwood requests that the USACE provide a preliminary jurisdictional determination on the property and written confirmation that the delineated wetland boundaries are acceptable for Clean Water Act permitting purposes.

2.0 SITE LOCATION AND DESCRIPTION

The Site is located in S. 12, T. 112N, R. 35W, Paxton Township and S. 7, T. 112, R34W of Sherman Township, Redwood County, Minnesota (**Exhibit 1**) and approximately one mile south of Morton, Minnesota. The property is bounded by CSAH 24/2 to the north, 320th Street to the south, Porter Avenue to the east, and agricultural land to the west. The westernmost 240 acres of the Site is split from the east portion of the property by County Highway 13. The approximately 740-acre Site consists primarily of agricultural land with a large wetland extending diagonally northwest to southeast along the southern part of the Site. Numerous isolated wetlands are also located within the Site. Several single-family homes are located along the primary roadways and water treatment ponds are located in the eastern part of the site. Approximately 75 acres in the northeast part is enrolled in the Conservations Reserve Program (CRP).

3.0 WETLAND DELINEATION METHODOLOGY

Prior to delineating wetland boundaries in the field, Westwood reviewed National Wetland Inventory (NWI) mapping (**Exhibit 2**), the Natural Resource Conservation Service (NRCS) Soil Survey Geographic database (SSURGO2) for Redwood County (2006) (**Exhibit 3**), and the *Minnesota Department of Natural Resources* (MnDNR*) Public Waters and Wetlands Inventory* (PWI) for Redwood County (**Exhibit 4**).

On July 25 and 26, 2011, Westwood delineated the wetlands using the level two routine determination method set forth in the USACE Wetlands Delineation Manual (Environmental Laboratory, Waterways Experiment Station, 1987) and the supplemental methods set forth in the Regional Supplement to the USACE Wetland Delineation Manual: Midwest Region (US Army Engineer Research and Development Center, 2010). Methods included establishment of sampling transects in a representative transition zone of the identified wetland. Each transect consisted of one sampling point in upland and one point in wetland. Soils, vegetation, and hydrology data were recorded on data forms and are included in **Appendix A** of this report.

Species dominance for vegetation measurements was based on the percent coverage visually estimated within a 30-foot radius of the sample point location for the tree and vine layers, a 15-foot radius for the shrub layer, and a five-foot radius for the herbaceous layer.

Westwood reviewed historical aerial photography and FSA slides to determine wetlands in cropped portions of the property using the accepted protocol for conducting off-site wetland determinations. In 1994, the Natural Resources Conservation Service (NRCS -- then the Soil Conservation Service) executed a nationwide Memorandum of Agreement (MOA) with the U. S. Army Corps of Engineers (USACE), U. S. Environmental Protection Agency (USEPA) and U. S. Fish and Wildlife Service (USFWS) outlining an accepted protocol for conducting off-site wetland determinations using historic aerial photography. This agreement was supplemented with a regional cooperative agreement entitled *State of Minnesota Cooperative Agreement for Implementation of the Federal Wetland Delineation Memorandum of Agreement*). The coordination process described in the 1994 nationwide MOA was superseded by 2005 NRCS/USACE guidance. However, the mapping protocol set forth in the Minnesota MOA remains valid and has not been rescinded or superseded. Additional 2006 and 2010 guidance documents on off-site hydrology determinations from Minnesota Board of Water and Soil Resources (BWSR) were also used for reference. A FSA slide review summary table and selected historical aerial photographs are included in **Appendix C.** The location of Areas reviewed is depicted in **Exhibit 5**.

Wetlands were classified according to Wetlands of the United States (U.S. Fish and Wildlife Service Circular 39; Shaw and Fredine; 1971) and Wetlands and Deepwater Habitats of the United States (FWS/OBS Publication 79/31; Cowardin et. al. 1979) (see the Classification Systems Table in **Appendix B**). Common names and scientific names for vegetation identified in this report and on the attached data forms generally correspond with the nomenclature used in the National List of Plant Species that Occur in Wetlands: North Central (Region 3) (USFWS, Reed, 1988).

Delineated wetland boundaries were marked in the field using pink pin flags and then located using a Trimble GeoXH sub-meter accuracy global positioning unit (GPS) (**Exhibit 5**). Wetland boundary points were then post processed using Trimble Pathfinder Office software to ensure sub-meter accurate GPS coordinates.

4.0 RESULTS

4.1 Mapping

NWI mapping (Exhibit 2) depicts a portion of one PEMFd/PEMCd wetland, one PEMAd/PEMFd/PUBFx wetland complex, one PUBG, three PEMF, three PEMFd, one PEMCd, one PEMA, and three PEMAd wetlands within the site.

The NRCS SSURGO2 for Redwood County indicates that the soils listed in **Table 1** are mapped within the Site (Exhibit 3). Canisteo clay loam, Mayer loam, Hanska fine sandy loam, Biscay loam, and Oshawa variant stony clay loam are listed as hydric in the NRCS SSURGO2 database.

Table 1. Soil Summary Table				
Map Symbol[1]	Map Unit Name[2]	Map Unit Type[3]	Rating[4]	Percent Hydric Soil[4]
27A	Dickinson fine sandy loam, 0 to 2% slopes	Consociation	Not Hydric	0
39A	Wadena loam, 0 to 2% slopes	Consociation	Not hydric	0
41A	Estherville sandy loam, 0 to 2 % slopes	Consociation	Not hydric	0
86	**Canisteo clay loam**	**Consociation**	**Hydric**	**85**
L201A	Normania loam, 0 to 3% lsopes	Consociation	Partially hydric	5
247	Linder loam	Consociation	Not hydric	0
255	**Mayer loam**	**Consociation**	**Hydric**	**85**
282	**Hanska fine sandy loam**	**Consociation**	**Hydric**	**85**
327A, B	Dickman sandy loam, 0 to 2 and 2 to 6% slopes	Consociation	Not hydric	0
399	**Biscay loam, depressional**	**Consociation**	**Hydric**	**85**
421B	Ves loam, 1 to 4% slopes	Consociation	Not hydric	0
421B2	Ves loam, 1 to 4% slopes, eroded	Consociation	Not hydric	0
999B2	Ves-Estherville-Storden complex, 3 to 6% slopes, eroded	Complex	Not hydric	0
1850	**Oshawa variant stony clay loam**	**Consociation**	**Hydric**	**85**

[1] – Soils determined using GIS geospatial query clipping the NRCS Spoil Survey Geographic (SSURGO2) spatial data by Project boundaries.

[2] – As indicated in the SSURGO2 database

[3] – As indicated in the SSURGO2 Database. All soil map units can include minor amounts of contrasting soils (called inclusions) that are not identified in the map unit name.
Consociations are dominated by a single soil series and similar soils. The total amount of dissimilar inclusions of other components in a map unit generally does not generally exceed about 15 percent.
Complexes and Associations consist of two or more dissimilar major soils occurring in a regularly repeating pattern. The total amount of inclusions in a map unit that are dissimilar to any of the major components does not exceed about 15 percent.
Undifferentiated Groups consist of two or more soils that are not consistently associated geographically and may not always occur together in the same map delineation. These soils are included as the same named map unit because use and management are the same or very similar for common uses.

[4] – As indicated in the SSURGO2 database. Where percentages are small (e.g. > 15 %) the hydric soil is likely an inclusion that is not recognized in the map unit name. The absence of a value does not necessarily indicate the absence of hydric soils, but that the relative percentages of included minor soils has not been determined.

The MnDNR PWI (Exhibit 4) for Redwood County indicates no MnDNR Public Wetlands or Waters located within the Site. An unnamed stream and Guggisberg Slough are located within ½ mile of the south property boundary and the Minnesota River is within ½ mile of the north end of the Site.

4.2 Delineated Wetland Descriptions

Westwood completed a wetland delineation on the Site and identified 19 wetlands on the site which included 11 Type 1, two Type 2, two Type 3, two Type 4, one Type 5, and one Type 2/3/5 wetland complex (**Exhibit 5**). Detailed data collected for these wetlands are provided on data forms included in Appendix A. Table 2 summarizes the delineated wetlands.

Table 2: Delineated Wetlands					
Wetland	Classification		NWI Mapped	Surface Connection to Jurisdictional Water	Dominant Vegetation (≥ 20% cover)
ID	Circ. 39	Cowardin	Yes/No	Yes/No	Wetland
A	Type 2	PEMB	Yes	Yes (connection south via ditch to unnamed DNR-mapped watercourse which drains to Wabasha Creek)	Giant goldenrod, reed canary grass, Kentucky bluegrass, prairie cordgrass, sedge
B	Type 1	PEMAf	No	No (is connection via hydric soil unit)	Barnyard grass, horsetail, sedge
C	Type 1	PEMAf	No	No (is connection via hydric soil unit)	Green bulrush, horsetail, yellow nutsedge
D	Type 1	PEMAf	No	No (is connection via hydric soil unit)	Barnyard grass, giant goldenrod, and willow
F	Type 2/3/5	PEMB/ PEMC/ PUBFx	Yes	Yes (connection south via ditch to unnamed DNR-mapped watercourse which drains to Wabasha Creek)	Giant goldenrod, prairie cordgrass, green bulrush, cattail, reed canary grass
G	Type 1	PEMAf	No	No (is connection via hydric soil unit)	Reed canary grass, barnyard grass, sedge
H	Type 5	PUBG	Yes	No	duckweed
I	Type 3	PEMF/C	Yes	No	Cattail, reed canary grass
J	Type 1	PFO1A	No	No	Box elder, willow, reed canary grass, giant ragweed
K	Type 2	PEMB	No	No	Prairie cordgrass, reed canary grass
L	Type 4	PEMF/A	Yes	No	Sandbar willow, reed canary grass, cattail
M	Type 4	PEMF/A	Yes	No	Reed canary grass, smartweed
N	Type 1	PEMAf	No	No	Yellow nutsedge, barnyard grass, poverty rush
O	Type 1	PEMA	Yes	No	Foxtail barley, poverty rush, sedge, Kentucky bluegrass
P	Type 1	PEMA	No	No	Spikerush, Kentucky bluegrass
Q	Type 1	PEMAf	No	No	Barnyard grass
R	Type 1	PEMAf	No	No (is connection via hydric soil unit)	Barnyard grass, horsetail, sedge, blue vervain, curly dock
S	Type 1	PEMAd	Yes	No	Reed canary grass, giant goldenrod
T	Type 3	PEMF/C/A	Yes	Yes (connection south via ditch to unnamed DNR-mapped watercourse which drains to Wabasha Creek)	Giant goldenrod, prairie cordgrass, cattail, Kentucky bluegrass, sedge, reed canary grass

Other Areas
Two areas (**Area 1** and **Area 2)** east of Reservation Highway 4 were mapped as PEMA and PEMAd wetlands on the NWI but were found to be non-wetland (Exhibit 5). ***Area 1*** consisted of a NWI-mapped PEMA wetland within woods between cropped portions of the property. Field observations found this area dominated by box elder, however no primary or secondary indicators of wetland hydrology were observed. Soils within the area were without redoximorphic features and no free water was observed within 24 inches of the soil surface at the sample plot. FSA slides showed Area 1 with normal vegetative cover and without wetland signatures in all normal precipitation years. For these reasons, Area 1was determined to be non-wetland.

Area 2 was a NWI-mapped PEMAd wetland within corn cropland southeast of Area 1. Field observations found Area 2 with healthy cropped corn and no evidence of crop stress in the area. Soils were without redoximorphic features and no primary or secondary indicators of wetland hydrology were observed. FSA slides showed Area 2 was cropped in all normal precipitation years. For these reasons, Area 2 was determined to be non-wetland.

Wetland Notes
Wetlands A and F are part of the same large Type 2/3/5 wetland complex that extends diagonally southeast over much of the southwest part of the Site. CSAH 13 divides the complex into what is named Wetland A and F. The portion east of CSAH 13 (Wetland F) has an extensive wet meadow component with numerous native subdominants including marsh aster, dogbane, several species of rushes, green bulrush, prairie cordgrass, water horehound, swamp milkweed, Canada bluejoint, and several species of sedge. The central portion of Wetland F is grazed pasture that includes an excavated stock pond.

Wetlands A (north part), B, C, D, G, N, Q, and R are all Type 1 seasonally inundated wetlands within cropland. At the time of the delineation most of the basins were not cropped and likely avoided due to wet conditions, however it is likely some of these wetlands would be cultivated in dryer years. **Table 3** shows the percentage of normal years with wetland signatures for those wetlands.

Table 3. FSA Slide Review Summary

Wetland ID	Percent Normal Years with Wetland Signatures
Wetland A (north part)	71
Wetland B	71
Wetland C	71
Wetland D	57
Wetland G	88
Wetland N	63
Wetland Q	50
Wetland R	75

All of the wetlands delineated within cropland showed wetland signatures in more than fifty percent of normal precipitation years. In general, between 1991 and 2000, the site appeared wetter overall and had much more agricultural area left uncropped. The last Type 1 wetland is Wetland P which consists of a seasonally inundated roadside ditch.

Wetland H was a Type 5 wetland with a very narrow Type 1 fringe. At the time of the delineation, a constant flow of water was noted draining into the northwest edge of the wetland from a 4-inch diameter PVC pipe that appeared to extend under a single-family home northwest of the wetland. Approximately six inches of standing water extended over the driveway adjacent to the west side of Wetland H.

Upland Areas F1 and F3

Due to access issues, upland areas F1 and F3 were delineated using a combination of field reconnaissance and review of aerial photography for wetland signatures. The landowner advised against entering the enclosure with the livestock in the area of F1 and F3. Consequently, the current condition of upland areas F1 and F3 were viewed from accessible adjacent areas to see their extent, overall plant communities, and topography in relation to wetland areas. The extent of F1 and F3 were further confirmed by viewing wetland signatures on historical photographs from 1991, 2003, 2006, 2008, 2009, and 2010.

5.0 CONCLUSIONS

Westwood delineated and flagged 11 Type 1, two Type 2, two Type 3, two Type 4, one Type 5, and one Type 2/3/5 wetland complex on the site.

Based on the review of mapping resources and field observations, all delineated wetlands, with the exception of Wetland A, F, and T appear isolated.

Westwood requests that the USACE provide a preliminary jurisdictional determination (JD) and wetland boundary determination for the wetlands identified on the site. A completed Request for Corps of Engineers Wetland Delineation Review form accompanies this request to facilitate the wetland boundary and jurisdictional determination.

6.0 LITERATURE CITED

Cowardin, L.M. , V.M. Carter , F.C. Golet , and E.T. LaRoe . 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Biological Services Program, Washington, DC, USA. FWS/OBS-79/31. 103pp.

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

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U.S. Army Corps of Engineers. 2009. 1996 National List of Vascular Plant Species that Occur in Wetlands. http://www.usace.army.mil/CECW/Documents/cecwo/reg/plants/l96_intro.pdf

United States Department of Agriculture, Natural Resources Conservation Service, 2010. Field Indicators of Hydric Soils in the United States, Verson 7.0. C.M. Vasilas, G.W. Hurt, and C.V. Noble (eds.). USDA NRCS, in cooperation with the National Technical Committee for Hydric Soils.

7.0 CERTIFICATION

I certify that, to the best of my knowledge and belief, the wetland delineation completed for this Site is consistent with current wetland delineation practices and guidelines. I have the specific qualifications, education, training, and experience to complete wetland delineations and determinations in accordance with federal and state requirements.

Sincerely,

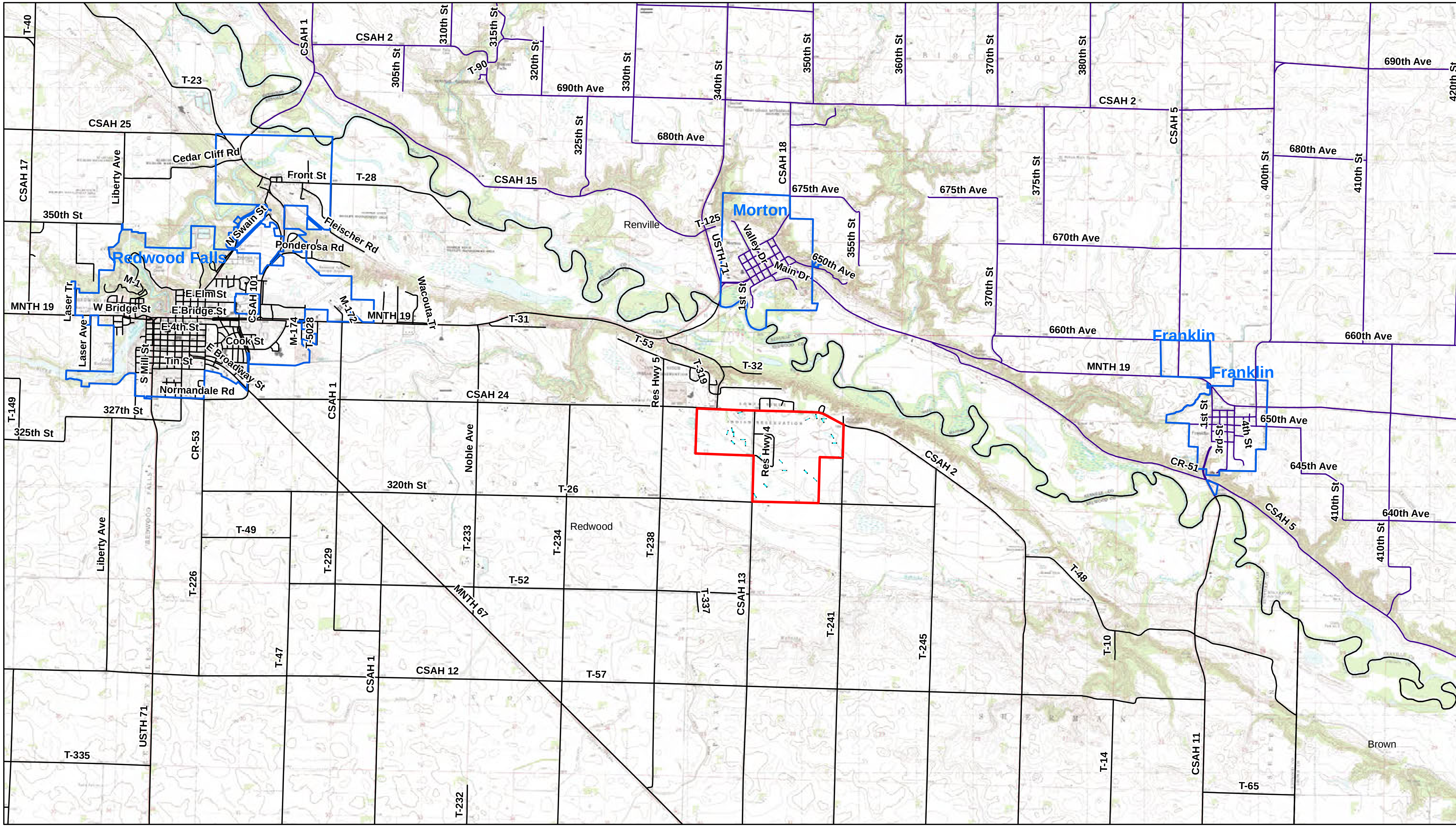
WESTWOOD PROFESSIONAL SERVICES

Kelly S. Kunst
Environmental Scientist
Professional Wetland Scientist No. 1757
MN Certified Wetland Delineator No. 1114

Exhibits

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Redwood County, Minnesota



Data Source(s): USDA-NRCS (2002), MnDOT BaseMap Roads (2004) Redwood and Renville County, Mn/DOT BaseMap - Muni (2003), Westwood (2011).

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Map Document: (P:\20101210\gis\20101210_loc018_site2.mxd)
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Legend

Approximate Site Location

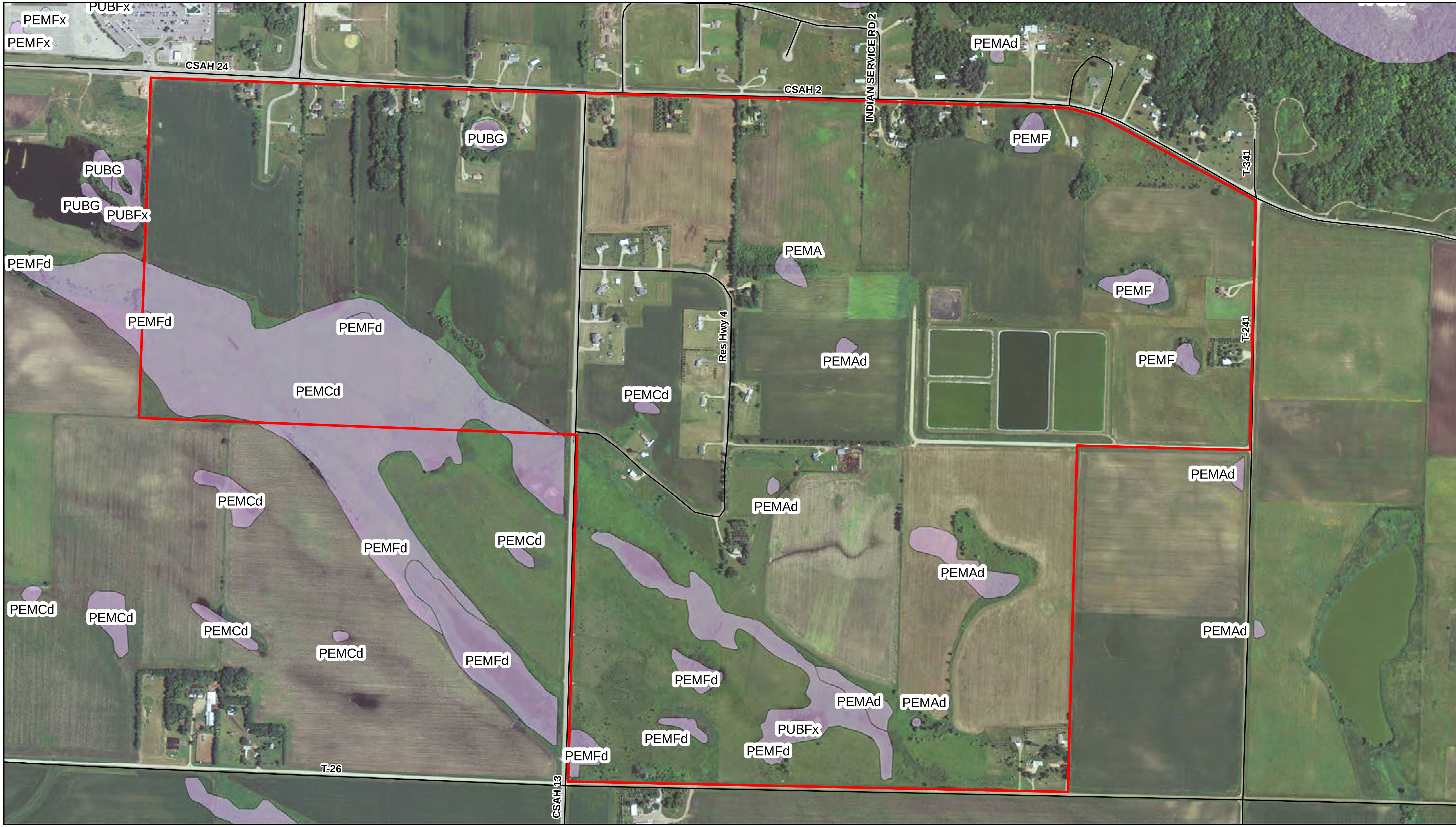
Municipal Boundary

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Minnesota

Site Location and USGS Topography

EXHIBIT 1



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N

0 700 Feet

Legend

- National Wetlands Inventory
- Approximate Site Location

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Minnesota

National Wetlands Inventory

EXHIBIT 2

Data Source(s): USDA-NRCS SSURGO database for Redwood County, MnDOT BaseMap Roads (2004) Redwood and Renville County, LMIC (accessed 2011), Westwood (2011).

Legend

Soil Unit

All hydric

Approximate Site Location

N

0 700 Feet

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Minnesota

Digital Soils

EXHIBIT 3

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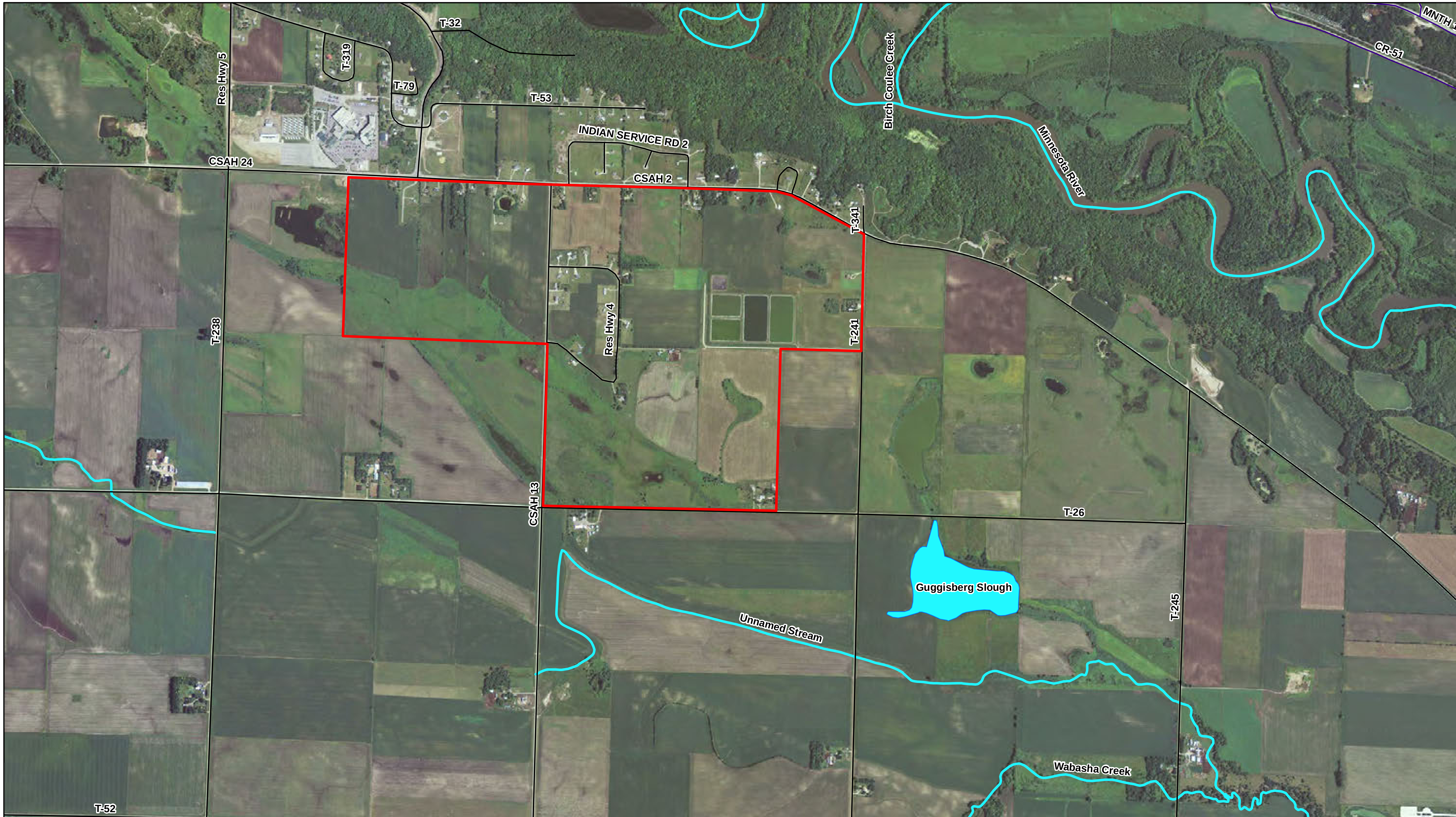

Data Source(s): USDA-FSA-MN (2007), MnDOT BaseMap Roads (2004) Redwood and Renville County, LMIC (accessed 2011), Westwood (2011), MnDNR (2008).

Legend

Public Watercourse
Approximate Site Location
Public Waters

N

0 — 1,500 Feet

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Minnesota

MnDNR Public Waters & Wetlands

EXHIBIT 4

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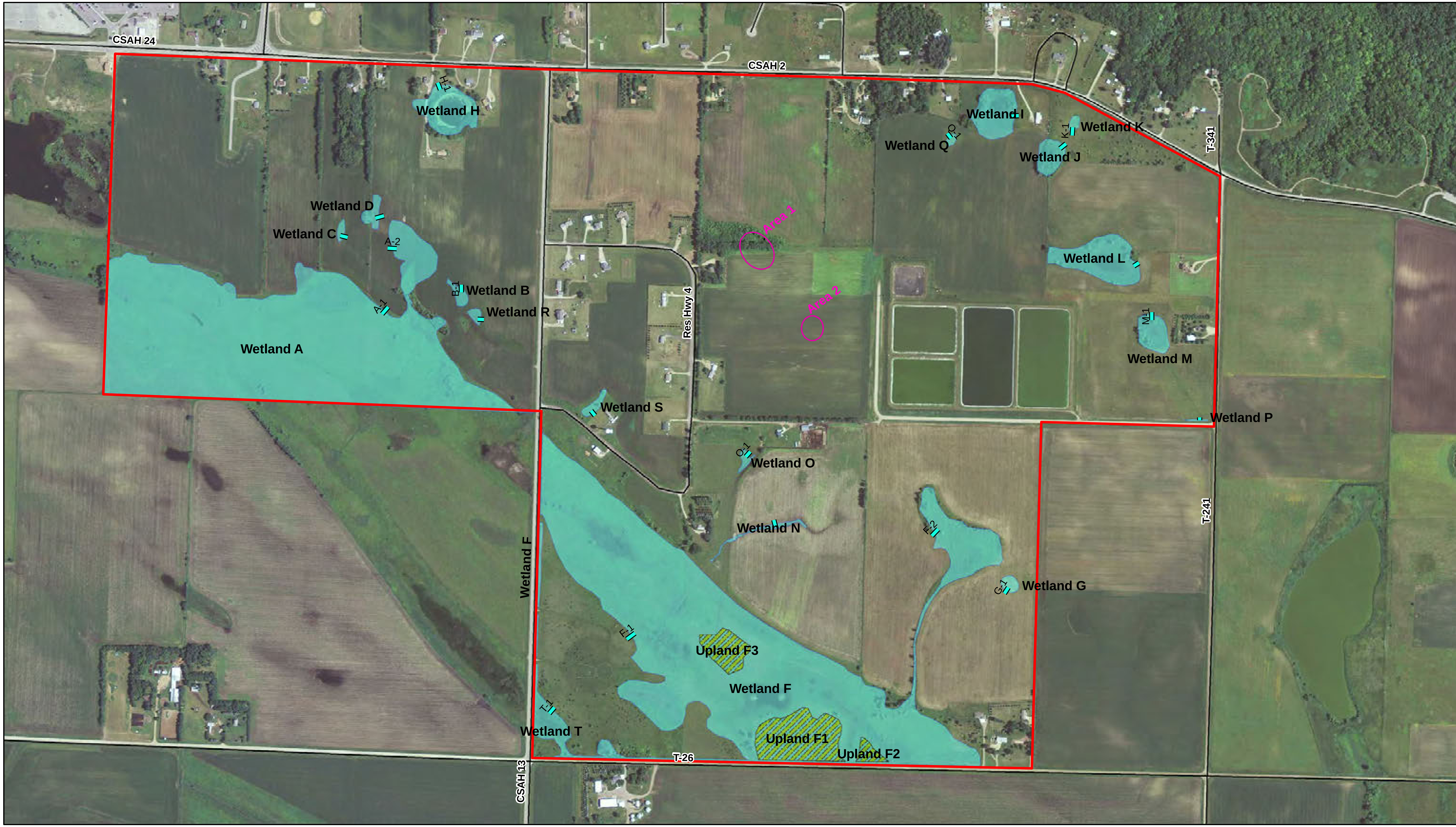

Data Source(s): MnDOT BaseMap Roads (2004) Redwood and Renville County, LMIC (accessed 2011), Westwood (2011).

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N

0 700 Feet

Legend

- Isolated upland
- Wetland
- Sample Transect Locations
- Approximate Site Location

Dakota Lower Sioux-Site 2

Paxton and Sherman Townships, Minnesota

Delineated Wetlands

EXHIBIT 5

Map Document: (P:\20101210\gis\20101210_wtd_018_site2.mxd)
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Geotechnical Evaluation Report

Proposed Wind Turbine
Lower Sioux Indian Community
Morton, Minnesota

Prepared for

Lower Sioux Indian Community

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Philip E. Bailey, PE
Staff Engineer
License Number: 47539
December 8, 2010

PHILIP E. BAILEY
LICENSED PROFESSIONAL ENGINEER
47539
STATE OF MINNESOTA

Project MA-10-09734

Braun Intertec Corporation

BRAUN
INTERTEC

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Mankato, MN 56001

Phone: 507.345.4913
Fax: 507.345.5042
Web: braunintertec.com

December 8, 2010

Project MA-10-09734

Lower Sioux Indian Community
Attn: Dakota Futures, Inc.
39375 County Highway 24
Morton, MN 56270

Re: Geotechnical Evaluation
Proposed Wind Turbine
Lower Sioux Indian Community
Morton, Minnesota

Dear Mr. Franzen:

We are pleased to present this Geotechnical Evaluation Report for the proposed wind turbine, access road and crane pad. A summary of our results, and a summary of our recommendations in light of the geotechnical issues influencing design and construction, is presented below. More detailed information and recommendations follow.

Summary of Results

The general geologic profile at the site consists (proceeding down from the ground surface) of alluvial and glacial sands and clays over glacial clay soils. Penetration resistance values recorded in the glacial sands indicate they were locally very loose but loose to dense overall. Penetration resistance values recorded in the glacial clays indicate that they were medium in consistency in the upper portion of the boring and very stiff to hard at depth.

Groundwater was measured or estimated to be down approximately 2 feet as our boring was advanced. Seasonal and annual fluctuations of groundwater should also be anticipated.

Summary of Recommendations

The geologic materials present at anticipated structure subgrade elevations generally appear suitable for support of conventional foundations, crane pad and access road after removal of some topsoil, though shallow groundwater conditions will impact design and construction. The site is relatively low-lying, with moist to wet subsurface conditions. Groundwater was observed at a depth of 2 feet and will likely vary seasonally and annually. With the planned foundation depth of 7 feet and groundwater observed at 2 feet, buoyancy must be considered in the structural design of the foundation. Dewatering will likely be required to facilitate an evaluation of the geologic materials exposed in the excavation sides and bottoms, and the placement and compaction of backfill.

The subgrade at the turbine location will consist of glacial till clays or glacial outwash sands that are generally at or above their optimum moisture contents. When clays are wet, they are susceptible to disturbance by construction traffic and equipment. Where foundation subgrades are wet, we recommend limiting construction traffic over the clays and sands by using low ground-pressure equipment or else by performing the excavations with backhoes equipped with smooth-edged buckets.

To reduce subgrade disturbance if the foundation subgrade consists of glacial clays, we recommend that a lean concrete "mud mat" or a section of about 1 foot of clean crushed rock be constructed in the base of the excavation as soon as possible after excavation.

Additionally, the clayey soils present in the upper few feet in haul roads and staging areas will be particularly sensitive to disturbance and strength loss. Subexcavation and recompaction or replacement of subgrade soils can be limited if these traffic areas are protected with crushed rock.

Remarks

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please call Philip Bailey at 507.345.4913 (office) or 507.995.8186 (cell)

Sincerely,

BRAUN INTERTEC CORPORATION

Philip E. Bailey, PE
Staff Engineer

Holly Vetter for:

Daniel B. Mahrt, PE
Senior Engineer

c: Nathan Franzen, Westwood Professional Services, Inc.

BRAUN
INTERTEC

Table of Contents

Description **Page**

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Description **Page**

A. Introduction

A.1. Project Description

We understand the project will consist of the construction of a utility scale wind turbine at the referenced site. We understand that a 1.5 MW GE turbine is being considered.

A.2. Purpose

The purpose of this geotechnical evaluation is to characterize subsurface geologic conditions at a boring location within the foundation area and evaluate their impact on the design and construction of the proposed wind turbine, access road, and crane pad.

A.3. Background Information and Reference Documents

To facilitate our evaluation, we were provided with or reviewed the following information or documents:

- Preliminary turbine location sketch
- Geologic atlas

A.4. Site Conditions

Our referenced documents and past project experience in the general area indicate that the site is underlain with alluvial granular soils overlying glacial till soils.

Historically, it appears that several sites in the general area of the turbine have been mined for sand and gravel.

Currently, the site exists as agricultural land and existing topography slopes gently downward to the east.

A.5. Scope of Services

Our scope of services for this project was originally submitted as a Proposal to Mr. Nathan Franzen of Westwood Professional Services, Inc.. Tasks performed in accordance with our authorized scope of services included:

- Performing a reconnaissance of the site to evaluate equipment access to exploration locations.
- Staking and clearing exploration locations of underground utilities.
- Performing one penetration test borings to a depth of about 50 feet.
- Obtaining a bulk sample of the geologic materials encountered at the borehole from the auger cuttings.
- Performing laboratory moisture content, density and unconfined compression tests on selected penetration test samples.
- Performing a laboratory standard Proctor test on the bulk sample.
- Preparing this report containing a CAD sketch, exploration logs, a summary of the geologic materials encountered, results of laboratory tests, and recommendations for structure subgrade preparation and the design of the turbine foundation, access road and crane pad.

Exploration locations and surface elevations were staked and surveyed by Westwood Professional Services, Inc.

Our scope of services was performed under the terms of our June 15, 2006, General Conditions.

B. Results

B.1. Exploration Logs

B.1.a. Log of Boring Sheets

Log of Boring sheets for our penetration test borings are included in the Appendix. The logs identify and describe the geologic materials that were penetrated, and present the results of penetration resistance tests, laboratory tests performed on penetration test samples retrieved from them and on a bulk sample, and groundwater measurements.

Strata boundaries were inferred from changes in the penetration test samples and the auger cuttings. Because sampling was not performed continuously, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may also occur as gradual rather than abrupt transitions.

B.1.b. Geologic Origins

Geologic origins assigned to the materials shown on the logs and referenced within this report were based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

B.2. Geologic Profile

B.2.a. Geologic Materials

The general geologic profile at the site consists (proceeding down from the ground surface) of alluvial and glacial sands and clays over glacial clay soils.

The boring initially encountered about 1 1/4 feet of clayey topsoil over alluvial lean clay that extended to a depth of about 2 feet. Below the alluvial clay, glacial outwash sands that were medium to coarse grained, brown and waterbearing were encountered to a depth of about 9 feet. While drilling, gravel and cobbles were noted from the 6 to 9 foot depth. The glacial outwash was underlain by glacial till soils consisting mainly of clayey sand and sandy lean clay that was brown to gray and moist to wet and extended to the boring's termination depth, with the exception of a layer of fine grained silty sand that was encountered from about 33 to 37 feet.

Penetration resistance values recorded in the glacial sands ranged from 4 to 38 blows per foot (BPF) but generally exceeded 7 BPF, indicating they were locally very loose but loose to dense overall. Penetration resistance values recorded in the glacial clays ranged from 7 to 34 BPF, indicating that they were medium in consistency in the upper portion of the boring and very stiff to hard at depth.

B.2.b. Groundwater

Groundwater was measured or estimated to be down approximately 2 feet as our boring was advanced. Seasonal and annual fluctuations of groundwater should also be anticipated.

B.3. Laboratory Test Results

The moisture content of the clayey sand tested was determined to be about 12 percent, indicating that the material was likely near its probable optimum moisture content.

Our mechanical analyses indicated that the poorly graded sand with silt tested contained about 13 percent gravel, 76 percent sand and 11 percent silt and clay by weight.

An unconfined compression test performed on a thin-walled sample from the boring indicated an unconfined compressive strength of 2.19 tons per square foot.

The results of the standard Proctor test performed on a bulk sample of clayey sand obtained from the auger cuttings indicated a maximum dry density of 125.4 psf at an optimum moisture content of 10.2 percent.

C. Basis for Recommendations

C.1. Design Details

C.1.a. Turbine Foundation Design Details

The wind turbine for this project has not yet been selected, however, it will likely have an output of about 1.5 MW. We anticipate the turbine will be supported on a cylindrical pedestal over an octagonalshaped mat foundation with an estimated radius of about 50 to 65 feet (we have used a 60 foot diameter in our analysis). For purposes of this report we have assumed that the bearing pressures for the structures' operational loads will be up to 60% of the maximum bearing pressure for the critical wind load. We have assumed the bury depth for the turbine foundations will be at least 7 feet below existing grades.

C.1.b. Anticipated Grade Changes

Existing ground surface elevations in the vicinity of the wind turbine are anticipated to remain relatively unchanged.

C.1.c. Precautions Regarding Changed Information

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. Depending on the extent of available information, assumptions may have been made based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, we should be notified. New or changed information could require additional evaluation, analyses and/or recommendations.

C.2. Design Considerations

The geologic materials present at anticipated structure subgrade elevations generally appear suitable for support of conventional foundations, crane pad and access road after removal of some topsoil, though shallow groundwater conditions will impact design and construction. The site is relatively low-lying, with moist to wet subsurface conditions. Groundwater was observed at a depth of 2 feet and will likely vary seasonally and annually. With the planned foundation depth of 7 feet and groundwater observed at 2 feet, buoyancy must be considered in the structural design of the foundation.

Additionally, haul roads and staging areas will be particularly sensitive to disturbance and strength loss. Subexcavation and recompaction or replacement of subgrade soils can be limited if these traffic areas are protected with crushed rock.

C.3. Construction Considerations

The soils encountered at the proposed turbine location appear capable of supporting the proposed wind turbine, provided the subgrades are not disturbed from their native condition. The subgrade at the turbine location will consist of glacial till clays or glacial outwash sands that are generally at or above their optimum moisture contents. When clays are wet, they are susceptible to disturbance by construction traffic and equipment. Where foundation subgrades are wet, we recommend limiting construction traffic over the clays and sands by using low ground-pressure equipment or else by performing the excavations with backhoes equipped with smooth-edged buckets.

The project team should also be aware that excavations will likely penetrate the perched groundwater at depths of about 2 feet. Dewatering will likely be required to facilitate an evaluation of the geologic materials exposed in the excavation sides and bottoms, and the placement and compaction of backfill. Water should not be allowed to accumulate in the excavation; dewatering will likely be necessary until the foundation is backfilled.

To reduce subgrade disturbance we recommend that a lean concrete "mud mat" or a section of about 1 foot of clean crushed rock be constructed in the base of the excavation as soon as possible after excavation.

Additionally, the clayey soils present in the upper few feet in haul roads and staging areas will be particularly sensitive to disturbance and strength loss. Subexcavation and recompaction or replacement of subgrade soils can be limited if these traffic areas are protected with crushed rock.

D. Recommendations

D.1. Turbine Foundation Excavation and Preparation

D.1.a. Embedment Depth

We recommend embedding the foundation at least 60 inches for frost protection, therefore, the proposed 9-foot embedment appears satisfactory for frost protection.

D.1.b. Excavations

Based on the penetration resistances and laboratory testing, we anticipate the soils encountered will consist of:

> **Type B soils** - Cohesive soils with an unconfined compressive strength of at least 1,000 psf, based on Department of Labor Occupational Safety and Health Administration (OSHA) guidelines. Excavations deeper than 5 feet in Type B soils should be sloped at a gradient equal to or flatter than 1H:1V.

Type C soils – Any soils where groundwater is observed to be freely seeping from the excavation sidewalls, and clayey soils with an unconfined compressive strength of less than 1,000 psf will be Type C soils. Any excavations deeper than 5 feet in Type C soils should be sloped at a gradient equal to or flatter than 1.5H:1V.

We anticipate that the sand soils at this site will be Type C soils.

D.1.c. Excavation Dewatering

Based on the high groundwater table and medium- to coarse -grained soils present in the upper 9 feet, we anticipate that well points or significant dewatering will be required to facilitate construction of the turbine foundation. We recommend that where groundwater must be drawn down more than 2 feet, a well contractor should review our logs to determine if wells are required, how many will be required, and to what depths they will need to be installed.

In sands, we do not recommend attempting to dewater from within an excavation. Upward seepage will loosen and disturb the excavation bottom. Rather, groundwater should be drawn down at least 2 feet below the anticipated excavation bottom in advance of excavation.

D.2. Turbine Foundation Design Parameters

D.2.a. Allowable Bearing Pressure

The soils encountered at the anticipated foundation subgrade elevation are of moderate strength and moderate compressibility. Due to the relatively large size of the proposed wind turbine foundation, stress increases will extend deep into the soil profile. Stress increases in the soils results in settlement, therefore it is necessary to balance the load placed on the soil with an acceptable amount of settlement.

Additionally, several loading cases are typically analyzed for wind turbine foundations. A standard approach in the wind industry is to use a factor of safety of 2.26 for extreme load conditions, and a factor of safety of 3.0 for operational loads[1]. Considering these factors, we recommend using a net allowable bearing pressure of 3,000 psf for extreme load conditions, and a net allowable bearing pressure of 2,000 psf for operational load conditions.

[1] Morgan, K., Ntambakwa, E. "Wind Turbine Foundation Behavior and Design Considerations", AWEA Windpower Conference, Houston, Texas, June 2008.

D.2.b. Lateral Resistance and Uplift

Resistance to uplift will be provided by the weight of the soil placed above the foundation. Due to the potential for perched groundwater conditions, we recommend assuming a groundwater level located at a depth of up to 2 feet below the final grades. If groundwater is encountered in the excavations and is observed at a depth higher than estimated the geotechnical and the structural engineer should be notified immediately.

We recommend utilizing a design wet unit weight of 125 pounds per cubic foot (pcf) above the assumed groundwater depth, and an effective unit weight of 60 pounds per cubic foot below the assumed groundwater depth. Although we anticipate that the compacted backfill materials will generally have a unit weight higher than these values, we have included a reduction to account for variable soil conditions and potential future drying.

Resistance to sliding will be provided by friction between the base of the foundation or mud mat and the underlying subgrades, and also by passive soil pressures acting against the sides of the foundation. Assuming a smooth concrete surface at the base of the foundation, we recommend using a passive pressure equal to 212 pcf (assuming sand or gravel will be used as backfill adjacent to the foundation) and a sliding coefficient equal to 0.6. These values are un-factored, and are based on an effective unit weight of 60 pounds per cubic foot, and a friction angle of 34 degrees. Lateral resistance due to friction at the base of the footing should be ignored in load scenarios where uplift also occurs.

D.2.c. Foundation Stiffness

Based upon the soils encountered in the borings, we recommend using the following parameters for stiffness design:

Shear Wave Velocity (V_s) = 600 feet per second (fps)

Shear Modulus (G) = 1400 kips per square feet (ksf)

Poisson's Ratio (v) = 0.4.

The values provided above have not been factored.

D.2.d. Settlement

Three types of settlement are considered for turbine foundations: immediate, long-term, and differential settlement.

Immediate Settlement

Immediate settlement occurs as the foundation is constructed and the turbine is erected. We estimate that up to about ½ inch of immediate settlement will occur. Because a significant portion of immediate settlement occurs as the foundation is backfilled (before tower erection), we do not anticipate that the immediate settlement will significantly contribute to differential settlement.

Long Term Settlement

Long-term settlement of foundations occur from compression of soils due to stress increases in the soils. Consolidation theory was utilized to calculate settlement caused by the dead load of the turbine and foundation and the operational load. Based on the results of unconfined compression tests, N-values, and Atterberg limits, we do not anticipate that operational loads will result in primary consolidation of the clay soils.

When the wind turbines are put into service, various loading conditions will occur, depending on the wind speed and direction. Wind acting on a turbine and tower results in an overturning moment applied to the foundation. The overturning moment magnitude will vary with wind speed and direction, and will result in various stress distributions and eccentricity at the foundation level. In a typical stress distribution for an extreme event, the maximum gross allowable bearing pressure for the foundation will occur only at the edge of the foundation opposite the wind direction, and the applied stress decreases moving into the wind direction. Because of the geometry of the stress distribution for the extreme event and the typically short duration, the loading case for extreme events is not considered the worst-case scenario for settlement calculations.

Operational loads can last for periods of time long enough for pore pressures to increase and consolidation to occur. Because wind directions change, the operational loads can be assumed to apply over the entire foundation area. Based on our analyses described in this section, we estimate total settlements due to operational loads to be less than 1 1/2 inches.

Differential Settlement

Based on assumed geometries, differential settlements are estimated to be approximately ½ to ¾ of the total settlement. In our experience, a typical tolerance for differential settlement is $\Delta/L=0.003$ (or a settlement of 0.003 feet over a distance of 1 foot). This would apply over approximately half of the footing plus the eccentricity (eccentricity is foundation specific). For the assumed 60-foot diameter footing with a total settlement of 1 1/2 inches and a differential settlement of ¾ the total, the differential settlement is calculated to be less than $\Delta/L=0.003$.

D.2.e. Backfill Material Requirements Above Foundation Bottom

Backfill materials placed above the bottom of the foundation (above and adjacent the foundation) should meet the following requirements:

- Free of organic and foreign materials, with exception to the upper 1 foot,
- Free of materials with a maximum particle size exceeding 3 inches where placed within 2 feet (vertical or horizontal) of the finished concrete surface,
- Able to be properly moisture-conditioned and compacted to the minimum requirements listed in Table 1 below, and to the minimum unit weight as required in the structural details.

On-site materials removed from the excavations can generally be reused as backfill and fill over and adjacent the foundations. Where more than 2 feet from any concrete surface, cobbles and boulders may be reused as foundation backfill, provided that their quantities are low enough such that each cobble and boulder is fully surrounded by soil, and provided that the materials containing cobbles/boulders can be suitably compacted.

D.2.f. Placement, Moisture-Conditioning and Compaction Requirements

We recommend spreading backfill in 4- to 8-inch thick loose lifts, depending on the composition of the material and the type of compactor used. We recommend backfill be moisture-conditioned and compacted in accordance with the criteria presented below in Table 1.

Table 1. Compaction Recommendations Summary

Location	Relative Compaction, % (ASTM D 698 – std. Proctor)	Moisture Content Variance from Optimum, percentage points
Foundation Backfill	95, or to the minimum unit weight requirement specified in the Structural Notes, whichever is greater	-1 to +4 for Cohesive Soils -3 to +3 for Cohesionless Soils

D.3. Crane Pad Preparation

In order to provide support for the crane, we recommend removing the surficial alluvial clay soils to the underlying sands. We anticipate the excavation will extend to a depth of about 2 feet.

We recommend that backfill to used to grade the crane pad consist of clean, coarse sands having less than 50 percent passing the number 200 sieve and less than 5 percent passing the number 200 sieve due to the wet conditions anticipated. Alternatively, crushed rock could be used to bring the crane pad up to near the finished grade. If crushed rock is used, we recommend that it be capped with at least 4 inches of aggregate base meeting MnDOT Specification 3138 for class 5 in order to confine the rock and provide a working platform. Crane loadings, types, or locations were not provided to us at the time of this report. In order to determine whether or not our recommendations require alteration, we request that the crane information be provided to us for our review when it is available.

D.4. Access Roads

D.4.a. Subgrade Preparation

The following recommendations have been prepared based on the soil boring performed at the turbine location. With the likelihood for variability of surface conditions on this site, there will likely be a need for situational recommendations that are not included in this section. The on-site geotechnical engineer/quality control firm should be able to provide additional on-site recommendations during construction.

It is our understanding that the roadways will be subject to heavy traffic during construction, consisting of concrete trucks, loaded dump trucks, cranes, and semi-tractor trailers. After construction, the roadway will be subject to lighter traffic, consisting primarily of pickup trucks and other maintenance trucks. The main intention of the access road design is to provide support during construction.

D.4.b. General Surface Preparations

We recommend removing surface vegetation and root zones from all roadway areas. We recommend black/organic topsoils be removed from within a minimum of 2 vertical feet below the roadway subgrade (subgrade = bottom of road base aggregate elevation). The topsoil thickness observed in the penetration test boring performed at the turbine location was about 1 foot, but topsoil thicknesses will likely vary along the roadway alignment.

Where topsoils are encountered more than 2 foot below the subgrade, they may be left in place provided they are stable enough to support the compaction of overlying fills and to meet proofroll requirements.

In roadway cut areas, or where embankment construction requires less than 2 feet of fill placement, the embankment subgrade should be subcut to allow for placement of at least 1 foot of crushed, clean 1 1/2 inch or 3 inch minus rock to enable compaction of the aggregate base material atop the saturated sands and clays. Depending on the actual groundwater and soil conditions at the time of construction, this layer of crushed rock may not be needed.

D.4.c. Embankment Backfill and Fill Materials and Placement

Where fill will be placed within 2 feet of the groundwater surface, we recommend backfill and fill consist of clean sand having less than 50 percent passing the number 40 sieve and less than 5 percent passing the number 200 sieve or crushed rock. Backfill and fill materials placed in the roadway subgrade areas more than 2 feet above the groundwater surface should consist of non-organic mineral soils meeting the following requirements:

Free of black, organic or frozen materials,
Embankment materials shall meet ASTM or USCS classification requirements for materials with a prefix letter S, G or C, excluding any materials meeting the requirement for SC-SM (silty clayey sand), ML (silt), or CL-ML (silty clay),
Able to properly moisture conditioned and compacted per the requirements stated in this section.

We recommend road subgrade materials be moisture conditioned to within +/- 3 percentage points of their optimum moisture content, and compacted to at least 95 percent of the maximum dry density determined in accordance with the standard Proctor (ASTM D698). Materials that cannot be compacted to this requirement, or otherwise unsuitable materials observed at this time should be undercut and replaced with suitable fill or should be reworked and recompacted.

D.4.d. Proofrolling

We recommend proofrolling be performed over all roadway subgrades, road base aggregate surfaces, crane path shoulders, and crane pads. Proofrolling should be completed with a loaded tandem-axle dump truck with a minimum gross weight of 25 tons. All proofrolls should be performed in the presence of the geotechnical engineer or engineering assistant. Unstable materials observed during the proofroll should be undercut and replaced with compacted fill, or stabilized as recommended by the geotechnical engineer.

Proofroll acceptance should be based upon a specified maximum rut depth (< 1 ½ inch) and the absence of “pumping” behind the truck tires.

D.4.e. Road Base Aggregate Materials and Placement

We recommend road base aggregate meet the requirements for Minnesota Department of Transportation (MNDOT) crushed aggregate base meeting the requirements for MNDOT Specification 3138 for Class 5 or Class 7, respectively. Road base aggregate materials should be moisture conditioned to within +/- 3 percentage points of their optimum moisture content, and compacted to at least 100 percent of the maximum dry density determined in accordance with the standard Proctor (ASTM D698).

D.4.f. Road Base Aggregate Thickness

Laboratory tests to determine an R-value for pavement design were not included in the scope of this project. Based on our experience with similar projects in the area, however, it is our opinion that an R-value of 10 can be assumed for design purposes.

Based on the assumed R-value, we recommend placing at least 9 inches of aggregate base meeting MnDOT specification 3138 for Class 5 in access road areas.

E. Construction Observations and Testing

E.1. Observations for Foundations

We recommend a licensed and experienced geotechnical engineer with Braun Intertec, or an engineering assistant working under the engineer's direct supervision, observe all excavations related to subgrade preparations and foundations. The purpose of the observations is to evaluate the competence of the materials exposed in the excavations, the similarities/differences between the soils encountered in the boring and actual excavation, and the adequacy of required excavation oversizing; as well as to recommend and document any corrections necessary below the foundations.

E.2. Foundation Subgrade Testing

The geotechnical engineer or engineering assistant should perform testing of the WTG foundation subgrade prior to the placement of the mud mat and form work. In native soils, strength testing should consist of utilizing a dynamic cone penetrometer (DCP) for cohesionless soils and a static cone penetrometer (SCP) or hand vane shear equipment for cohesive soils, and hand auger probes to perform soil classifications. Moisture content tests should be performed on the subgrades (native or recompacted) using a nuclear densometer or the burner method.

Subgrade materials that are deficient in strength should be evaluated by the geotechnical engineer. The geotechnical engineer and structural engineer should be immediately notified of the presence of groundwater in the excavation or hand auger borings.

Where structural backfill is placed below foundation as a result of overexcavation or scarification and recompaction, relative moisture and compaction testing must be performed on the moisture conditioned and compacted fill with a nuclear density – moisture gauge. Relative moisture and compaction testing below foundations should be performed at a frequency of 2 tests per 1 foot lift.

E.3. Foundation Backfill Testing

Relative moisture and compaction tests should be performed on compacted foundation backfill materials for the WTG at a minimum frequency of 1 test per 1 foot lift. The relative moisture/compaction tests should also be used to measure the compacted unit weight of the backfill materials, for verification to the structural specification’s design unit weight for foundation backfill. Where materials are unable to be compacted to the unit weight requirement, the geotechnical engineer and structural engineer should be notified immediately.

E.4. Roadway and Crane Pad Observations and Testing

The geotechnical engineer or engineering assistant should observe all proof-rolling of the roadways and crane pad. Areas that are deficient in strength, as exhibited by excessive rutting or pumping, hand auger borings and/or DCP tests should be performed to evaluate the general extents of the deficient areas.

Relative moisture and compaction tests should be performed on recompacted/compacted roadway subgrades at a minimum frequency of 1 test per 1000 linear feet of roadway, with a minimum of 3 tests per access road spur. Relative moisture and compaction tests should be performed on all road base aggregates at a minimum frequency of 1 test per 1000 linear feet of roadway, with a minimum of 3 tests per access road spur.

E.5. Materials Testing

One standard Proctor test should be performed for each soil type used for foundation, roadway and crane pad backfill and fill materials. Where materials are encountered that appear to be highly plastic, an Atterberg limits test should also be performed.

We recommend performing sieve analyses on the road base aggregate materials at a minimum frequency of 1 test per 2500 cubic yards. A minimum of 2 standard Proctors should be performed on the road base aggregate materials.

We also recommend slump, air content and strength tests of Portland cement concrete be performed in accordance with ACI requirements.

E.6. Cold Weather Precautions

If site grading and construction is anticipated during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading. No fill or structure should be placed on frozen subgrades. No frozen soils should be used as fill.

Concrete delivered to the site should meet the temperature requirements of ASTM Test Method C 94. Concrete should not be placed on frozen subgrades. Concrete should be protected from freezing until the necessary strength is attained. Frost should not be permitted to penetrate below footings.

F. Procedures

F.1. Penetration Test Borings

The penetration test borings were drilled with a truck-mounted core and auger drill equipped with hollow-stem auger. The borings were performed in accordance with ASTM D 1586. Penetration test samples were taken at 2 1/2- or 5-foot intervals. Actual sample intervals and corresponding depths are shown on the boring logs.

Penetration test boreholes that met the Minnesota Department of Health (MDH) Environmental Borehole criteria were sealed with an MDH-approved grout. A sealing record for those boreholes will be forwarded to the Minnesota Department of Health Well Management Section.

F.2. Material Classification and Testing

F.2.a. Visual and Manual Classification

The geologic materials encountered were visually and manually classified in accordance with ASTM Standard Practice D 2488. A chart explaining the classification system is attached. Samples were placed in jars or bags and returned to our facility for review and storage.

F.2.b. Laboratory Testing

The results of the laboratory tests performed on geologic material samples are noted on or follow the appropriate attached exploration logs. The tests were performed in accordance with ASTM procedures.

F.3. Groundwater Measurements

The drillers checked for groundwater as the penetration test borings were advanced, and again after auger withdrawal. The boreholes were then backfilled or allowed to remain open for an extended period of observation as noted on the boring logs.

G. Qualifications

G.1. Variations in Subsurface Conditions

G.1.a. Material Strata

Our evaluation, analyses and recommendations were developed from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation and thickness away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

G.1.b. Groundwater Levels

Groundwater measurements were made under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. It should be noted that the observation periods were relatively short, and groundwater can be expected to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

G.2. Continuity of Professional Responsibility

G.2.a. Plan Review

This report is based on a limited amount of information, and a number of assumptions were necessary to help us develop our recommendations. It is recommended that our firm review the geotechnical aspects of the designs and specifications, and evaluate whether the design is as expected, if any design changes have affected the validity of our recommendations, and if our recommendations have been correctly interpreted and implemented in the designs and specifications.

G.2.b. Construction Observations and Testing

It is recommended that we be retained to perform observations and tests during construction. This will allow correlation of the subsurface conditions encountered during construction with those encountered by the borings, and provide continuity of professional responsibility.

G.3. Use of Report

This report is for the exclusive use of the parties to which it has been addressed. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

G.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

F:\MA\2010\MA1009734_Morton_ArcGIS_MXD\Boring_Loc_MA1009734_Morton_BoringLoc.mxd

Project No:	MA-10-09734
Scale:	1 in = 250 ft
Drawn By:	JBJ
Date Drawn:	12/3/2010
Checked By:	PB
Last Modified:	12/3/2010
Page 1 of 1	Figure 1

Proposed Wind Turbine
Morton Indian Reservation
Morton, Minnesota

BRAUN INTERTEC

0 125 250
Feet
N

LOG OF BORING

Braun Project MA-10-09734 Geotechnical Evaluation Proposed Wind Turbine Morton Indian Reservation Morton, Minnesota	BORING: ST-1 LOCATION: Northing 223081.440, Easting 558498.386 See attached sketch.
DRILLER: S. McLean — METHOD: 3 1/4" HSA, Autohammer	DATE: 11/18/10 — SCALE: 1" = 4'

Elev. feet 979.7	Depth feet 0.0	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
978.5	1.2	CL	LEAN CLAY, dark brown, wet. (Topsoil)				
977.7	2.0	CL	LEAN CLAY, brown, wet, soft. (Alluvium)		∇		
973.7	6.0	SP-SM	POORLY GRADED SAND with SILT, medium- to coarse-grained, with a trace of Gravel, brown, waterbearing, loose. (Glacial Outwash)	7 8			An open triangle in the water level (WL) column indicates the depth at which groundwater was observed while drilling. A solid triangle indicates the groundwater level in the boring on the date indicated. Groundwater levels fluctuate.
970.7	9.0	SP-SM	POORLY GRADED SAND with SILT, medium- to coarse-grained, with Gravel and Cobbles, brown, waterbearing, dense. (Glacial Outwash)	38			
961.7	18.0	SC	CLAYEY SAND, brown, wet, medium. (Glacial Till)	7 TW 8	▼	12	q_u=2.190 tsf WD=141 pcf DD = 126 pcf
		CL	SANDY LEAN CLAY, gray, moist to wet, medium to very stiff. (Glacial Till)	8 22 18			

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09734.GPJ BRAUN.GDT 12/9/10 10:53

BRAUN INTERTEC

LOG OF BORING

Braun Project MA-10-09734 Geotechnical Evaluation Proposed Wind Turbine Morton Indian Reservation Morton, Minnesota	BORING: ST-1 (cont.) LOCATION: Northing 223081.440, Easting 558498.386 See attached sketch.

DRILLER: S. McLean	METHOD: 3 1/4" HSA, Autohammer	DATE: 11/18/10	SCALE: 1" = 4'

Elev. feet 947.7	Depth feet 32.0	Symbol	Description of Materials (Soil- ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
946.7	33.0						
		SM	SILTY SAND, fine-grained, gray, waterbearing, very loose. (Glacial Outwash)	4			
942.7	37.0						
		SC	CLAYEY SAND, with a trace of Gravel, gray, moist, very stiff. (Glacial Till)	23			
936.7	43.0						
		CL	SANDY LEAN CLAY, with a trace of Gravel, gray, moist, very stiff to hard. (Glacial Till)	28 34			
928.7	51.0						
			END OF BORING. Water observed at 2 feet while drilling. Water observed at 11 feet immediately after withdrawal of auger. Boring then grouted.				

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING 09734.GPJ BRAUN.GDT 12/9/10 10:53

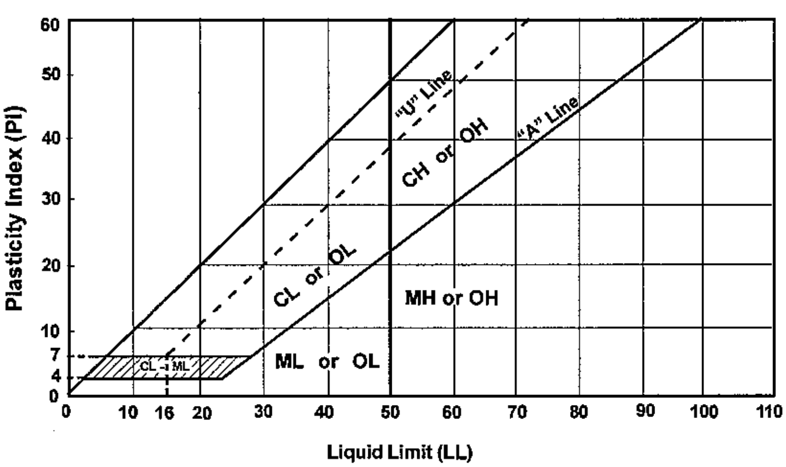
BRAUN INTERTEC

Descriptive Terminology of Soil

Standard D 2487 - 00
Classification of Soils for Engineering Purposes
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [a]				Soils Classification: Group Symbol	Soils Classification: Group Name [b]
Coarse-grained Soils more than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels 5% or less fines [e]	$C_u \geq 4$ and $1 \leq C_c \leq 3$ [c]	GW	Well-graded gravel [d]
			$C_u < 4$ and/or $1 > C_c > 3$ [c]	GP	Poorly graded gravel [d]
		Gravels with Fines More than 12% fines [e]	Fines classify as ML or MH	GM	Silty gravel [d f g]
			Fines classify as CL or CH	GC	Clayey gravel [d f g]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands 5% or less fines [i]	$C_u \geq 6$ and $1 \leq C_c \leq 3$ [c]	SW	Well-graded sand [h]
			$C_u < 6$ and/or $1 > C_c > 3$ [c]	SP	Poorly graded sand [h]
		Sands with Fines More than 12% [i]	Fines classify as ML or MH	SM	Silty sand [f g h]
			Fines classify as CL or CH	SC	Clayey sand [f g h]
Fine-grained Soils 50% or more passed the No. 200 sieve	Silts and Clays Liquid limit less than 50	Inorganic	PI > 7 and plots on or above "A" line [j]	CL	Lean clay [k l m]
			PI < 4 or plots below "A" line [j]	ML	Silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [k l m n]
				OL	Organic silt [k l m o]
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line	CH	Fat clay [k l m]
			PI plots below "A" line	MH	Elastic silt [k l m]
		Organic	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [k l m p]
				OH	Organic silt [k l m q]
Highly Organic Soils		Primarily organic matter, dark in color and organic odor		PT	Peat

a. Based on the material passing the 3-in (75mm) sieve.
b. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders or both" to group name.
c. $C_u = D_{60} / D_{10}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
d. If soil contains ≥15% sand, add "with sand" to group name.
e. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
f. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
g. If fines are organic, add "with organic fines" to group name.
h. If soil contains ≥ 15% gravel, add "with gravel" to group name.
i. Sands with 5 to 12% fines require dual symbols:
   SW-SM well-graded sand with silt
   SW-SC well-graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
j. If Atterberg limits plot in hatched area, soil is a CL-ML, silty clay.
k. If soil contains 10 to 29% plus No. 200, add "with sand" or "with gravel" whichever is predominant.
l. If soil contains≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
m. If soil contains≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
n. PI ≥ 4 and plots on or above "A" line.
o. PI < 4 or plots below "A" line.
p. PI plots on or above "A" line.
q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	OC	Organic content, %
WD	Wet density, pcf	S	Percent of saturation, %
MC	Natural moisture content, %	SG	Specific gravity
LL	Liquid limit, %	C	Cohesion, psf
PL	Plastic limit, %	∅	Angle of internal friction
PI	Plasticity index, %	qu	Unconfined compressive strength, psf
P200	% passing 200 sieve	qp	Pocket penetrometer strength, tsf

Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3"
Fine	No. 4 to 3/4"
Sand	
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Silt	< No. 200, PI < 4 or below "A" line
Clay	< No. 200, PI ≥ 4 and on or above "A" line

Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils

Very soft	0 to 1 BPF
Soft	2 to 3 BPF
Rather soft	4 to 5 BPF
Medium	6 to 8 BPF
Rather stiff	9 to 12 BPF
Stiff	13 to 16 BPF
Very stiff	17 to 30 BPF
Hard	over 30 BPF

Drilling Notes

Standard penetration test borings were advanced by 3 1/4" or 6 1/4" ID hollow-stem augers unless noted otherwise. Jetting water was used to clean out auger prior to sampling only where indicated on logs. Standard penetration test borings are designated by the prefix "ST" (Split Tube). All samples were taken with the standard 2" OD split-tube sampler, except where noted.

Power auger borings were advanced by 4" or 6" diameter continuous-flight, solid-stem augers. Soil classifications and strata depths were inferred from disturbed samples augered to the surface and are, therefore, somewhat approximate. Power auger borings are designated by the prefix "B."

Hand auger borings were advanced manually with a 1 1/2" or 3 1/4" diameter auger and were limited to the depth from which the auger could be manually withdrawn. Hand auger borings are indicated by the prefix "H."

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6" into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6" increments and added to get BPF. Where they differed significantly, they are reported in the following form: 2/12 for the second and third 6" increments, respectively.

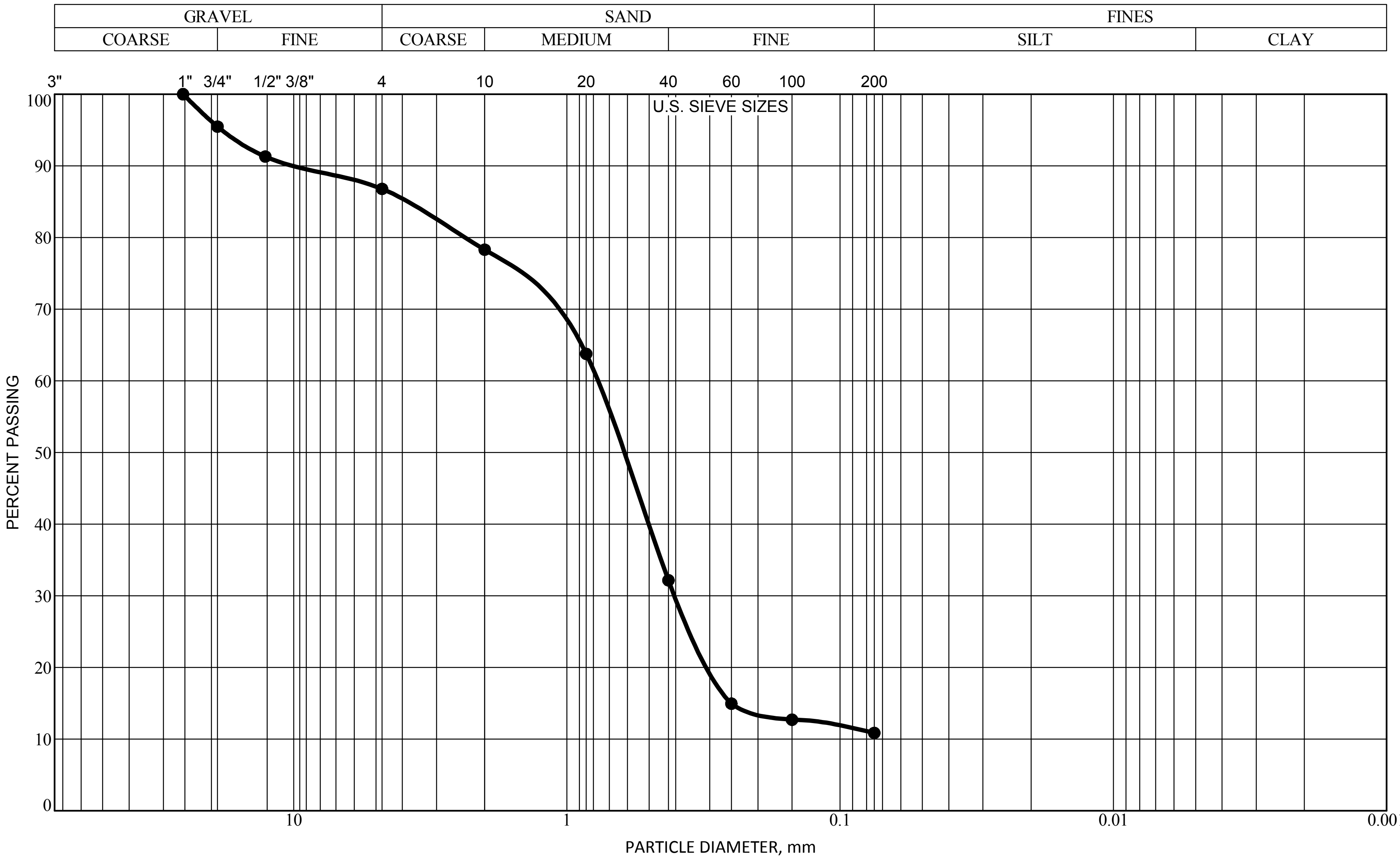
WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

TW indicates thin-walled (undisturbed) tube sample.

Note: All tests were run in general accordance with applicable ASTM standards.

GRAIN SIZE ACCUMULATION CURVE (ASTM)



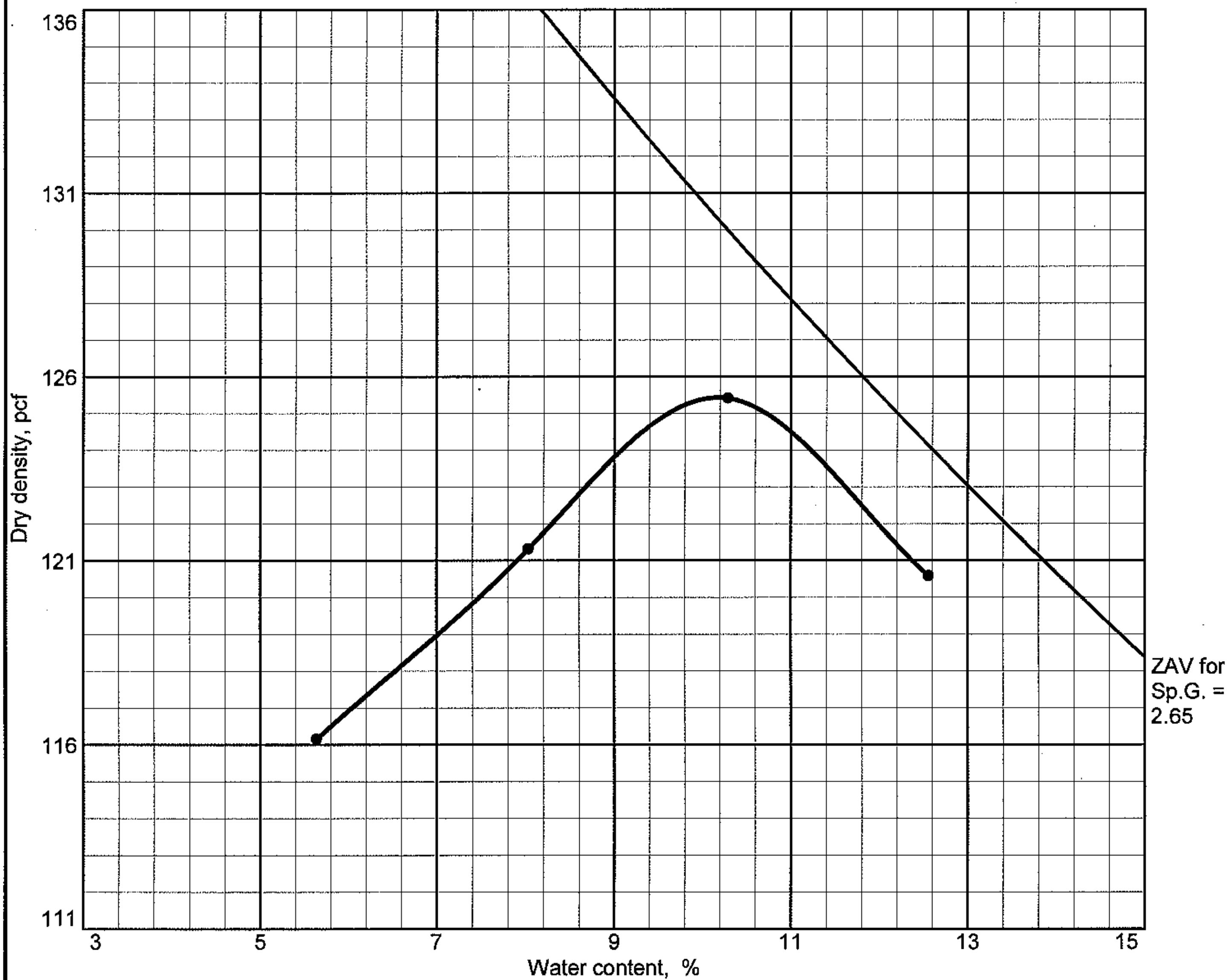
Braun Project MA-10-09734
Geotechnical Evaluation
Proposed Wind Turbine
Morton Indian Reservation
Morton, Minnesota
BORING: ST-1 DEPTH: 5.0'

GRAVEL	13.2%
SAND	75.9%
FINES	10.9%
D60=0.783 D30=0.398 D10=	Cu=14.4 Cc=3.7

CLASSIFICATION:
POORLY GRADED SAND with SILT(SP-SM)

GS ASTM MA-10-09734.GPJ BRAUN.GDT 12/3/10 09:27

Moisture-Density Relationship



Test specification: ASTM D 698-07e1 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						
	SC, tr grvl, gry			2.65			5.0	35.1

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 125.4 pcf Optimum moisture = 10.2 %	SC, Clayey sand, trace of gravel, Grey

Project No.: **Client:**

Project:

● **Location:** St-1 Cuttings

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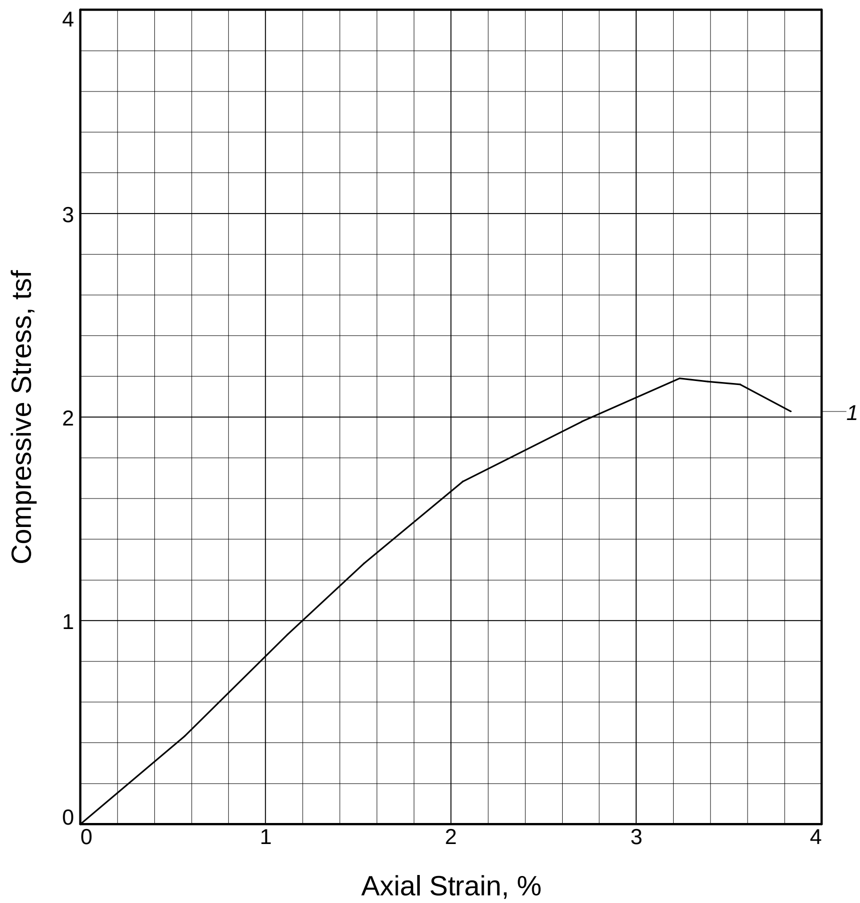
Remarks:

P-01

P-01

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	2.189			
Undrained shear strength, tsf	1.095			
Failure strain, %	3.2			
Strain rate, %/min.	1.00			
Water content, %	12.1			
Wet density, pcf	140.8			
Dry density, pcf	125.6			
Saturation, %	95.3			
Void ratio	0.3417			
Specimen diameter, in.	2.88			
Specimen height, in.	5.69			
Height/diameter ratio	1.98			

Description: SANDY LEAN CLAY, brown (CL)

LL =	**PL =**	**PI =**	**GS=** 2.70	**Type:** Thinwall

Project No.: MA-10-09734

Date Sampled:

Remarks:

Figure 1

Client: Westwood Professional Services, Inc.

Project: Proposed Wind Turbine
Morton Indian Reservation, Morton, MN

Sample Number: ST-1 **Depth:** 12-14'

BRAUN INTERTEC

Lower Sioux Wind Project – Permitting Matrix

Prepared By Westwood Professional Services, Inc. File 20101210.00

Project Name:	**Lower Sioux Wind Project**	Turbine Design: Assumed turbine with 82.5 meter rotor diameter
Location:	**Lower Sioux Indian Community**	No. of Turbines: Nine
Date:	**June 22, 2011**	Turbine Height: Assumed 121.3 m (398 ft)
Agency	**Permit/ Approval**	**Need for Permit/ Approval**
Federal		
U.S. Army Corps of Engineers (USACE)	Wetland Delineation Approvals	Wetland delineation needed to determine extent of USACE jurisdiction, quantify impacts, or document avoidance.
	Jurisdictional Determination	The Project may be eligible for a Letter of No Jurisdiction if wetlands are avoided or impacts are limited to isolated wetlands.
	Federal Clean Water Act Section 404 Permit(s)	Project may either require a USACE Regional General Permit or an Individual Permit depending on the amount and type of wetland impact proposed.
U.S. Fish and Wildlife Service (USFWS)	Request for Letter of No Effect for Threatened and Endangered Species	Federal endangered species review is needed to confirm that the Project will not adversely affect rare species and that no "incidental take" permit is needed.
Environmental Protection Agency (Region 5) (EPA) in coordination with the Minnesota Pollution Control Agency (MPCA)	Spill Prevention Control and Countermeasure (SPCC) Plan	Need to review if O&M facility or related oil storage tank is planned for this Project and need for SPCC Plan.
Lead Federal Agency (TBD if applicable)	Federal Section 106 Review	Section 106 of the National Historic Preservation Act (NHPA) may be invoked by a Federal Agency if the Project requires federal land, funding, or permits.
Federal Aviation Administration	Form 7460-1 Notice of Proposed Construction or Alteration (Determination of No Hazard)	Determination of No Hazard to Air Navigation needed for each structure over 200 feet tall via FAA Form 7460-1.
	Form 7460-2 Notice of Actual Construction or Alteration	Notify FAA of construction via FAA Form 7460-2.
State		
Minnesota Public Utilities Commission (PUC)	Site Permit Application (SPA) for Large Wind Energy Conversion System (LWECS) Site Permit	Required under Minnesota Statute Section 216F for a LWECS that generates 5 MW or more of electricity.
	Certificate of Need (CON) for LWECS	A CON is required under Minnesota Statute Section 216B.2421 for a LWECS unless the project meets exemption criteria set forth within Minnesota Statutes.
	Route Permit	A RP from the PUC is required under Minnesota Statute Section 216E for a high voltage transmission line (HVTL) with a design capacity of 100 kilovolts or more of electricity and 1,500 feet in length.
Minnesota Public Utilities Commission (PUC)	Certificate of Need (CON) for Transmission Line	A CON is required under Minnesota Statute 216B.243 for a HVTL defined by 216B.2421, unless the project meets exemption criteria set forth within Minnesota Statutes.
Minnesota State Historic Preservation Office (SHPO)	Cultural and Historic Resources Review and Review of State and National Register of Historic Sites and Archeological Survey	Consultation with SHPO is recommended. Should Section 106 of the National Historic Preservation Act (NHPA) be triggered, consultation will be mandatory.

Lower Sioux Wind Project – Permitting Matrix Prepared By Westwood Professional Services, Inc. File 20101210.00		
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Location:	**Lower Sioux Indian Community**	No. of Turbines: Nine
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Agency	**Permit/ Approval**	**Need for Permit/ Approval**
Minnesota Pollution Control Agency (MPCA)	Section 401 Water Quality Certification	Individual Section 401 Water Quality Certification or Waiver is required under the Federal Clean Water Act (CWA) for projects that require an Individual Section 404 Permit from the USACE to ensure that authorized activities do not violate state water quality standards.
	National Pollutant Discharge Elimination System Permit (NPDES) – MPCA General Stormwater Permit for Construction Activity (MN R100001)	Coverage under the MPCA General Stormwater Permit for Construction Activity is required for projects that disturb more than one acre of land. In addition to the General Stormwater Permit for Construction Activity, a SWPPP must be submitted for construction sites for a 30-day review, if the site disturbs more than 50 acres and is discharing to impaired or special waters within a mile of the site.
	Very Small Quantity Generator (VSQG) License – Hazardous Waste Collection Program	A VSQG generates 100 kg (220 lbs. or about 22 gal.) or less of hazardous waste per month. Minnesota Rules Chapter 7045 allows the formation of collection sites for VSQG waste. A VSQG may deliver hazardous waste it generates to a collection site, which then ships the waste to a disposal facility.
	Aboveground Storage Tank (AST) Notification Form	The storage of oil is subject to regulation per Minnesota Rules Chapter 7151. Facilities with a storage capacity that exceeds 1,320 gallons must also meet Spill Prevention, Control, and Countermeasure (SPCC) requirements (EPA requirements concerning SPCC are discussed previously).
Minnesota Department of Health (MDH)	Environmental Bore Hole (EBH)	EBH's are regulated by the MDH and the contractor drilling the EBH must be a Minnesota licensed well contractor or Minnesota registered monitoring well contractor boring in conformance with Minnesota Rules Chapter 4725.
Minnesota Department of Transportation	Utility Agreements and Permits	Minnesota Statute Section 161 requires a permit to place utility facilities on trunk highway rights-of-way (ROW).
Minnesota Department of Transportation	Oversize/Overweight Permit for State Highways	Under Minnesota Statute Section 169, a permit is required for hauling construction equipment and materials that exceed height and weight limits on U.S., Interstate, and state highways through Minnesota.
	Aviation Clearance	Structure heights are regulated per the conditions described within Minnesota Rules Chapter 8800 for tall towers. A permit is required for wind turbines located outside the zoned territory of any public use airport with public zoning in place.
Local		
Redwood Soil and Water Conservation District (SWCD)	Wetland Conservation Act (WCA) Approval	Draining, filling, and excavating in wetlands is regulated under WCA and is prohibited unless exempt or replaced by restoring or creating wetland areas.
City of Redwood Falls	General approval of Project	TBD
City of Morton	General approval of Project	TBD
Redwood County Office of the Treasurer	Reporting on assets	TBD
Redwood County Highway Department	Utility Installation Permit	Likely required for if utility lines will intersect County roadways.
	Oversized/Overweight Vehicle Permit	Required for hauling construction equipment and materials on the County road system.
	County Road Entrance Permit/Driveway Permit	County Road Entrance Permit may be required for the installation of new or alteration of existing entrances along the County road system.

Lower Sioux Wind Project – Permitting Matrix Prepared By Westwood Professional Services, Inc. File 20101210.00		
Project Name:	**Lower Sioux Wind Project**	Turbine Design: Assumed turbine with 82.5 meter rotor diameter
Location:	**Lower Sioux Indian Community**	No. of Turbines: Nine
Date:	**June 22, 2011**	Turbine Height: Assumed 121.3 m (398 ft)
Agency	**Permit/ Approval**	**Need for Permit/ Approval**
Sherman Township, Redwood County	General approval of Project	TBD
Paxton Township, Redwood County	General approval of Project	TBD

Fredrikson & Byron, P.A.

MEMO

TO: Westwood Professional Services

FROM: Fredrikson & Byron

DATE: September 27, 2011

RE: Lower Sioux Indian Community: Planned Wind Development

I. INTRODUCTION

The Department of Energy's Tribal Energy Program solicits, awards, administers, and manages financial assistance agreements for renewable energy and energy efficiency projects on tribal lands. The Lower Sioux Indian Community received a Tribal Energy Program grant to evaluate the feasibility of an approximately 10 MW wind project on lands held in trust for the Lower Sioux Indian Community. The Lower Sioux Indian Community has contracted with Westwood Professional Services ("Westwood") to prepare the Lower Sioux Indian Community's feasibility analysis. In preparing the feasibility analysis, Westwood has asked Fredrikson & Byron to address the following issues:

1. The extent to which federal permitting requirements are applicable to the planned project;

2. Whether the setback and permit standards required by the Minnesota Public Utilities Commission (PUC) for site permits for Large Wind Energy Conversion Systems (LWECS) are applicable to the planned project; and

3. Whether state or local jurisdiction applies to the placement of a planned electric transmission line extending from within the Lower Sioux Indian Community boundaries to a substation located outside of the exterior boundary of the Lower Sioux Indian Community.

Generally applicable federal regulations, such as the Clean Water Act and the Clean Air Act, must be adhered to on tribal lands; however, the applicability of federal permitting requirements should be considered on a permit-by-permit basis. While tribal sovereignty will not trump Congressional intent to regulate tribal lands and development activities occurring on those lands, Congress must clearly indicate that an Indian tribe is subject to the law. Additionally, if Bureau of Indian Affairs approval is required for any tribal activities associated with the wind project, NEPA requirements may be triggered.

Based on the information provided by Westwood, the Lower Sioux Community has the authority to site the proposed wind farm on tribal lands following tribal regulations rather than the State of Minnesota regulations. Because the proposed transmission line will be located on non-tribal lands, the project will need to seek approvals from various state and local agencies when siting the transmission line.

II. REGULATORY JURISDICTION

A tribe's power to regulate can be obtained from two sources: (1) a tribe's "treaty power," which is derived from treaties or acts of Congress, or (2) a tribe's inherent sovereignty.[1]

A. Treaty Power

Courts look to the rights and interests granted to tribes in treaties or acts of Congress to determine whether a tribe has "sole" or "exclusive" jurisdiction over certain lands.[2]

In this case, all treaties between the United States and the Mdewakanton Sioux have been abolished, as have the reservations those treaties created and later modified.[3] While the Mdewakanton Sioux entered into multiple treaties with the United States between 1837 and 1858, members from the four Sioux bands revolted in August of 1862 after the United States failed to furnish promised money and supplies to the Sioux. As a result, the United States annulled its treaties with the Sioux and removed the Sioux from state territory.[4]

Rather, acts of Congress relating to the Lower Sioux Indian Community are the authorities that provided the Lower Sioux Indian Community with its tribal lands and potentially, certain powers to regulate. Congress passed three acts in 1888,[5] 1889,[6] and 1890,[7] which appropriated funds for the purchase of land, cattle, horses, and agricultural implements for those "full-blood" loyal Mdewakanton—determined by 1886 census—who had severed their tribal relations.[8] Among the lands purchased (the "1886 lands") were approximately 575 acres located in Redwood County (the "Lower Sioux" lands).[9] Rather than granting the land in fee simple, the Department of the Interior chose to make the land available for use by the loyal Mdewakanton while retaining title in the United States' name.[10]

In 1934, the Indian Reorganization Act fundamentally altered the way in which the federal government dealt with Indians and Indian tribes. The Indian Reorganization Act permitted "[a]ny Indian tribe, or tribes, residing on the same reservation . . . to organize for its common welfare."[11] Pursuant to the Indian Reorganization Act, the Mdewakanton and others formed

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[1] *See, e.g.*, *Brendale v. Confederated Tribes & Bands of Yakima Nation*, 492 U.S. 408, 421 (1989) (examining whether the Yakima Nation had the authority, "derived either from its treaty with the United States or from its status as an independent sovereign, to zone the fee lands owned by Brendale and Wilkinson.").
[2] *See, e.g.*, *Montana v. United States*, 450 U.S. 544, 550-58 (1981).
[3] *See Wolfchild v. United States*, 96 Fed. Cl. 302 (Fed. Cl. 2010).
[4] *Id.*
[5] 25 Stat. 217.
[6] 25 Stat. 980.
[7] 26 Stat. 336.
[8] *Wolfchild v. United States*, 96 Fed. Cl. 302 (Fed. Cl. 2010).
[9] *Id.*
[10] *Id.*
[11] 25 U.S.C. § 16.

three communities: the Shakopee Mdewakanton Sioux Community, the Prairie Island Indian Community, and the Lower Sioux Indian Community.[12]

After the passage of the Indian Reorganization Act, "additional lands were acquired in trust for the benefit of" the three communities.[13] As a result, the three communities had "two classes of members: all members of the community who were entitled to the benefits of the tribal lands acquired under the Reorganization Act and members who were descendants of the 1886 Mdewakanton and who had exclusive rights to the benefits of the 1886 lands."[14] The property interests possessed by the two classes of members of the three communities were interspersed and resulted in "a checkerboard pattern of land used that severely diminishe[d] the effectiveness of overall land management programs and community development."[15] In a lame-duck session following the 1980 elections, Congress statutorily addressed the disparate property interests of the members of the three communities in December 1980.[16]

The 1980 Act provided that the 1886 lands, which "were acquired and are now held by the United States for the use or benefit of certain Mdewakanton Sioux Indians" under the Appropriations Acts, would from that time forward be "held by the United States . . . in trust for" the three communities.[17] The 1980 Act also contained a savings clause providing that the 1980 Act would not "alter" any rights then existing under "any contract, lease, or assignment entered into or issued prior to enactment of" the 1980 Act.[18] As a result, all of the individuals then holding assignments to the 1886 lands retained their rights to use the land unaffected by the 1980 legislation.[19] Upon the death of an assignee of the 1886 lands, the assignee's parcel of land was shifted to the control of the community that possessed an interest in the surrounding land pursuant to the 1980 Act.[20]

While the 1980 Act states that the 1886 lands were held by the United States for the "use and benefit" of certain Mdewakanton Sioux Indians," neither the Appropriation Acts nor the 1980 Act provide the Lower Sioux Indian Community with the "exclusive" or "sole" use and benefit of the lands, and land use and zoning regulation are not specifically addressed by the acts. Therefore, the Appropriation Acts and the 1980 Act cannot be used to demonstrate the Lower Sioux Indian Community's power to exclusively regulate the siting of wind turbines or transmission lines within the exterior boundaries of the reservation. On the other hand, the Acts do not include any language which could be interpreted to provide state or local governments with regulatory jurisdiction over the Lower Sioux lands.

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[12] *Wolfchild v. United States*, 96 Fed. Cl. 302 (Fed. Cl. 2010).
[13] *See* H.R. Rep. No. 96-1409, at 2 (1980).
[14] *Id.*
[15] *See id.* at 6.
[16] *See* Act of Dec. 19, 1980, Pub.L. No. 96-557, 94 Stat. 3262 (the "1980 Act").
[17] *Id.*
[18] *Id.*
[19] *Wolfchild v. United States*, 96 Fed. Cl. 302 (Fed. Cl. 2010).
[20] *Id.*

B. Inherent Tribal Sovereignty

1. Federal Regulation

At one time the United States Supreme Court held the view that Indian tribes were wholly distinct nations; however, the Court has since acknowledged limitations on tribal sovereignty. Today, Indian tribes function as quasi sovereign entities. They possess the inherent rights of sovereignty; however, "[w]here Congress clearly indicates that Indian tribes are subject to a given law, no tribal sovereignty exists to bar the reach or enforcement of that law."[21] Generally speaking, federal laws of general application, such as the Clean Water Act and the Clean Air Act, apply on tribal land, and any associated permitting requirements are also likely applicable. Because Congress must clearly indicate its intent to regulate Indian tribes under federal laws, the statutory language authorizing a federal permitting requirement should be separately reviewed to determine whether Congress has clearly expressed its intention to regulate tribal activities.

Additionally, certain actions taken in regard to tribal land require federal authorization and as a result, may trigger NEPA requirements. For example, under 25 U.S.C. § 415, most leases of tribal land must receive Bureau of Indian Affairs (BIA) approval. Granting an easement or using tribal land as security for financing may also require BIA approval and trigger NEPA requirements.

2. Tribal versus State: Common Law Principles

As noted above, Indian tribes were once viewed as wholly sovereign nations, and within tribal boundaries, state laws were given no force.[22] For example, the Court has held that Indian tribes have been implicitly divested of their sovereignty in certain respects by virtue of their dependent status,[23] that under certain circumstances a State may validly assert authority over the activities of nonmembers on a reservation,[24] and that in exceptional circumstances a State may assert jurisdiction over the on-reservation activities of tribal members.[25]

Nevertheless, in developing the respective areas of state and tribal authority over Indian reservations, the Court has continued to stress that Indian tribes are unique aggregations possessing '"attributes of sovereignty over both their members and their territory,'"[26] Because of their sovereign status, tribes and their reservation lands are insulated in some respects by a "historic immunity from state and local control."[27]

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[21] *Blue Legs v. U.S. Bureau of Indian Affairs*, 867 F.2d 1094, 1097 (8th Cir. 1989).
[22] *Worcester v. Georgia*, 31 U.S. 515, 560 (1832).
[23] *See, e.g.*, *Oneida Indian Nation v. County of Oneida*, 414 U.S. 661, 667-668 (1974).
[24] *See, e.g.*, *Brendale v. Confederated Tribes & Bands of Yakima Nation*, 492 U.S. 408, 421-25 (1989); *Montana v. United States*, 450 U. S. 544, 550-57 (1981).
[25] *See generally Puyallup Tribe v. Washington Game Dept.*, 433 U.S. 165 (1977).
[26] *White Mountain Apache Tribe v. Bracker*, 448 U. S. 136, 142 (1980) (quoting *United States v. Mazurie*, 419 U. S. 544, 557 (1975)).
[27] *Mescalero Apache Tribe v. Jones*, 411 U.S. 145, 152 (1973).

The sovereignty retained by tribes includes "the power of regulating their internal and social relations,"[28] and United States Supreme Court case law establishes that '"absent governing Acts of Congress,"' a State may not act in a manner that '"infringe[s] on the right of reservation Indians to make their own laws and be ruled by them."'[29]

3. *Tribal Versus State: Power to Regulate Tribal Trust Land*

These general principles regarding the tribal power to regulate are allocated considerable strength in regard to tribal regulation of tribal trust land and tribal members. The United States Court of Appeals for the Ninth Circuit, in its opinion in *Santa Rosa Band of Indians v. Kings County*, noted that "any concurrent jurisdiction the states might inherently have possessed to regulate Indian use of reservation lands has long ago been preempted by extensive Federal policy and legislation."[30] In discussing jurisdiction over land held in trust by the United States for the use and benefit of the Santa Rosa Band of Indians, the Ninth Circuit explained:

> Congress, by the Indian Reorganization Act, authorized the government to purchase the lands involved here, and to hold the title in trust; it also authorized adoption of a tribal constitution for the exercise of tribal self-government over the area. 25 U.S.C. § 476. Against the historical backdrop of tribal sovereignty (subject only to the paramount power of the United States) over reservation lands, we have little doubt that Congress assumed and intended that states have no power to regulate the Indian use or governance of the reservation, provided, except as Congress chose to grant that power.[31]

The Ninth Circuit ultimately held that Kings County's Zoning Ordinance and Building Code were not applicable on reservation trust lands.[32] The Eighth Circuit, citing the *Santa Rosa* opinion, further noted that the Indian Reorganization Act "does not support an extension of civil jurisdiction to the states that could undermine tribal government, a possible result if tribal governments and reservation Indians were subordinated to the full panoply of civil regulatory powers,"[33] and the United States Supreme Court interpreted Public Law 280, an act that provided state governments with some criminal and civil jurisdiction over tribes, as not giving the state of Minnesota general regulatory authority over tribal members living on the reservation.[34] Therefore, without an express Congressional grant of power, state and local regulations are generally not applicable in regard to tribe-member actions occurring on tribal trust lands.

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[28] *United States v. Kagama*, 118 U. S. 375, 381-382 (1886) (cited in *United States v. Wheeler*, 435 U. S. 313, 322 (1978))

[29] *McClanahan v. Arizona State Tax Comm'n*, 411 U. S. 164, 171-172 (1973) (quoting *Williams v. Lee*, 358 U. S. 217, 219-220 (1959)). *See also In re Otter Tail Power Co.*, 116 F.3d 1207, 1214 (8th Cir. 1997).

[30] 532 F.2d 655, 658 (9th Cir. 1975).

[31] *Id.*

[32] *Id.* at 659 ("Thus the County is without jurisdiction to enforce its zoning ordinance or building code on the [reservation] unless such jurisdiction is explicitly granted by P.L. 280, 28 U.S.C. § 1360. We hold for a number of alternative reasons, that P.L. 280 does not confer such jurisdiction.")

[33] *Shakopee Mdewakanton Sioux Community v. City of Prior Lake*, 771 F.2d 1153, 1157 (8th Cir. 1985).

[34] *Bryan v. Itasca County, Minnesota*, 426 U.S. 373, 383-90 (1976).

There are, however, exceptions to the general rule. As noted above, in exceptional circumstances a State may assert jurisdiction over the on-reservation activities of tribal members. In *Puyallup Tribe Inc. v. Washington Dept. of Game*, the Court upheld the State of Washington's authority to regulate on-reservation fishing by tribal members.[35] While the decision in *Puyallup* rested in part on the fact that the dispute centered on lands which, although located within the reservation boundaries, had been alienated in fee simple and no longer belonged to the tribe, the Court also relied on a provision of the Indian treaty which qualified the Indians' fishing rights by requiring that they be exercised "in common with all citizens of the Territory," and on the State's interest in conserving a scarce, common resource.[36]

Drawing guidance from *Puyallup*, the Minnesota Supreme Court recently held that uniform enforcement of state election laws in an election for state legislative office does not interfere with tribal self-sufficiency or tribal economic development, regardless of whether the election-related activities at issue occurred on the reservation.[37] In reaching its decision, the Minnesota Supreme Court explained that "'the state interests at stake' may be 'sufficient to justify the assertion of state authority,' even if state jurisdiction 'interferes or is incompatible with federal and tribal interest reflected in federal law.'" [38] The Minnesota Supreme Court further noted that the "tribal interests to be balanced against state interests are 'traditional notions of Indian sovereignty' and the congressional goal of Indian self-government, including its 'overriding goal of encouraging tribal self-sufficiency and economic development.'"[39]

Further, *Paquin* explained that Public Law 280 does not bar the assertion by Minnesota of jurisdiction over activities of Indians "going beyond reservation boundaries[,]" and that running for state legislative office and signing a nominating petition for state legislative office are such activities.[40]

4. Applicability of PUC Setbacks to Wind Development on Lower Sioux Indian Community Trust Lands

Minnesota Statutes section 216F.08 provides counties with the option to assume responsibility over processing wind site permitting for LWECS less than 25 MW in total nameplate capacity. Redwood County, however, has not assumed this permit authority.[41] Thus, if the state has jurisdiction over the Lower Sioux Indian Community's planned project, the PUC's general permitting and setback requirements will apply. PUC-issued site permits have "required minimum setbacks from certain land uses or structures to protect public safety, to ensure

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[35] *See Puyallup*, 433 U.S. at 165-66.
[36] *See id.* at 173-77.
[37] *Paquin v. Mack*, 788 N.W.2d 899, 905 (Minn. 2010).
[38] *Id.* (quoting *New Mexico v. Mescalero Apache Tribe*, 462 U.S. 324, 331-32 (1983)).
[39] *Id.* (quoting *New Mexico v. Mescalero Apache Tribe*, 462 U.S. 324, 334-35 (1983)).
[40] *Id.* (quoting *Mescalero Apache Tribe v. Jones*, 411 U.S. 145, 148-49 (1973)).
[41] *See generally* PUC Docket No. E,G999/M-07-1102.

compliance with Minnesota Statutes Chapter 216F and Minnesota Rules Chapter 7854, and to ensure orderly development of wind resources."[42]

Based on land ownership information provided by Westwood, wind turbines constructed as a part of the Lower Sioux Indian Community's project will be placed wholley on tribal trust lands within the exterior boundaries of the Lower Sioux Indian Community reservation. The Lower Sioux Indian Community holds inherent sovereignty over its trust lands, and the state is precluded from asserting regulatory jurisdiction over those lands, including its regulatory authority relating to wind-turbine siting. Similar to the factual scenario in *Santa Rosa*, the Indian Reorganization Act provided the federal government with the authority to hold the title of the Lower Sioux lands in trust; and it also authorized the adoption of a tribal constitution for the exercise of tribal self-government over the area. Congress assumed and intended that Minnesota has no power to regulate the Lower Sioux Indian Community's use or governance of the trust lands.

Two additional factors, however, may provide the state with arguments for jurisdiction over wind turbine siting on Lower Sioux lands: (1) off-reservation effects and effects on nonmembers and (2) the Lower Sioux Indian Community's submission to state jurisdiction.[43]

As discussed above, Minnesota is authorized to assert its jurisdiction over tribal activities that go beyond reservation boundaries.[44] If wind-turbine-related issues the PUC's setback requirements are intended to address (*e.g.*, detrimental affects to neighboring wind rights owners, noise, etc.) have the potential to affect non-reservation lands, Minnesota may have a meritorious argument – both in terms of off-reservation activities and comparative interests – that state jurisdiction over wind-turbine siting should apply to the planned wind development regardless of turbine placement on trust lands.

Additionally, Minnesota may argue that the Lower Sioux Indian Community's constitution supports the application of the PUC's permitting and setback requirements. The Preamble to the Constitution of the Lower Sioux Indian Community in Minnesota, provides as follows:

> We, the Minnesota Mdewakanton Sioux residing on the Lower Sioux Reservation under the Pipestone jurisdiction in the State of Minnesota, in order to form a more perfect union, develop our natural resources, insure our domestic tranquility, promote the general welfare, to enjoy certain rights of home rule, . . .and to secure the opportunities offered us under the Indian Reorganization Act, do hereby establish the following Constitution and Bylaws; and we solemnly affirm that *it is our earnest intention faithfully to support, respect and promote the integrity of* the Constitution of

[42] Minnesota Department of Commerce, *Summary of Historic PUC Wind Setbacks and Standards*, In the Matter of Establishment of General Permit Standards for the Siting of Wind Generation Projects Less than 25 Megawatts (PUC Docket No. E,G999/M-07-1102), Sept. 28, 2007.
[43] Further, if tribal activities will have impact State of Minnesota road rights of ways extending through the Lower Sioux Indian Community, applicable state regulations may apply.
[44] *See Paquin*, 788 N.W. 2d at 905.

> the United States and *the Constitution of the State of Minnesota, together with all laws pertaining thereto which are the constituted authority of our common wealth*.[45]

An "earnest intention faithfully to support, respect, and promote" is not an express statement that the Lower Sioux Indian Community will submit to state jurisdiction and should not be read as such; however, if the Lower Sioux Indian Community has established a course of conduct or has any agreements with the state that demonstrates the tribe's submission to state regulatory jurisdiction, these factors may weigh in favor of a state argument for jurisdiction over the planned project.

5. State and County Regulation of Transmission Lines

The Lower Sioux Indian Community's currently planned project will include a transmission line of unknown voltage and length, extending from within the reservation to a substation located outside of the exterior boundary of the reservation. Because the Lower Sioux Indian Community's transmission line will extend beyond the boundary of the reservation, the exterior portion of the line will be subject to applicable state or local laws and regulations.

III. RECOMMENDATIONS

A. Federal Regulation

Congress has the authority to exert regulatory jurisdiction over tribal activities. Generally, when developing the project, Westwood should assume that federal regulations apply; however, if issues arise, potentially applicable federal permitting requirements should be examined on a case-by-case basis to determine if Congress has clearly expressed its intention for a federal law or permitting requirement to govern tribal activities.

Additionally, certain tribal activities affecting tribal trust lands, such as leasing or encumbering those lands, require the approval of the BIA. Westwood should consult with the Lower Sioux Indian Community to determine whether the proposed project structure or development activities will require BIA authorization. If so, NEPA requirements will likely apply to the wind project.

B. PUC Setbacks

Minnesota cannot assert regulatory jurisdiction over tribal activities solely affecting tribal lands held in trust and tribal members. Therefore, if the Lower Sioux Indian Community's wind-turbine siting will only affect trust lands and tribal members, the PUC's setbacks are not applicable to the planned wind project.

If the Lower Sioux Indian Community's turbine siting has the potential to affect lands or property interests that are not held in trust for the Lower Sioux Indian Community, Minnesota

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[45] Constitution of the Lower Sioux Indian Community in Minnesota, as amended through September 19, 2007.

may attempt to assert jurisdiction over the project due to the wind development's impact(s) on nonmembers or nontrust lands.

In either circumstance, we recommend that the Lower Sioux Indian Community follow the PUC's setback requirements. By applying the PUC's setback requirements to wind-turbine siting, the Lower Sioux Indian Community will ensure that no related jurisdictional questions will arise.

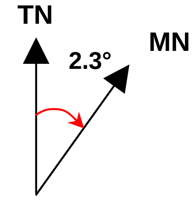
C. State/Local Regulation of Transmission Lines

Depending on the voltage and length of the transmission line, state or local jurisdiction will apply to the portion of the transmission line located outside of the exterior boundary of the reservation, and additionally, state/local jurisdiction may apply to any portion of the line located on nontrust lands. Therefore, it is recommended that the Lower Sioux Indian Community comply with applicable state or local regulations (dependent upon line length and voltage) with respect to the portion of the line located outside of the reservation boundary.

4937837_3

NATIONAL WIND ASSESSMENTS

402 Demers Ave., Suite 201
Grand Forks, ND 58201
Phone: (701) 757-1044



LOCATION: *Redwood Falls, MN*
(Nearest Town/Landmark) *Landowner: Lower Sioux Indian Community*

Magnetic Declination: ***2.3 ° E***

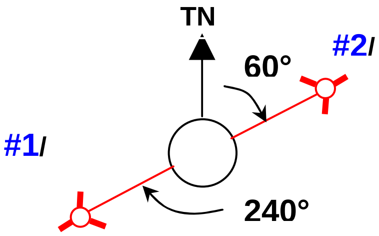
Installation Date: *12/18 /10*
Installer: *Fred Romuld & crew*
Tower: *NRG 60m XHD Tilt-up*
Owner: *Jackpot Junction Casino*
Contact: *Westwood Professional Services*
Jack Hays (952) 937-5150

SENSOR CONFIGURATION

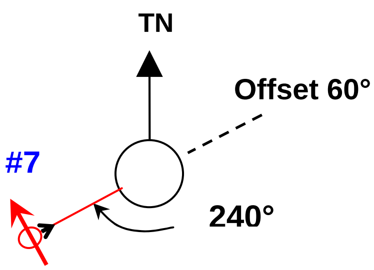
Typical Boom Length: ***95.0"***

POSITION | ***HIEGHTS***

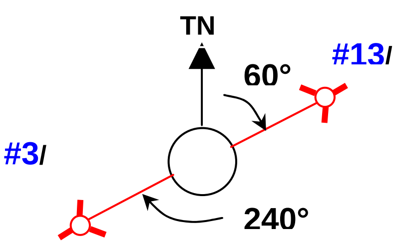
Tower: ***197'-5"***
L.R.:



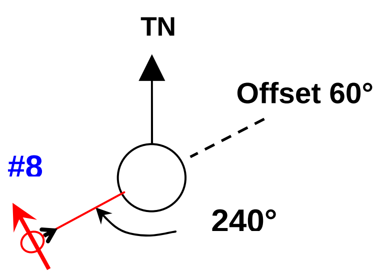
193'-6"
(58.98 m)



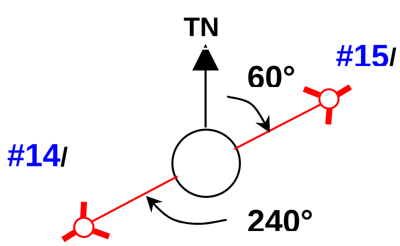
187'-6"
(57.15 m)



155'-3"
(47.32 m)



139'-9"
(42.60 m)



104'-0"
(31.70 m)

Data Logger Type: *NRG SymphoniePlus*
Site #:
SN:
Time Zone: *-6 (CST)*

iPack Type: *NRG Symphonie/CDMA*
SN:
ESN:
MDN:
Antenna signal strength: *100% @ 7'*
(Height & Direction)

Call-In Schedule
First day of call-in: *12/20/10*
Call Schedule: *Every 7 days (Monday)*
Call-In time: *1:30 pm (CST)*

GPS *(Garmin)*
Latitude: *N44° 31.917'*
Longitude: *W095° 0.538'*
Datum: ***WGS84***
Elevation: *299 m (980 ft)*
UTM:

Zone:

Instruments/Equipment
Temperature: *#12 @ 6'*
Barometric Press: *#11 @ 5', SN/1805*
Voltmeter: *#10*
Types: Anemometer: *NRG #40C*
Direction Vane: *NRG #200P*
Anchors: *8" Screw-in*
Anchor Locker Tested to: *NA*
Movement Noted: *NA*

Tower Marking: *AV70 Solar Airfield Light, 4-Marking Balls placed 22' down the top guy wire & guy shields.*

Ground Voltage: *NA*
Ground Resistance: *NA*

Notes: *The tower was set on the ground at 150° toward the SE.*

7699 Anagram Drive
Eden Prairie, MN 55344

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www.westwoodps.com

2011 ANNUAL WIND REPORT

Date: April 5, 2012

To: Darin Minkel, CEO, Dakota Futures

From: Joey Vossen and Nathan Franzen, Westwood Professional Services

The following is the Annual Wind Report for the year **2011**, as part of Westwood Professional Services' Wind Feasibility Study for the Lower Sioux Indian Community.

Overview

The data for this report was collected from the meteorological (met) tower located at the Lower Sioux Indian Community. This report collects data reported between 1/1/11 12:00AM and 11/1/11 12:00AM. It incorporates data from six anemometers and two wind vanes, along with temperature, air density, and barometric pressure sensors. The met tower is located approximately one half mile west of the Jackpot Junction Casino Hotel.

The met tower used at the Lower Sioux Indian Community is a 60-meter tower from NRG Systems. The datalogger is a NRG SymphoniePlus, which transmits data over a CDMA cellular network using the NRG Symphonie iPack.

The tower is configured with six NRG #40C anemometers, offset from true North by 60 and 240 degrees (three at each angle) to minimize the effects of tower shading in the prevailing winds from the northwest. The six anemometers are mounted at three heights: 58.98 meters, 47.32m, and 31.70m. These staggered sensor heights are used to measure wind shear, meaning the change in wind speed across a vertical dimension, and predict wind speeds at elevations higher than the met tower itself.

The tower also utilizes two wind direction vanes, the NRG #200P, mounted at 57.15m and 42.6m. These wind vanes are offset from true North by 240 degrees. Additional tower-mounted sensors include temperature and barometric pressure sensors mounted six feet above the tower base.

The following table describes overall trends and measurement variables described in this report.

Variable	Value
Latitude	N 44° 32' 0.000"
Longitude	W 95° 1' 0.000"
Elevation	299 m
Start date	1/1/2011 0:00
End date	1/1/2012 0:00
Duration	12 months
Length of time step	10 minutes
Calm threshold	0 m/s
Mean temperature	8.02 °C
Mean pressure	978.9 mbar
Mean air density	1.216 kg/m^3
Power density at 50m	202 W/m^2
Wind power class	2 (Marginal)
Power law exponent	0.417
Surface roughness	3.89 m
Roughness class	5.04
Roughness description	Urban

Table 1

Wind Speed Assessment

The recorded average wind speed at this location for the year 2011, at an anemometer height of 59 meters (193 feet), is **6.071 meters per second (13.58 mph)**. This wind speed is based on the combined average wind speeds of the two anemometers located at 59m. The following table shows cumulative monthly average wind speeds for 2011, and the following figure shows the same as a graph.

Anemometer	59m A	59m B	47m A	47m B	32m A	32m B
January 2011	5.485	5.502	4.906	5.114	4.05	4.487
February 2011	6.612	6.581	5.925	6.105	4.979	5.364
March 2011	6.025	6.064	5.344	5.692	4.457	5.046
April 2011	6.721	6.717	6.063	6.356	5.247	5.651
May 2011	6.925	6.724	6.186	6.275	5.269	5.528
June 2011	6.333	6.228	5.533	5.864	4.737	5.061
July 2011	5.056	5.063	4.191	4.659	3.476	3.956
August 2011	4.642	4.663	3.736	4.298	3.095	3.549
September 2011	5.356	5.203	4.515	4.786	3.742	4.006
October 2011	6.698	6.816	5.934	6.245	5.012	5.435
November 2011	6.832	6.804	6.11	6.269	5.135	5.444
December 2011	6.216	6.256	5.507	5.788	4.556	5.006
Average (m/s)	**6.075**	**6.052**	**5.329**	**5.621**	**4.480**	**4.878**
Average (mph)	**13.59**	**13.54**	**11.92**	**12.57**	**10.02**	**10.91**

Table 2

Figure 1

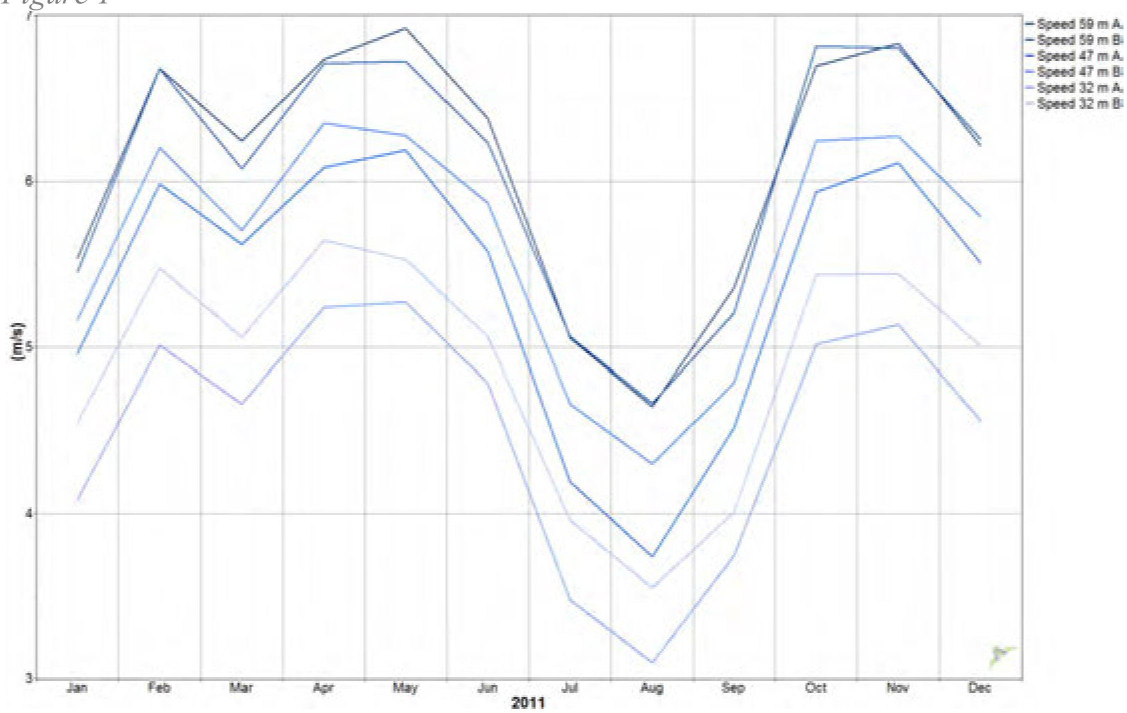


Table 3 below shows average, median, and maximum wind speeds for all anemometers, plus mean wind power density and energy content. These are measurements of the amount of usable energy contained in the wind.

Anemometer	59 m A	59 m B	47 m A	47 m B	32 m A	32 m B
Measurement height (m)	59	59	47	47	32	32
Mean wind speed (m/s)	6.094	6.048	5.348	5.624	4.490	4.883
Median wind speed (m/s)	5.900	5.800	5.100	5.300	4.200	4.500
Max wind speed (m/s)	22.900	22.200	21.800	21.000	20.100	19.000
Mean power density (W/m²)	240	234	186	194	127	139
Mean energy content (kWh/m²/yr)	2,105	2,047	1,630	1,697	1,112	1,217

Table 3

Table 4 below ranks each month's average wind speed at 59m, from most to least windiest. May was the windiest month of the year at 6.825 m/s (15.27 mph), and August was the least windy month at 4.653 m/s (10.41 mph).

Month	Wind Speed (m/s)
May-11	6.825
Nov-11	6.818
Oct-11	6.757
Apr-11	6.719
Feb-11	6.597
Jun-11	6.281
Dec-11	6.236
Mar-11	6.045
Jan-11	5.494
Sep-11	5.280
Jul-11	5.060
Aug-11	4.653

Table 4

Probability Distribution Functions

The probability distribution function *f(x)* gives the probability that the wind will blow at a certain speed. Here it is expressed graphically using a frequency histogram, which gives the frequency with which the wind speed falls within certain ranges, or "bins."

Figures 3 and 4 are histograms showing wind speed probability distribution functions for the six anemometers. Hourly wind speeds were sorted into bins, with each bin representing 0.5 m/s. Each bar represents the frequency with which wind speeds occurred in each bin.

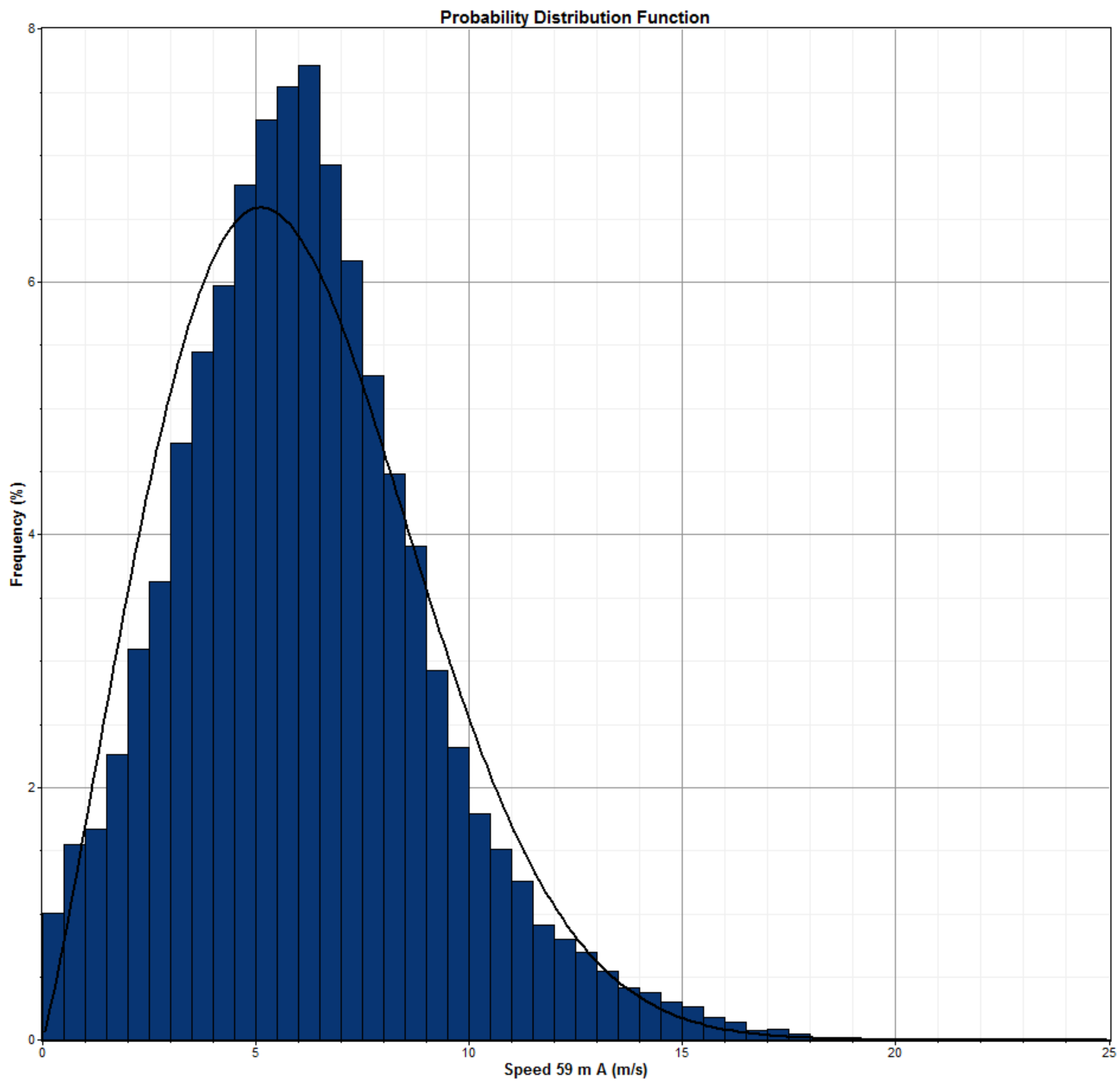


Figure 2

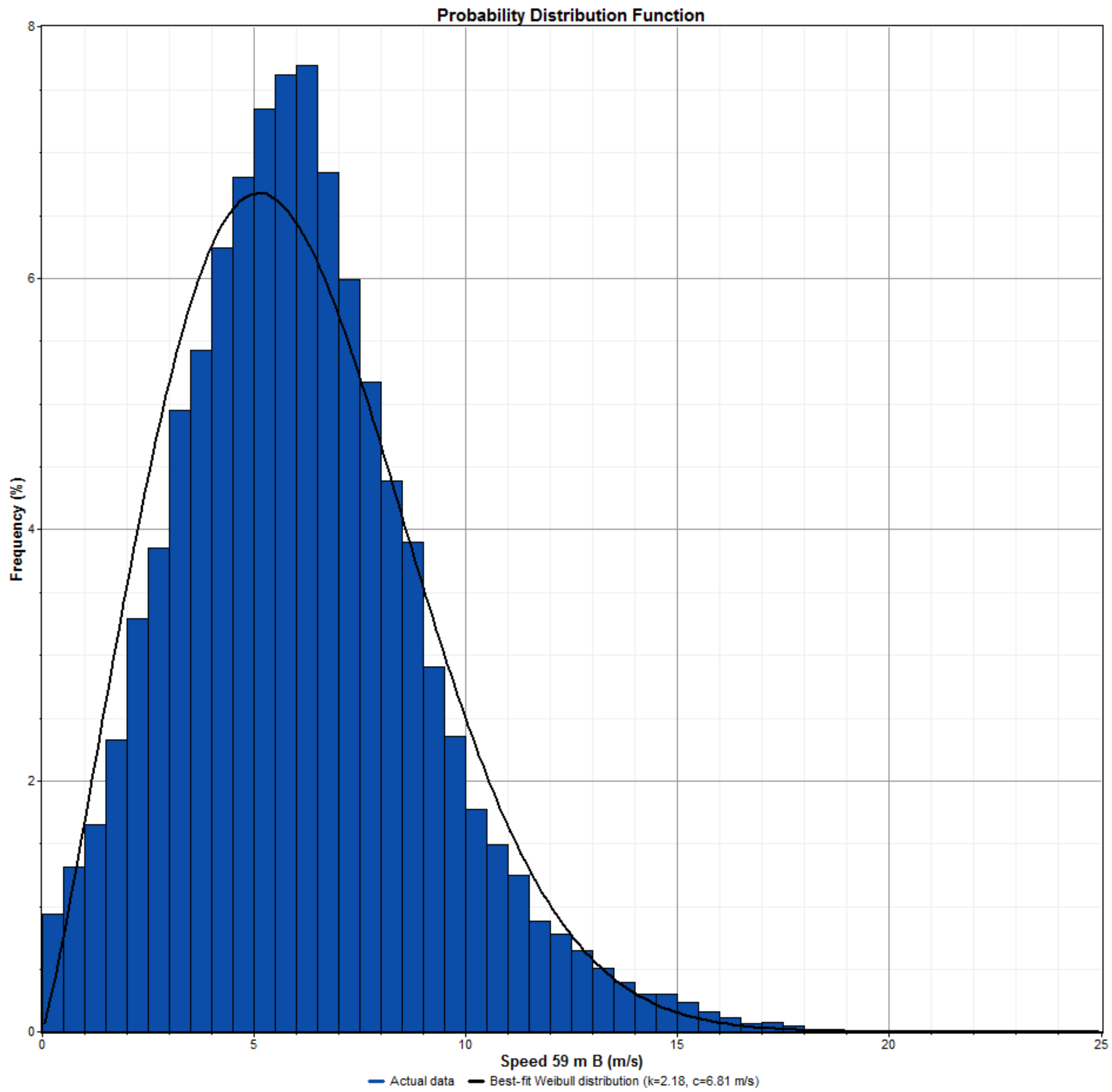


Figure 3

The black line represents the best-fit Weibull distribution, which is a statistical approximation of the wind speed values. The Weibull *k* value is a factor reflecting the breadth of the wind speed distribution. Lower *k* values correspond to broad distributions where the wind speed tends to vary widely, and higher *k* values correspond to tighter distributions where the wind speed tends to stay within a narrower range. The functions for anemometers 59m A and 59m B have *k* values of 2.16 and 2.18, respectively, indicating a fairly tight distribution of wind speeds.

Table 5 illustrates the same frequency data as shown in the histograms. In this table, each “occurrence” is a ten-minute time step.

	Bin Endpoints (m/s)		Speed 59m A		Speed 59m B	
	Lower	**Upper**	**Occurrences**	**Frequency (%)**	**Occurrences**	**Frequency (%)**
1	0.0	0.5	492	0.998	469	0.941
2	0.5	1.0	761	1.543	653	1.31
3	1.0	1.5	824	1.671	824	1.653
4	1.5	2.0	1,111	2.253	1,158	2.324
5	2.0	2.5	1,525	3.093	1,640	3.291
6	2.5	3.0	1,789	3.628	1,917	3.847
7	3.0	3.5	2,330	4.726	2,467	4.95
8	3.5	4.0	2,684	5.444	2,702	5.422
9	4.0	4.5	2,942	5.967	3,108	6.236
10	4.5	5.0	3,335	6.764	3,391	6.804
11	5.0	5.5	3,591	7.283	3,660	7.344
12	5.5	6.0	3,719	7.543	3,797	7.619
13	6.0	6.5	3,801	7.709	3,834	7.693
14	6.5	7.0	3,415	6.926	3,406	6.834
15	7.0	7.5	3,041	6.168	2,982	5.984
16	7.5	8.0	2,590	5.253	2,577	5.171
17	8.0	8.5	2,206	4.474	2,185	4.384
18	8.5	9.0	1,928	3.91	1,942	3.897
19	9.0	9.5	1,440	2.921	1,446	2.901
20	9.5	10.0	1,142	2.316	1,170	2.348
21	10.0	10.5	883	1.791	884	1.774
22	10.5	11.0	745	1.511	742	1.489
23	11.0	11.5	619	1.255	623	1.25
24	11.5	12.0	448	0.909	438	0.879
25	12.0	12.5	393	0.797	387	0.777
26	12.5	13.0	344	0.698	322	0.646
27	13.0	13.5	268	0.544	252	0.506
28	13.5	14.0	202	0.41	196	0.393
29	14.0	14.5	186	0.377	151	0.303
30	14.5	15.0	149	0.302	150	0.301
31	15.0	15.5	128	0.26	117	0.235
32	15.5	16.0	86	0.174	78	0.157
33	16.0	16.5	68	0.138	58	0.116
34	16.5	17.0	36	0.073	32	0.064
35	17.0	17.5	41	0.083	37	0.074
36	17.5	18.0	22	0.045	23	0.046
37	18.0	18.5	9	0.018	7	0.014
38	18.5	19.0	6	0.012	6	0.012
39	19.0	19.5	3	0.006	3	0.006
40	19.5	20.0	0	0	0	0
41	20.0	20.5	0	0	0	0
42	20.5	21.0	2	0.004	2	0.004
43	21.0	21.5	0	0	0	0
44	21.5	22.0	0	0	0	0
45	22.0	22.5	1	0.002	1	0.002
46	22.5	23.0	1	0.002	0	0

Table 5

Diurnal Profile

The diurnal profile represents the recorded average wind speed for a given hour of an average day in 2011. The average daily profile of wind speed is found by calculating the average value of all of the points that occur within the hour of 12:00am to 1:00am, then all those that occur within the hour of 1:00am to 2:00am, and so on for each of the 24 hours of the day. The profile illustrates how wind speeds change with altitude and temperature. Generally, as temperature rises, so does wind speed. This is due to the decrease in air density that rising temperatures cause. Closer to the earth's surface, wind speeds change dramatically during the day, climbing in the afternoon and falling again at night. At higher altitudes, where the air is colder, wind speeds are steadier, with less diurnal fluctuation. As the altitude gets even higher this trend reverses, with higher wind speeds at night than during the day. Figure 4 shows the diurnal wind speed profile at the met tower. Table 6 presents the same wind speed data as Figure 4.

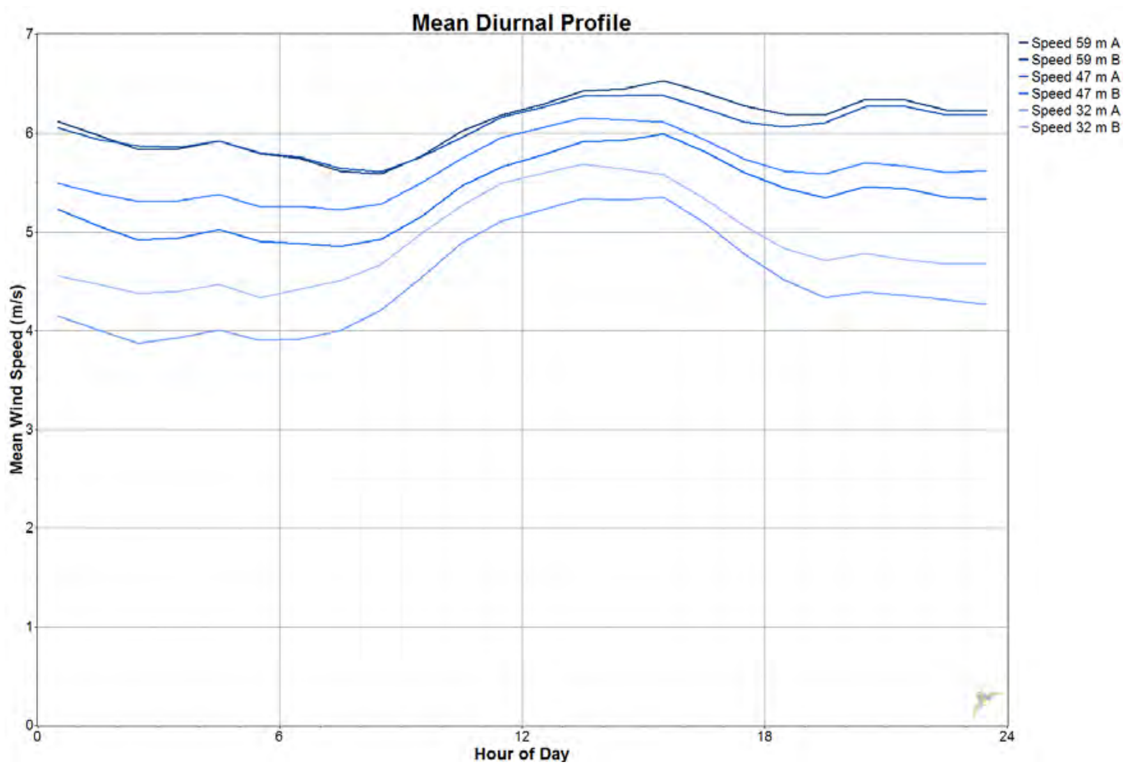


Figure 4

Hour	Mean (m/s)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	All
00:00 - 01:00	5.70	7.16	5.83	6.37	7.05	6.20	5.11	4.74	5.48	6.72	7.26	6.02	6.12
01:00 - 02:00	5.40	6.90	5.87	6.17	6.86	5.99	5.01	4.39	5.41	6.55	7.02	6.20	5.97
02:00 - 03:00	5.42	6.73	5.57	5.84	6.64	5.81	4.93	4.45	5.37	6.15	7.15	6.08	5.83
03:00 - 04:00	5.11	6.93	5.64	6.16	6.47	5.85	5.02	4.44	5.19	5.99	7.05	6.46	5.84
04:00 - 05:00	5.20	6.74	5.97	6.23	6.63	5.94	5.33	4.56	5.33	5.95	6.83	6.49	5.92
05:00 - 06:00	5.01	6.48	5.76	6.09	6.52	5.80	5.08	4.49	5.30	5.96	6.52	6.53	5.79
06:00 - 07:00	5.02	6.34	6.09	6.12	6.20	6.00	4.79	4.22	5.22	6.04	6.46	6.61	5.74
07:00 - 08:00	5.07	6.13	6.05	6.32	6.15	6.04	4.28	3.66	4.78	5.90	6.54	6.74	5.61
08:00 - 09:00	4.96	6.20	5.79	6.54	6.49	6.61	4.50	3.48	4.23	5.67	6.16	6.70	5.58
09:00 - 10:00	5.11	5.85	6.19	6.86	6.92	6.70	4.59	3.93	4.60	6.01	6.09	6.59	5.76
10:00 - 11:00	5.23	5.72	6.32	7.30	7.16	6.91	4.75	4.22	5.27	6.53	6.43	6.52	6.02
11:00 - 12:00	5.23	5.73	6.65	7.18	7.36	7.08	4.99	4.59	5.42	7.19	6.62	6.37	6.18
12:00 - 13:00	5.15	5.99	6.52	7.32	7.24	6.94	5.14	4.83	5.43	7.51	7.11	6.36	6.29
13:00 - 14:00	5.57	6.35	6.07	7.69	7.25	7.06	5.12	5.11	5.66	7.93	7.25	6.12	6.42
14:00 - 15:00	5.55	6.41	6.30	7.73	7.39	7.18	4.96	5.23	5.82	7.88	7.16	5.92	6.45
15:00 - 16:00	5.88	6.70	6.50	7.78	7.46	6.86	5.29	5.20	5.97	7.85	7.10	5.81	6.53
16:00 - 17:00	5.91	6.84	6.53	7.44	7.53	7.08	5.48	5.16	5.75	7.15	6.76	5.52	6.41
17:00 - 18:00	5.95	7.30	6.67	6.90	7.60	6.52	5.32	5.10	5.37	6.49	6.66	5.69	6.28
18:00 - 19:00	6.04	7.17	6.59	6.70	6.99	6.47	5.11	4.73	5.38	6.64	6.69	5.94	6.19
19:00 - 20:00	6.16	7.49	6.44	6.50	6.66	6.07	5.02	4.86	5.63	6.81	6.66	6.06	6.18
20:00 - 21:00	6.08	7.48	6.90	6.62	6.76	5.90	5.46	5.21	5.72	7.22	6.95	5.95	6.34
21:00 - 22:00	5.97	7.21	6.93	6.76	7.12	5.92	5.56	5.12	5.49	7.00	7.21	5.94	6.33
22:00 - 23:00	6.14	7.12	6.62	6.53	6.97	6.05	5.28	4.91	5.35	6.76	7.19	6.07	6.23
23:00 - 24:00	5.88	7.29	6.40	6.52	6.84	5.89	5.23	4.87	5.54	6.71	7.12	6.51	6.23
All	5.53	6.68	6.25	6.74	6.93	6.38	5.06	4.64	5.36	6.70	6.83	6.22	6.09

Table 6

Wind Shear

Wind shear is the change in wind speed with height above ground. The wind speed tends to increase with the elevation. For this reason, wind turbines are generally mounted on the tallest tower possible. In order for the met tower data to be useful at higher altitudes (such as the hub height of a wind turbine), it must be vertically extrapolated through a formula applied to each wind speed record that adjusts it upward to the new altitude. There are two formulas for this process: the logarithmic law formula ("log law") and the power law formula. Both are common to the wind industry; however, they tend to produce different results. As the distance from the known altitude to the estimated altitude grows, the gap between the formulas' results spread further apart, with the log law being the more conservative (lower) of the two estimates. These formulas depend on collected wind shear data to predict wind speeds at higher altitudes. For example, as shown in the figure below, the power law formula predicts that wind speeds will be 7 m/s at 80 meters. This wind shear data has been used to estimate wind turbine energy production.

The data show a high wind shear at the met tower location. This is typically due to increased ground cover, or "surface roughness," on the Earth's surface. Numerous factors can account for this surface roughness at the tower site:

- Light forest to the north and east
- Higher land elevation to the north
- Residences to the north and east
- Casino buildings to the east

Wind speed changes drastically as these obstacles are cleared by the wind. If the tower were located in open prairie the wind shear would be lower, as the ground wind speed would be higher with fewer obstacles. The data would indicate that a turbine at the Community should be placed on the highest tower possible to avoid surface obstacles.

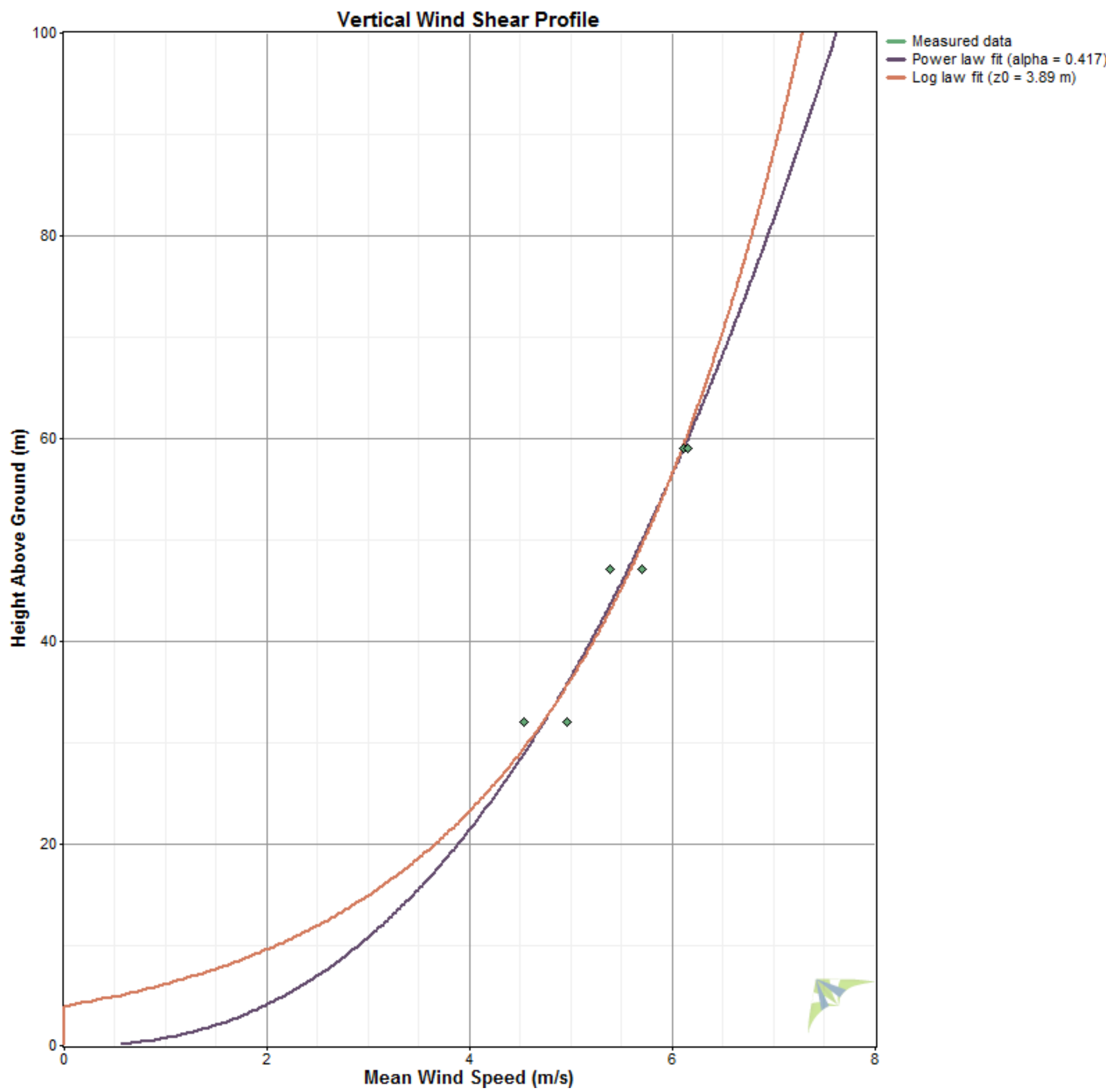

Vertical Wind Shear Profile
Measured data
Power law fit (alpha = 0.417)
Log law fit (z0 = 3.89 m)
Height Above Ground (m)
Mean Wind Speed (m/s)
0
20
40
60
80
100
0
2
4
6
8

Figure 5

Wind Direction Assessment

Wind direction is measured by two wind vanes on the met tower, located at 57 meters and 43m. Direction is an important metric for evaluating the quality of wind in a given area. If wind is too turbulent, flowing infrequently from many directions rather than from one prevailing direction, a wind turbine will be less efficient because it will spend more time yawing from one direction to another instead of steadily collecting wind energy from one focused direction.

In constructing wind farms it is important to understand the prevailing wind direction so wind turbines are arrayed in such a way as to receive the most high-quality wind power possible without interfering with one another.

An analysis of wind direction data collected at the met tower in 2011 shows that the wind most often blows from the northwest. This is the prevailing wind direction. However the data also indicate that significant wind energy also comes from the southeast.

Wind direction data is mapped in a polar graph called a wind rose. A wind frequency rose shows the frequency with which wind blows from a certain direction. The figure below shows wind frequencies by direction for 2011 at a wind vane height of 57m. The figure makes clear that the northwest is the prevailing wind direction.

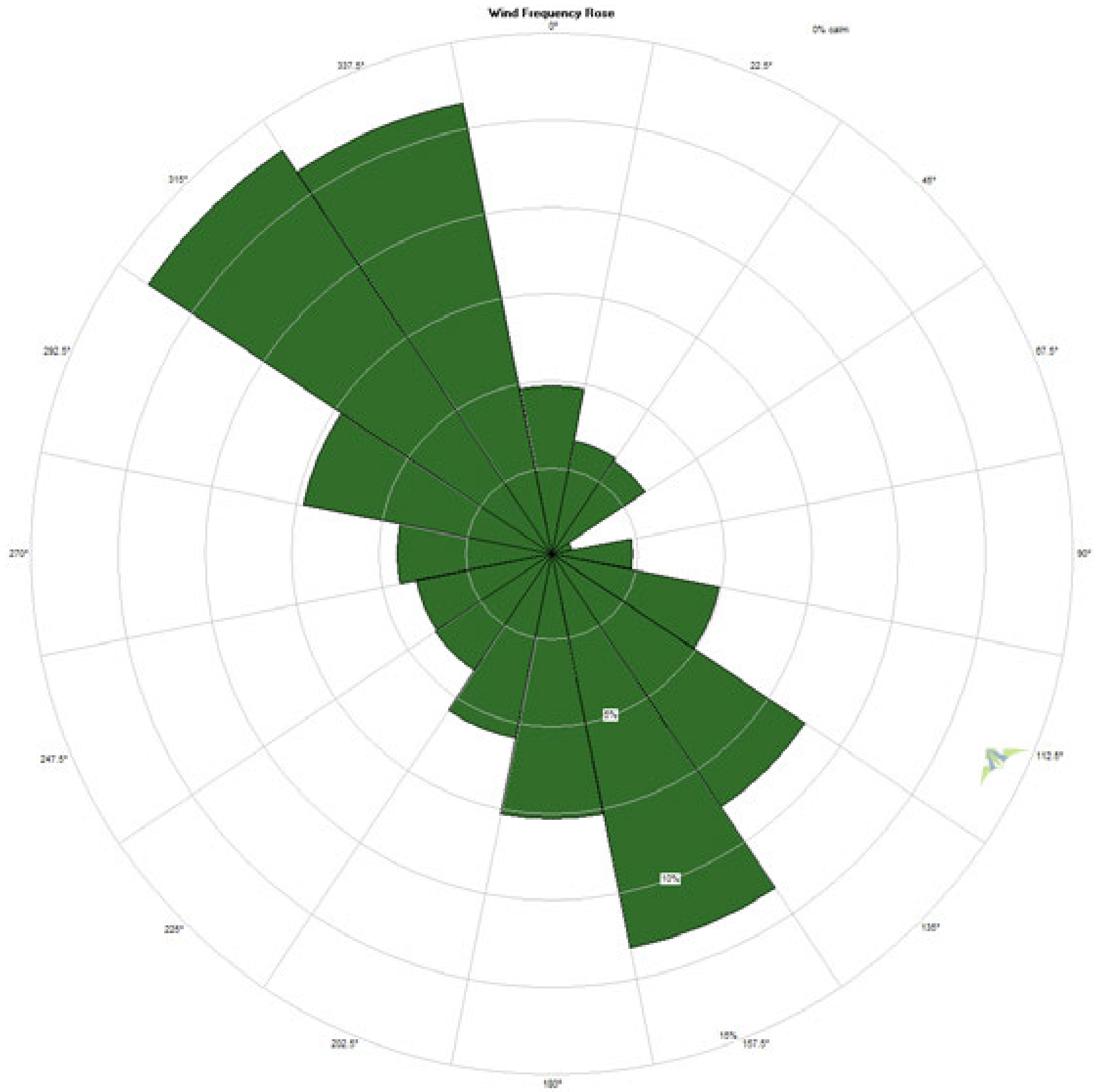


Figure 6

Typically northwest winds are associated with colder weather and winter months, and southeast winds with warmer weather and summer months. The shoulder seasons show increased fluctuation between the two. The wind rose below, which plots temperature versus direction, shows this correlation.

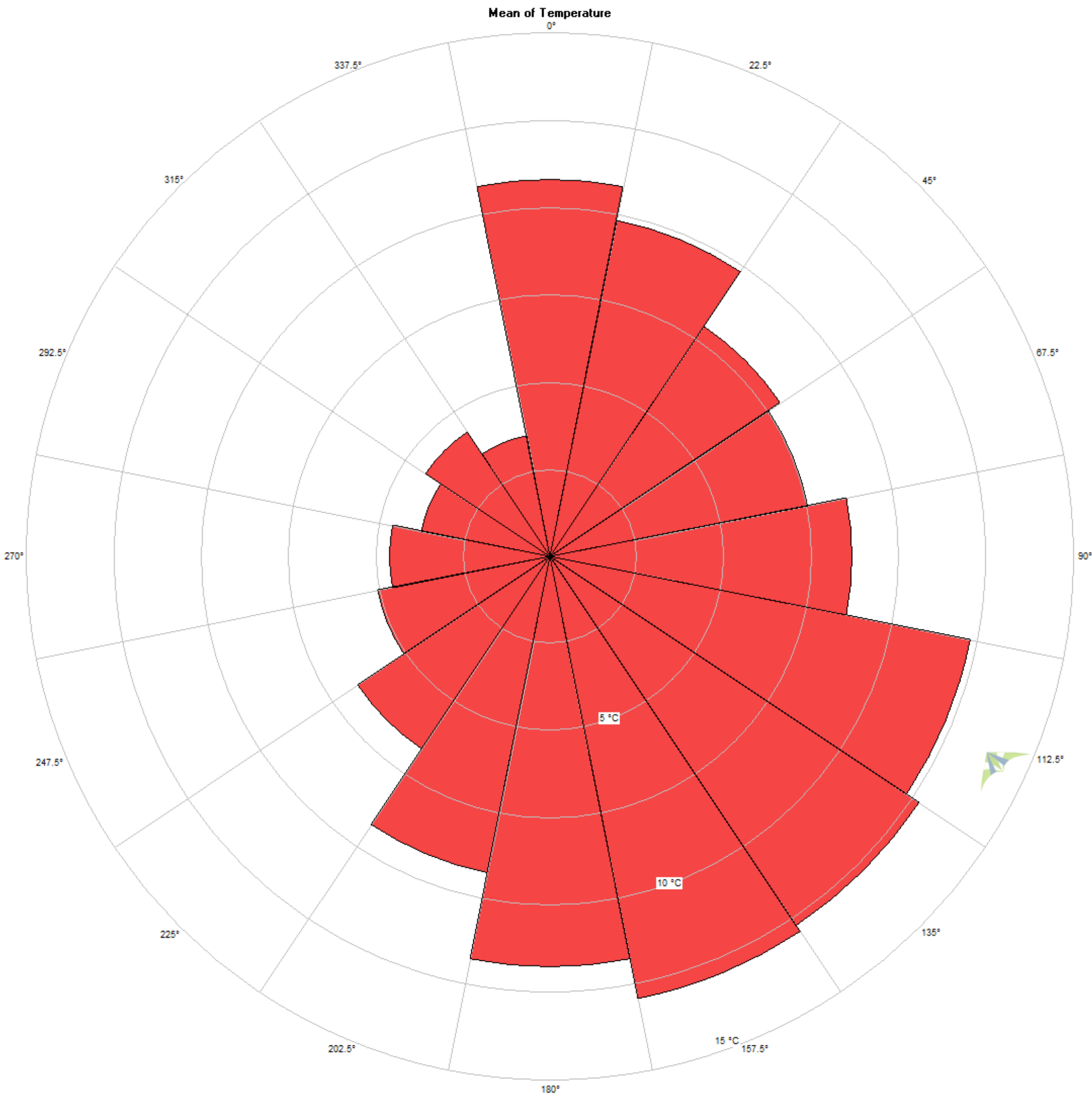


Figure 7

Interestingly, although the first wind rose shows that wind is most frequently out of the northwest, the wind rose in the figure below, which plots wind power density (in watts per square meter) versus direction, shows that a significant amount of wind energy, nearly 18% of the year's total, came from the strong spring/fall southwest winds rather than the prevailing northwest winds.

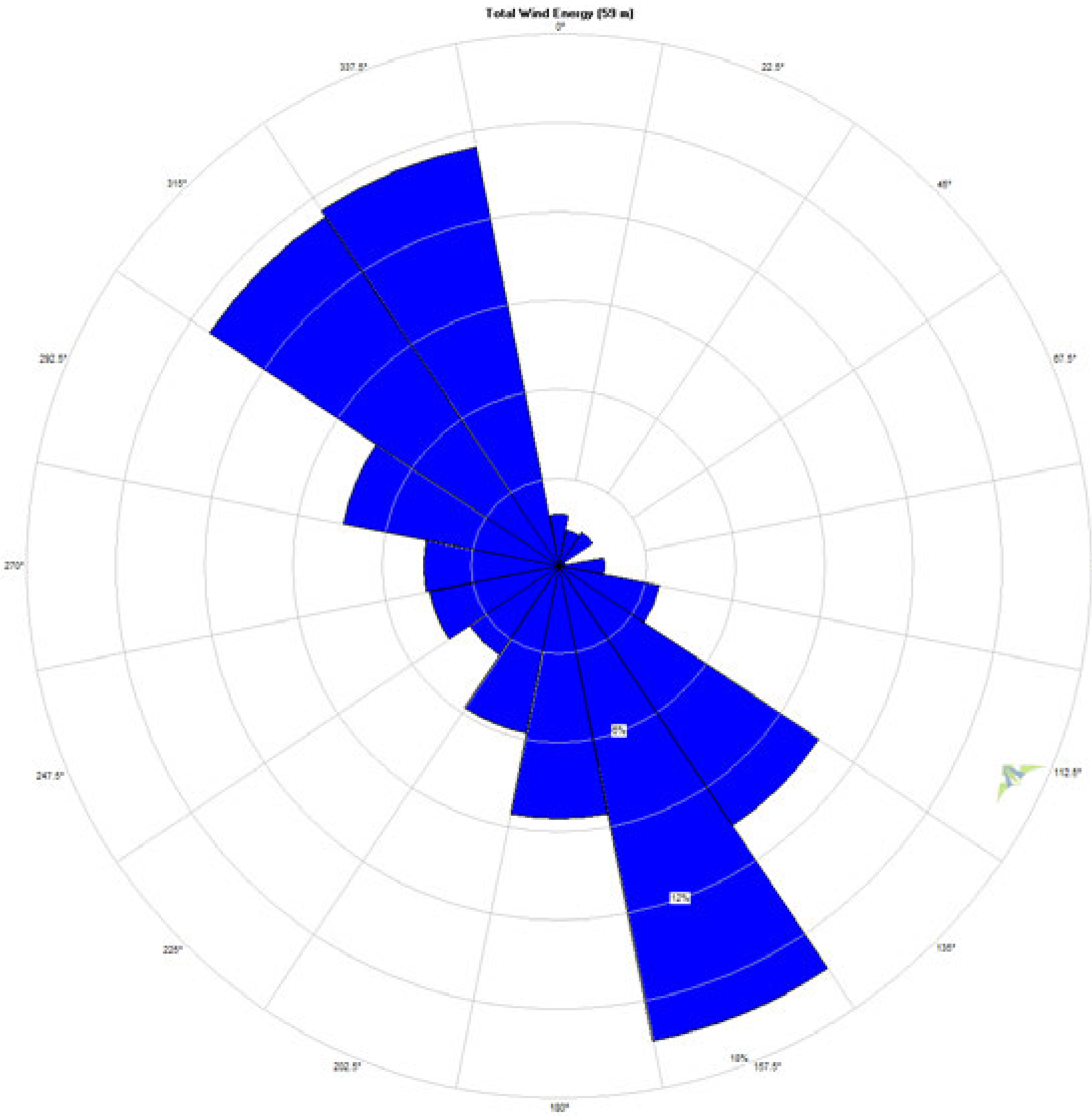

Total Wind Energy (59 m)
0°
22.5°
45°
67.5°
90°
112.5°
135°
157.5°
180°
202.5°
225°
247.5°
270°
292.5°
315°
337.5°
6%
12%
18%

Figure 8

Wind Power Assessment

The recorded average wind power density (WPD) for the year at this location, at an anemometer height of 59 meters is **237 watts per square meter (w/m^2)**. WPD is a measurement of the potential power generated by the wind over a certain area. This estimate is calculated using wind speed and air density data. Combining WPD with the swept area of a particular turbine – the area of the circle in which the turbine blades rotate – can provide an estimate of the power capacity factor for that turbine. WPD is calculated for each anemometer, and the results are in Table 7 below. As the table shows, as turbine height increases, so does WPD.

Anemometer	Mean (w/m2)
Speed 59 m A	240
Speed 59 m B	234
Speed 47 m A	186
Speed 47 m B	194
Speed 32 m A	127
Speed 32 m B	139

Table 7

Figure 9 shows monthly average WPD for the year to date. It closely correlates to the wind speed graph shown in Figure 1.

Figure 9

Wind Power Class
The wind power class is a number indicating the mean energy content of the wind resource. Wind power classes are based on the mean WPD at 50 meters above ground, according to the following table:

Wind Power Class	Description	Power Density at 50m (W/m^2)
1	Poor	0-200
2	Marginal	200-300
3	Fair	300-400
4	Good	400-500
5	Excellent	500-600
6	Outstanding	600-800
7	Superb	800-2000

Table 8

Using the data collected at the Lower Sioux anemometer, the wind power density at 50m was determined to be **202 watts per square meter**. This establishes the wind as a Class 2 resource for the year 2011 at this location.

Appendix A
General Climate Data

Table A1 – General Climate Summary

	Mean	Min	Max
Temperature (°C)	11.92	-7.2	32.8
Pressure (mbar)	979	969	992
Air Density (kg/m3)	1.2	1.12	1.28

Figure A1 – Temperature Daily Means

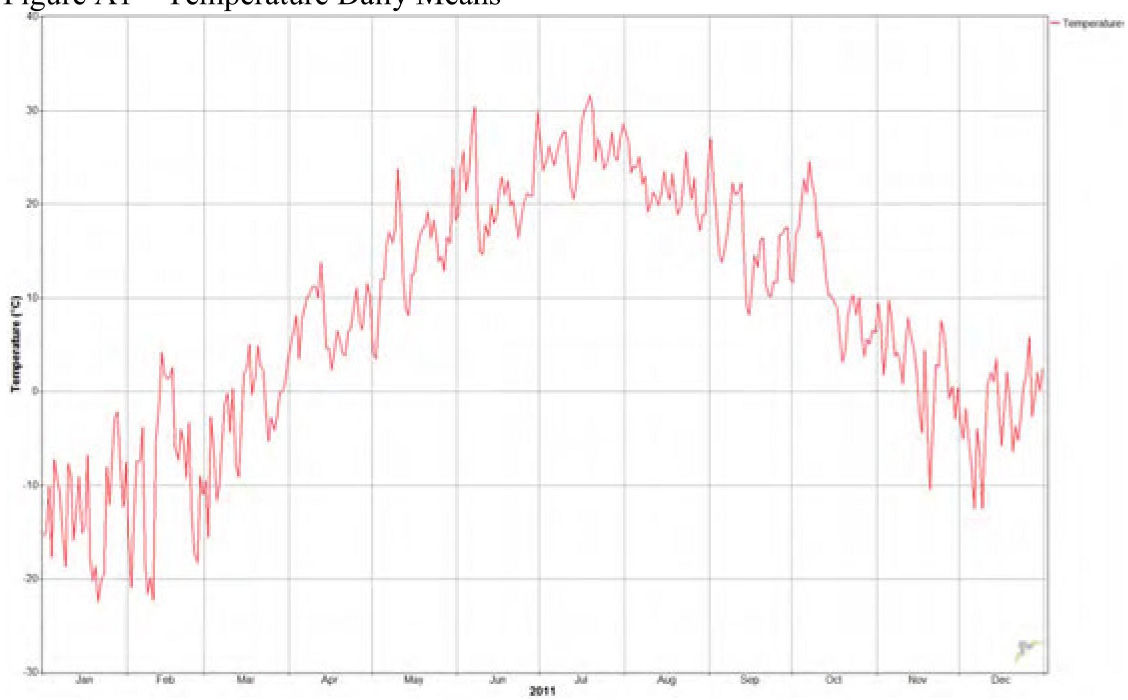


Figure A2 – Barometric Pressure Daily Means

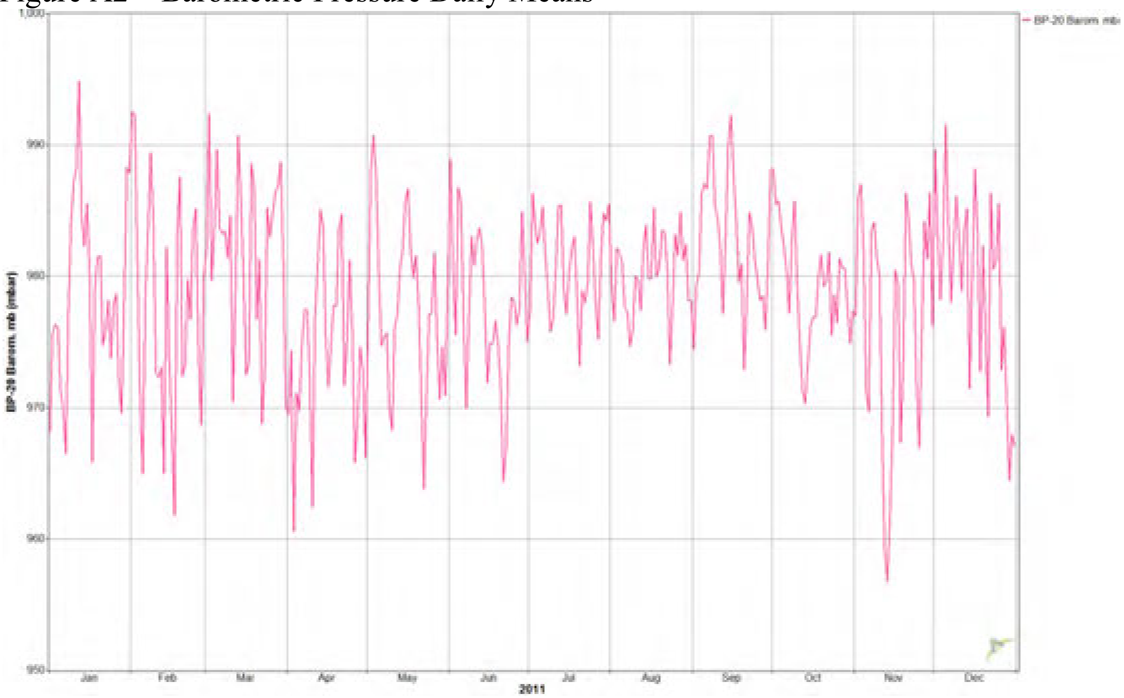
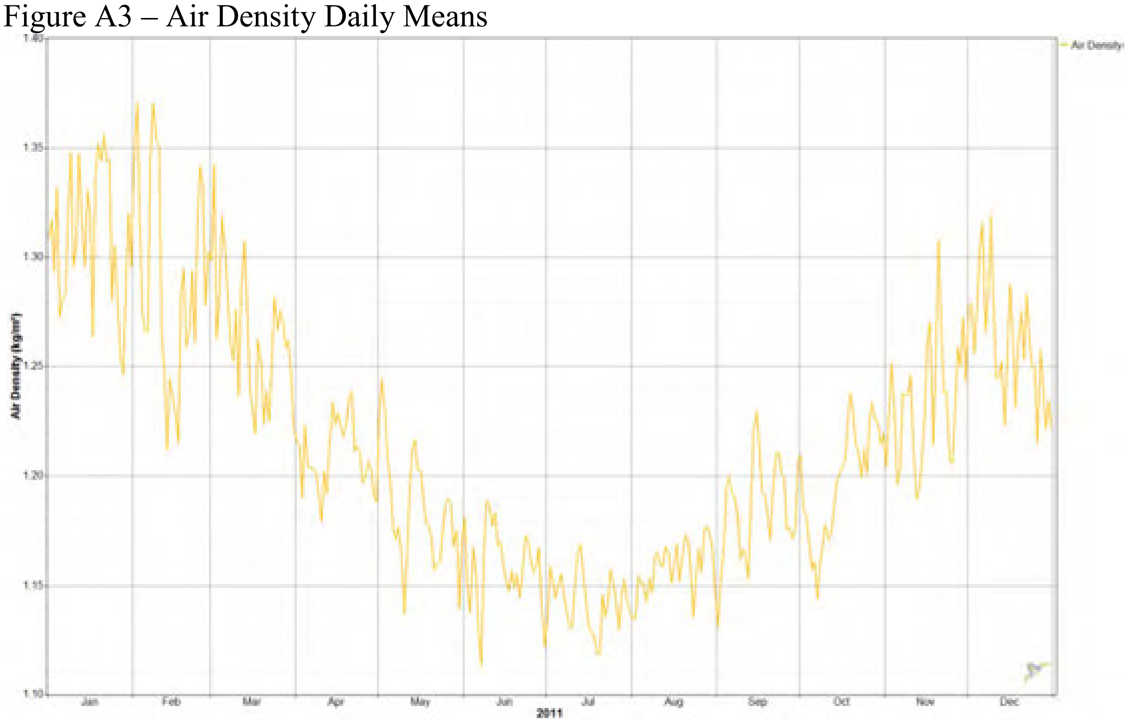


Figure A3 – Air Density Daily Means



Westwood Professional Services, Inc.

Morton, Minnesota
Long-Term Variability Analysis

March 02, 2012

Confidential Business Information

WindLogics®

Client Name	**Westwood Professional Services, Inc.**
Contact	Jack Hays
Document ID	0312-WND-847-01
Issue	A
Version	Final
Date	March 02, 2012

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REVISION HISTORY

Issue	Issue Date	Revision Summary
A	03/02/2012	Original Issue

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ATTACHMENTS

APPENDICES

EXECUTIVE SUMMARY

Westwood Professional Services, Inc. engaged WindLogics to estimate the long-term wind resource at the Morton, Minnesota potential windfarm site for purposes of assessing the viability of nine wind turbine generators. Meteorological tower data, supplied by Westwood Professional Services, Inc., was put through a rigorous quality-checking process and then extrapolated on a timestep-by-timestep basis to a hub height of 80 meters above ground level (m AGL). The on-site data was then applied to statistical regression techniques, or Enhanced-MCP, to assess the long-term wind and energy variability of the Morton, Minnesota site.

The results of this process indicate a long-term wind speed value of 6.94 m/s and gross capacity factor of 38.4% for the GE 1.6-82.5 – Normal Turbulence (Rev 0) – Cold Weather Package turbine at the Met 6765 location. An initial estimate of the net energy production based on a constant loss factor is 32.7% for the GE 1.6-82.5 – Normal Turbulence (Rev 0) – Cold Weather Package turbine

1. INTRODUCTION

Westwood Professional Services, Inc. engaged WindLogics to estimate the long-term wind resource at the Morton, Minnesota potential windfarm site for purposes of assessing the viability of nine wind turbine generators.

The analysis was performed for one meteorological data collection (met) tower location at the Morton, Minnesota site, see Table 1 and Appendix A. The site is located roughly 3 kilometers (km) southwest of the city of Morton, Minnesota in Redwood County.

Tower	Latitude (WGS 84)	Longitude (WGS 84)	Elevation (meters AMSL)
Met 6765	N 44.5334	W 95.0112	299

Table 1: Met Tower Location

The data from the Met 6765 tower were put through a rigorous quality-checking process, and were then extrapolated on a timestep-by-timestep basis to the projected hub height of 80 meters above ground level (m AGL). The wind data were combined with 30 years of meteorological reference data from NASA using the WindLogics Enhanced Measure-Correlate-Predict (E-MCP) method. The resulting estimated wind data were applied to the power curve for the GE 1.6-82.5 – Normal Turbulence (Rev 0) - Cold Weather Package turbine model and then statistically summarized as annual and monthly wind speed, wind direction, gross energy production and gross capacity factor values for a possible wind farm containing nine wind turbine generators, which represent the long-term characteristics of the site.

2. SITE DESCRIPTION

2.1 Topography

The Morton, Minnesota site is characterized as generally flat, with sudden elevation change near the Minnesota River Valley.

The site elevations range from roughly 242 to 345 m Above Mean Sea Level (AMSL), with the land generally flat with constant elevation, except in locations near the Minnesota River Valley. Small rivers and creeks draining to the Minnesota River are observed in many locations, but the depressions they cut in the terrain appear shallow (5-20m) and likely do not significantly influence the flow of winds near the surface. The elevation changes created by the Minnesota River Valley, however, are substantial (50-100m), and should impact the flow of winds near the surface.

At 299 m AMSL elevation, Met 6765 is located along the southern edge of the Minnesota River Valley. Due to the lower elevation of this terrain feature, Met 6765 has less exposure to the wind resource than many areas to the north and south of the Minnesota River.

Taking a broader view of the topography (out to a radius of roughly 80 km), the terrain maintains the same general characteristics as the site in all directions. To the southwest, as the Buffalo Ridge is approached, the terrain becomes higher and slightly more variable.

2.2 Land Characteristics and Vegetation

Land characteristics in the vicinity of the site include farmland, woody wetlands, and areas of increased tree growth along the Minnesota River. As a result, seasonal changes in deciduous vegetation will impact near-surface wind flow. This is an area that experiences periods of snow cover during the winter. A barren winter terrain has a lower roughness length than the same land in summer.

Roughness length is a derived quantity that is used to describe the effect the surface of the earth has on slowing near-surface winds. Given the seasonality of the area, the current land use suggests roughness length changes during the year will be of consequence in evaluating the wind resource.

This is a site where the large-scale, synoptic weather patterns, as opposed to localized terrain influences, will determine the nature of the wind resource.

2.3 Meteorological Overview

Jet stream location and related tracks of large-scale weather systems are the main drivers of the low level winds at the Morton, Minnesota site.

During the winter and transitional seasons, the wind regime of the Morton, Minnesota site is highly influenced by transient and developing synoptic-scale weather systems associated with the position of the cool/cold season jet stream. These weather systems establish strong pressure gradients that drive the low-level winds.

During the late spring, the jet stream and associated disturbances weaken, and the site experiences a decrease in the wind speeds. The summer winds in this region do not weaken as much as in most parts of the country. This is due to the juxtaposition of two large-scale climatic features. Over the eastern and particularly southeastern United States, the summer weather pattern is dominated by a feature called the Bermuda High. At the same time, an area of predominantly low pressure, called a thermal low, sets up over the southwestern and intermountain western United States.

High pressure to the east and low pressure to the west establishes generally southerly flow in the transitional zone between these two features. As a result, we see a corridor of reasonably energetic southerly summer winds over West Texas extending northward through parts of the plains states. The Dakotas mark the approximate northern extent of this feature. While these winds are not as strong as those associated with the winter storm systems, they are still significant from a wind energy perspective.

Note that when we talk about climatic features such as the Bermuda High, or southwestern thermal low, we are referring to time-averaged data. The instantaneous weather pattern at a given point in time may look considerably different due to the passage of discrete weather systems.

3. METEOROLOGICAL TOWER DATA PROCESSING

This section describes the methods used to quality check the data collected at met tower Met 6765.

3.1 Met Tower Sensor Configuration

Westwood Professional Services, Inc. supplied WindLogics with met tower commissioning information. These metadata were entered into the WindLogics Data Management Database as-is. Table 2 lists the specific location and sensor configuration for Met 6765.

MetTower	Met 6765
Site Desc	Westwood
Land Owner	
Site Location	Morton MN
Site Elevation	299.000 m
Latitude	N 44.5334667
Longitude	W 95.0111667
Time offset (X hrs to GMT)	GMT-06(CST)

-----Sensor Information-----	Settings in Symphonie	-----Sensor Information-----	Settings in Symphonie	-----Sensor Information-----	Settings in Symphonie
Channel # 1	**1**	**Channel # 2**	**2**	**Channel # 3**	**3**
Description	NRG #40C Anem	Description	NRG #40C Anem	Description	NRG #40C Anem
Serial #	SN:160134	Serial #	SN:160135	Serial #	SN:160136
Height	59m	Height	59m	Height	47m
Units	m/s	Units	m/s	Units	m/s
NRG Default or Calibrated	0.00	NRG Default or Calibrated	0.00	NRG Default or Calibrated	0.00
Scale Factor	0.758	Scale Factor	0.758	Scale Factor	0.76
Offset	0.43	Offset	0.38	Offset	0.39
Precision	0.1	Precision	0.1	Precision	0.1
Channel # 4	**4**	**Channel # 5**	**5**	**Channel # 6**	**6**
Description	No SCM Installed	Description	No SCM Installed	Description	No SCM Installed
Serial #	No SCM Installed	Serial #	No SCM Installed	Serial #	No SCM Installed
Height	No SCM Installed	Height	No SCM Installed	Height	No SCM Installed
Units	No SCM Installed	Units	No SCM Installed	Units	No SCM Installed
NRG Default or Calibrated	No SCM Installed	NRG Default or Calibrated	No SCM Installed	NRG Default or Calibrated	No SCM Installed
Scale Factor	No SCM Installed	Scale Factor	No SCM Installed	Scale Factor	No SCM Installed
Offset	No SCM Installed	Offset	No SCM Installed	Offset	No SCM Installed
Precision	No SCM Installed	Precision	No SCM Installed	Precision	No SCM Installed
Channel # 7	**7**	**Channel # 8**	**8**	**Channel # 9**	**9**
Description	NRG #200P Vane	Description	NRG #200P Vane	Description	No SCM Installed
Serial #	**Missing**	Serial #	**Missing**	Serial #	No SCM Installed
Height	57m	Height	43m	Height	No SCM Installed
Units	deg	Units	deg	Units	No SCM Installed
NRG Default or Calibrated	0.00	NRG Default or Calibrated	0.00	NRG Default or Calibrated	No SCM Installed
Scale Factor	0.351	Scale Factor	0.351	Scale Factor	No SCM Installed
Offset	67	Offset	67	Offset	No SCM Installed
Precision	0	Precision	0	Precision	No SCM Installed
Channel # 10	**10**	**Channel # 11**	**11**	**Channel # 12**	**12**
Description	NRG iPack Voltmeter SCM	Description	NRG BP20	Description	NRG #110S Temp
Serial #	**Missing**	Serial #	**Missing**	Serial #	**Missing**
Height	3m	Height	2m	Height	3m
Units	v	Units	0.43	Units	C
NRG Default or Calibrated	NRG Default Settings	NRG Default or Calibrated		NRG Default or Calibrated	NRG Default Settings
Scale Factor	0.02	Scale Factor	0.43	Scale Factor	0.14
Offset	0.00	Offset	650.00	Offset	-86.38
Precision	0.10	Precision		Precision	0.10
Channel # 13	**13**	**Channel # 14**	**14**	**Channel # 15**	**15**
Description	NRG #40C Anem	Description	NRG #40C Anem	Description	NRG #40C Anem
Serial #	SN:160613	Serial #	SN:160614	Serial #	SN:160125
Height	47m	Height	32m	Height	32m
Units	m/s	Units	m/s	Units	m/s
NRG Default or Calibrated	0.00	NRG Default or Calibrated	0.00	NRG Default or Calibrated	0.00
Scale Factor	0.76	Scale Factor	0.76	Scale Factor	0.76
Offset	0.38	Offset	0.44	Offset	0.37
Precision	0.10	Precision	0.10	Precision	0.10

Table 2: NRG Symphonie[tm] Configuration for Met 6765

3.2 Met Tower Data Processing Overview

The ten-minute average, binary NRG met tower data files were transmitted electronically to WindLogics. The data were processed using the NRG

Symphonie™ software and were then quality checked and stored in the WindLogics Data Management database. See Appendix B for more information regarding the WindLogics Met Tower Data QA/QC Processing System.

3.3 Met Tower Data Recovery Statistics

Table 3 lists the recovery rates for all operational sensors on Met 6765. Overall the recovery rate was high (> 95%) for all anemometer sensors.

Met 6765 (1/1/2011 - 12/31/2011)							
Channel Name/Height	Variable Type	Total Timestamps	Missed Timestamps	Percent Received	Flagged Timestamps	Total Missing/Flagged Timestamps	Percent Not Missing/Flagged
Ch. 01 NRG Anem. 59m (SW)	Wind Speed	52,560	0	100.00%	591	591	98.88%
Ch. 02 NRG Anem. 59m (NE)	Wind Speed	52,560	0	100.00%	544	544	98.96%
Ch. 03 NRG Anem. 47m (SW)	Wind Speed	52,560	0	100.00%	1,820	1,820	96.54%
Ch. 07 NRG Vane 57m (SW)	Wind Direction	52,560	0	100.00%	1,010	1,010	98.08%
Ch. 08 NRG Vane 43m (SW)	Wind Direction	52,560	0	100.00%	1,135	1,135	97.84%
Ch. 10 NRG Volt 3m (N)	Volts	52,560	0	100.00%	0	0	100.00%
Ch. 11 NRG Press. 2m (N)	Pressure	52,560	0	100.00%	41,871	41,871	20.34%
Ch. 12 NRG Temp. 3m (N)	Temperature	52,560	0	100.00%	167	167	99.68%
Ch. 13 NRG Anem. 47m (NE)	Wind Speed	52,560	0	100.00%	521	521	99.01%
Ch. 14 NRG Anem. 32m (SW)	Wind Speed	52,560	0	100.00%	2,447	2,447	95.34%
Ch. 15 NRG Anem. 32m (NE)	Wind Speed	52,560	0	100.00%	921	921	98.25%
	Total:	**578,160**	**0**	**100.00%**	**51,027**	**51,027**	**91.17%**

Table 3: Recovery Statistics for Met 6765

3.4 Hub-Height Wind Speed Extrapolation

Met tower wind speeds were extrapolated using shear coefficients from 47 and 59 m sensor levels.

The goal of any wind resource analysis is to assess the wind's ability to drive wind turbines at specific locations. It is often only possible to measure the wind at heights that are lower than the typical height of the turbine. This requires that the hub-height wind speed be estimated from the measured data.

Estimating hub-height wind speeds from measurements at lower elevations requires the use of a wind shear exponent, commonly referred to as α (alpha), which is a value showing the relationship between wind speeds at an upper and a lower height. This value is then used in the *power law equation* to calculate estimated hub-height wind speeds. Met tower wind speed data were extrapolated to the hub height of 80 m AGL using the shear coefficient calculated from data collected at the 47 and 59 m AGL sensor levels. The calculated alpha value was applied via the power law equation to the uppermost sensor velocity on an hourly basis. In the case of redundant sensors, the maximum reading between both sensors was used.

Table 4, below, lists the average values of met tower wind speeds, wind shear exponent and estimated hub-height wind speed for the data collection period. As described above, the individual-tower wind shear exponents and hub-height wind speed values were calculated on an hour-by-hour basis.

Met 6765 (01/1/2011 - 12/31/2011)					
Upper Anemometer	Lower Anemometer	Upper Anem. Wind Speed Average (m/s)	Lower Anem. Wind Speed Average (m/s)	Shear Exponent (alpha)	Estimated 80m AGL Wind Speed (m/s)
59mNE & 59mSW Maximum	**47mNE & 47mSW Maximum**	6.09	5.62	0.354	6.80
59mNE & 59mSW Maximum	**32mNE & 32mSW Maximum**	6.09	4.89	0.389	6.85
47mNE & 47mSW Maximum	**32mNE & 32mSW Maximum**	5.62	4.89	0.404	6.92

Table 4: Wind Shear Exponents and Estimated Hub-Height Wind Speeds for Met 6765

Table 4 shows that during the data collection period at Met 6765, the average wind shear exponent was near 0.375 and the average estimated 80 m AGL wind speed values ranged from 6.80 m/s to 6.92 m/s, based on various sensor orientation and height combinations.

The observed wind shear exponent is unexpectedly high for this region, suggesting influence from the nearby vegetation. Figure 1 illustrates the observed wind shear exponent calculated from the various sensor height combinations during the calendar year. Based on this image, one can see the wind shear exponent becomes variable with height during the spring and summer time periods, when deciduous trees grow leaves. The leaves from the nearby trees increase the roughness impact on the met tower, slowing the wind speeds at lower heights (32 m AGL) more than upper heights (59 m); increasing the wind shear exponent. During the fall and winter months, when the leaves have fallen, the wind speeds observed at the met tower are less impacted by the local vegetation, and maintain a more constant wind shear exponent.

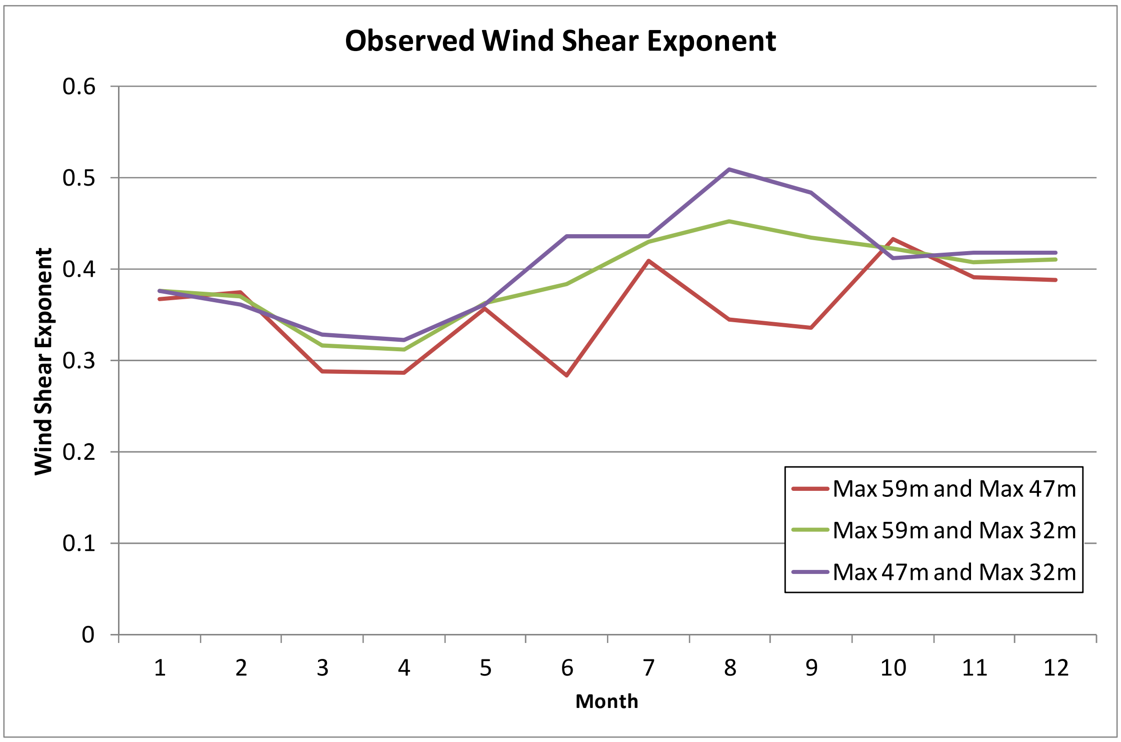


Figure 1: Wind Shear Exponents Observed at Met 6765

4. NORMALIZATION METHODOLOGY

This section describes the methods used to normalize the met tower data in order to provide a long-term characterization of the wind resource at the site.

4.1 Weather Data Archive for Long-Term Normalization

The reference dataset used for this analysis was the Modern Era Retrospective-Analysis for Research and Applications (MERRA) archive, which contains worldwide historical weather data, dating since 1979, collected and assimilated together using a state-of-the-art technique designed by NASA. See Appendix C for a more detailed description.

4.2 Normalization Processing

Output of E-MCP is thirty-year time-series of estimated values representative of onsite wind flow.

The quality-checked met tower data and multiple long-term data points from the WindLogics MERRA Data Archive were processed together using the E-MCP method to estimate long-term characteristics of the wind resource at the site. The E-MCP method uses a non-linear multi-parameter regression engine to numerically infer the relationship between the met tower and reference datasets. See Appendix D for a more complete description.

The output of the E-MCP processing phase was a thirty-year time-series of estimated values, at an hourly interval. These values were then applied to the turbine power curve and statistically summarized as the annual and monthly values presented in this report.

All gross energy production and capacity factor values are based on the GE 1.6-82.5 – Normal Turbulence (Rev 0) - Cold Weather Package turbine power curve. See Appendix E for a summary of the calculation methods and manufacturer-supplied information.

4.3 Normalization Validation

A site-specific validation was performed to quantify the error in the E-MCP-based prediction. This involved using a round-robin approach, predicting the wind values for each month, without using that month's data in training, and then calculating error statistics for the month that was withheld. In other words, each of the 12 months was estimated using the other 11 months of training data and then compared against the actual data from that month. This required a separate training and estimation process for each of the months, prior to running the final process that used training data from all months to estimate the long-term time series. This rigorous validation process provides a high level of insight into the predictive ability of the E-MCP process at the Morton, Minnesota site.

5. SUMMARY OF RESULTS

This section contains a summary of the results calculated for the Morton, Minnesota site.

5.1 Normalization Validation Results

There are two main ways to verify the predictive ability from the results of the E-MCP process:

- Analyze the results of the month-by-month round-robin validation

- Compare the estimated values to the on-site data during the period for which both data sources exist; of particular importance are the distributions of the data, which can be examined most effectively in graphical form

The average monthly wind speed (power) error was 0.37% (0.77 %). The 12-month overall wind speed (power) bias was 0.2% (-0.7%). See Table 5 for monthly normalization validation results of wind speed and power.

		Wind Speed (m/s)			Power (MWh) GE 1.6-82.5 - Normal Turbulence (Rev 0)		
Month	**Year**	**Actual Spd**	**E-MCP Spd**	**Error**	**Actual Power**	**E-MCP Power**	**Error**
January	**2011**	6.16	6.22	1.0%	3,081	3,044	-1.2%
February	**2011**	7.45	7.46	0.1%	4,459	4,452	-0.2%
March	**2011**	6.77	6.77	0.1%	3,705	3,693	-0.3%
April	**2011**	7.38	7.44	0.8%	4,544	4,522	-0.5%
May	**2011**	7.59	7.57	-0.3%	4,855	4,833	-0.5%
June	**2011**	6.95	6.98	0.5%	3,959	3,907	-1.3%
July	**2011**	5.79	5.79	0.0%	2,700	2,690	-0.4%
August	**2011**	5.33	5.33	0.0%	2,242	2,194	-2.1%
September	**2011**	6.26	6.32	1.0%	3,185	3,172	-0.4%
October	**2011**	7.67	7.65	-0.3%	5,053	4,987	-1.3%
November	**2011**	7.75	7.77	0.3%	5,036	5,016	-0.4%
December	**2011**	7.11	7.11	-0.1%	4,408	4,377	-0.7%
				Bias			**Bias**
Annual		**6.85**	**6.87**	**0.2%**	**3,936**	**3,907**	**-0.7%**
			MAE	**0.37**		**MAE**	**0.77**

Table 5: Month-By-Month E-MCP Validation Results at the Proposed 9 turbine GE 1.6-82.5 – Normal Turbulence (Rev 0) - Cold Weather Package Wind Farm based on Met 6765

The correlation to met tower-based power values had a coefficient of determination (R^2) of 88.0%. The plotted data points in Figure 2, below, represent each month of the 12 month training period. The diagonal red line in Figure 2 represents a theoretical 1:1 correlation between the met tower-based and E-MCP results. The closer a data point is to the diagonal line, the better the correlation between the met tower-based and E-MCP estimates. Figure 2 shows that the E-MCP estimates are highly correlated with the met tower-based power values.

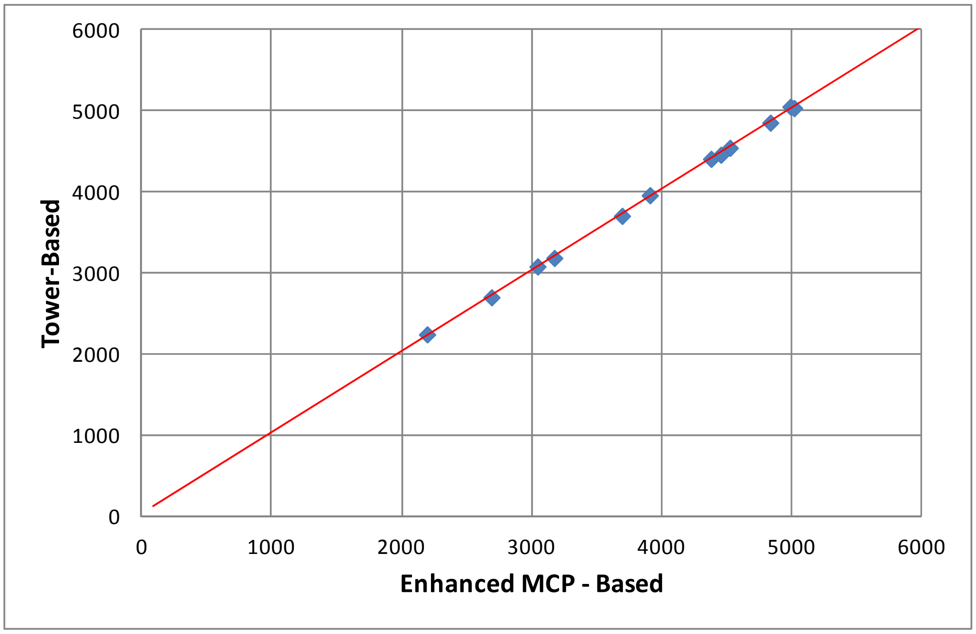


Figure 2: Monthly Average Gross Energy Production Scatter Plot

The E-MCP estimates follow the tower data very well, as can be seen in Figure 3. Not only are the peaks in phase, but the amplitude is re-created quite accurately.

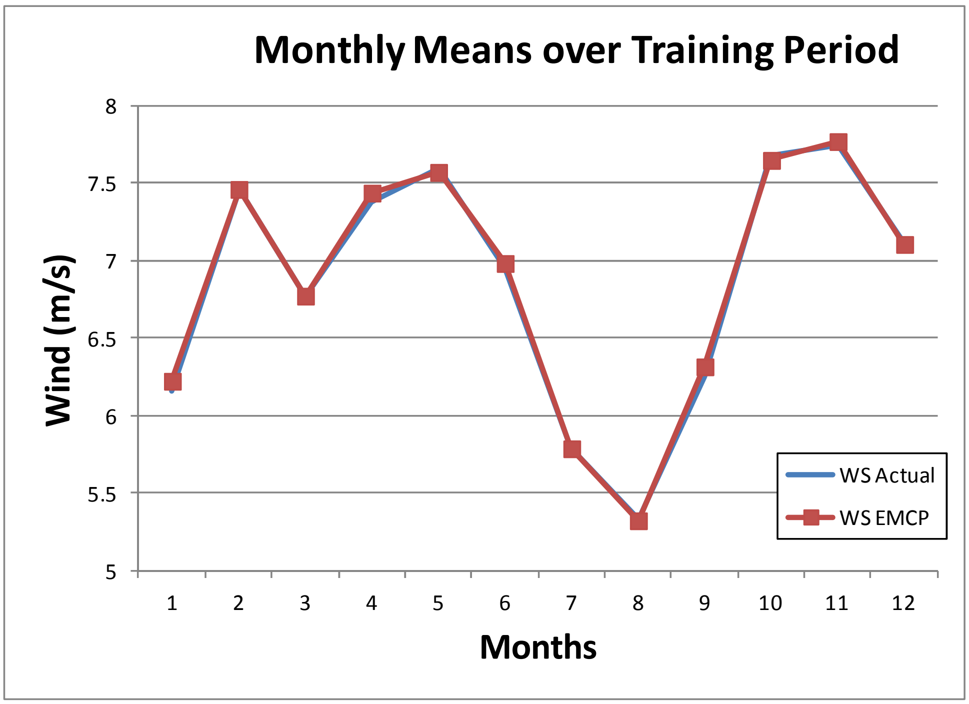


Figure 3: Monthly Average Energy Production Time Series

Figure 4 shows histograms of hub-height wind speed and the E-MCP estimated wind speed for the Met 6765 location.

Wind Speed Histogram for (12-month) Correlation Period

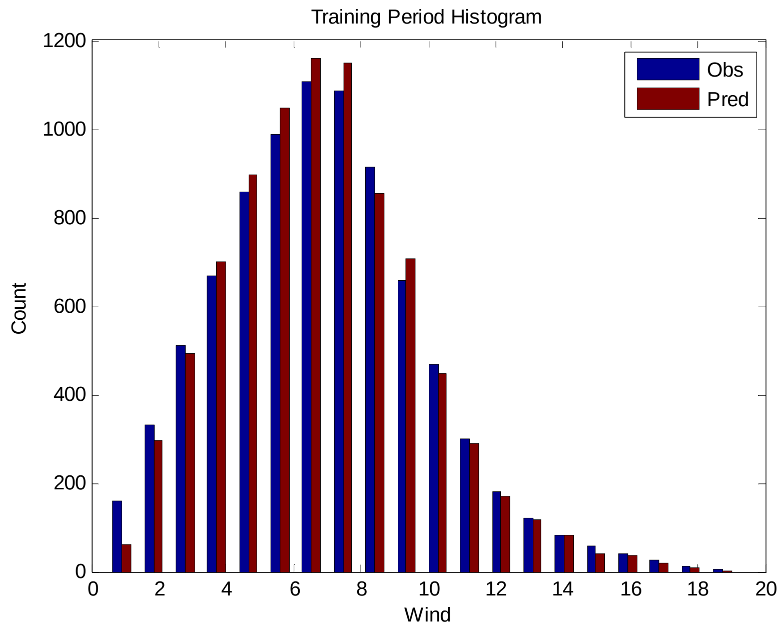


Figure 4: Histogram of Wind Speed (hourly intervals) for E-MCP and Met Tower Data

Figure 4 illustrates that the E-MCP method has a high degree of skill in reproducing the histogram distributions that were measured by the met tower.

5.2 Long-Term Monthly and Annual Wind Speed

At the Met 6765 location, the normalized annual average wind speed at 80 m AGL is 6.94 meters per second (m/s) corresponding to an annual gross capacity factor value of 38% and an annual gross energy production of 49.09 GWh for a possible 9 turbine GE 1.6-82.5 – Normal Turbulence (Rev 0) - Cold Weather Package wind farm. The normalized annual and monthly wind speed estimates, gross capacity factor and gross energy production at 80 m AGL are shown in Table 6.

It is important to note that the energy production estimate is for a 9 turbine wind farm at the Morton, Minnesota site based on the long term wind speeds observed at the Met 6765 location. This assumes the same wind characteristics would exist at each of the nine turbine locations, which could be at some distance to the Met 6765 location. WindLogics recommends Westwood Professional Services, Inc. continues to work with WindLogics to identify an optimal wind farm layout for each of the 9 proposed turbine locations.

	Wind Speed	GE 1.6-82.5 - Normal Turbulence (Rev 0)	
Month	m/s	EP (MWh/mo)	GCF
January	7.20	4,699	43%
February	7.11	4,118	42%
March	7.21	4,582	42%
April	7.30	4,365	42%
May	7.23	4,376	40%
June	6.51	3,314	32%
July	5.88	2,701	25%
August	5.95	2,789	26%
September	6.89	3,888	37%
October	7.30	4,689	43%
November	7.29	4,597	44%
December	7.41	4,974	46%
		EP (MWh/yr)	GCF
Annual Ave.	6.94	49,092	38%

Table 6: Normalized Monthly Average Wind Speed, Gross Capacity Factor and Energy Production at 80 m AGL for the Proposed 9 turbine GE 1.6-82.5 – Normal Turbulence (Rev 0) - Cold Weather Package Wind Farm based on Met 6765

5.3 Probability Analysis

5.3.1 Project Uncertainty

WindLogics estimated the project-specific uncertainties for the site as percentages of the mean wind speed. To reflect sensitivities in the annual energy production within the uncertainty model, an upward or downward shift (depending on the specific factor) in the wind speed distribution was applied.

For this analysis, the uncertainties of wind speed and energy production are assumed to follow a normal distribution and are independent of the other uncertainties. The project-specific uncertainties that have been considered are listed in Table 7 below.

Estimated Project Uncertainty Values		
Uncertainty Effect	Values Used in Analysis	
	Uncertainty Value (%)	Sensitivity to Gross Energy Yield (%)
Wind Speed Variability	2.7	214.9
Anemometer Measurements	3.0	214.9
Vertical Extrapolation	1.0	214.9
Horizontal Extrapolation	2.0	214.9
Normalization Model	1.0	214.9
Long-Term Reference Models	2.0	214.9
Power Curve	2.0	100.0
Other	0.0	100.0

Table 7: Estimated Project Uncertainty Values

- Wind Speed Variability – This uncertainty addresses the amount of variability of annual average wind speed from year to year. The uncertainty value applied within this analysis can be described by the standard deviation of the historical wind period, as calculated during the normalization process and is estimated to be 2.72%.

- Anemometer Measurements – This uncertainty applies to typical errors in the cup anemometry used within the meteorological data measurement campaign as well as the data collection period and quality as seen at the onsite met tower. The anemometer accuracy uncertainty for the Morton, Minnesota site is estimated to be 3.0% to account for the fact that there is only one year of on-site met tower data available for analysis. The data quality of Met 6765 is high, and is estimated to have a minimal impact.
- Vertical Extrapolation – The wind shear uncertainty applies to the confidence in wind shear assumptions using the anemometer configurations on the met tower. The vertical extrapolation uncertainty for the Morton, Minnesota site is estimated to be 1.0% to account for the greater than expected wind shear exponent, as described in Section 3.4.
- Horizontal Extrapolation – This uncertainty applies to the ability of the model to resolve the spatial variations of wind flow across the proposed wind farm, as calculated by a mesoscale and local wind flow models. WindLogics estimated the horizontal extrapolation uncertainty to be 2.0% because horizontal extrapolation of the wind speed is assumed to be equal, as observed at the Met 6765 location, at all nine turbine locations.
- Normalization Model – The normalization model uncertainty refers to the inherent errors in predicting a long-term record of winds from a short-term observation period. The degree of uncertainty is directly related to regional experience, correlation calculations between reference data sources (on-site met tower data and long-term reference data source) as well as error statistics that are output criteria of the “correlation” procedure within the normalization model. The normalization model is estimated to contribute 1.0% uncertainty to the evaluation.
- Long-Term Reference Models – The data integrity and data consistency can vary between long-term reference data sources. Each source may have various quality assurance aspects that determine the length of record, sensor maintenance/replacements and data quality. For this analysis, WindLogics used a gridded data source compiled by US government entities that has undergone stringent process control and quality assurance. Based on the regional experience and use of this data source, WindLogics estimated the long-term reference model uncertainty to be 2.0%.
- Power Curve Performance – Wind turbine power curves that are guaranteed by vendors are based on power curve performance tests that are made on simple terrain under ideal operating conditions. In practice, wind turbine deployment in the field in widely varying conditions exposes the machine to certain wind flow conditions that may be materially different from the terrain and climate conditions seen at the power performance test site of the vendor. WindLogics attributed a 2.0% sensitivity to the overall energy assessment for power curve performance.

5.3.2 Prediction Intervals

The annual average wind speed and gross capacity factor based on the 30-year data period (P50) are shown in Table 8, along with the standard prediction intervals. The prediction intervals were calculated based on the uncertainties mentioned above.

P-Value (%)	Wind Speed (m/s)	Gross Energy Production (GWh)	Gross Capacity Factor (%)
50	6.94	49.09	38.41%
75	6.72	45.67	35.76%
85	6.60	43.85	34.33%
90	6.52	42.61	33.36%
95	6.40	40.78	31.93%
99	6.18	37.36	29.25%

Table 8: Prediction Intervals of Wind Speed, Gross Energy Production, and Gross Capacity Factor for a 9 turbine GE 1.6-82.5 – Normal Turbulence (Rev 0) – Cold Weather Package wind farm at the Met 6765 Location

These values show the amount of inter-annual variability over the long-term period of interest. Average annual hub-height wind speed estimates at the Morton, Minnesota site varied between 6.44 and 7.37 m/s. The annual average gross capacity factors varied between 32.35% and 43.73% throughout the 30-year period.

The 30-year sequences of annual average wind speed and gross energy production from the E-MCP method are shown graphically in Figures 5 and 6, below.

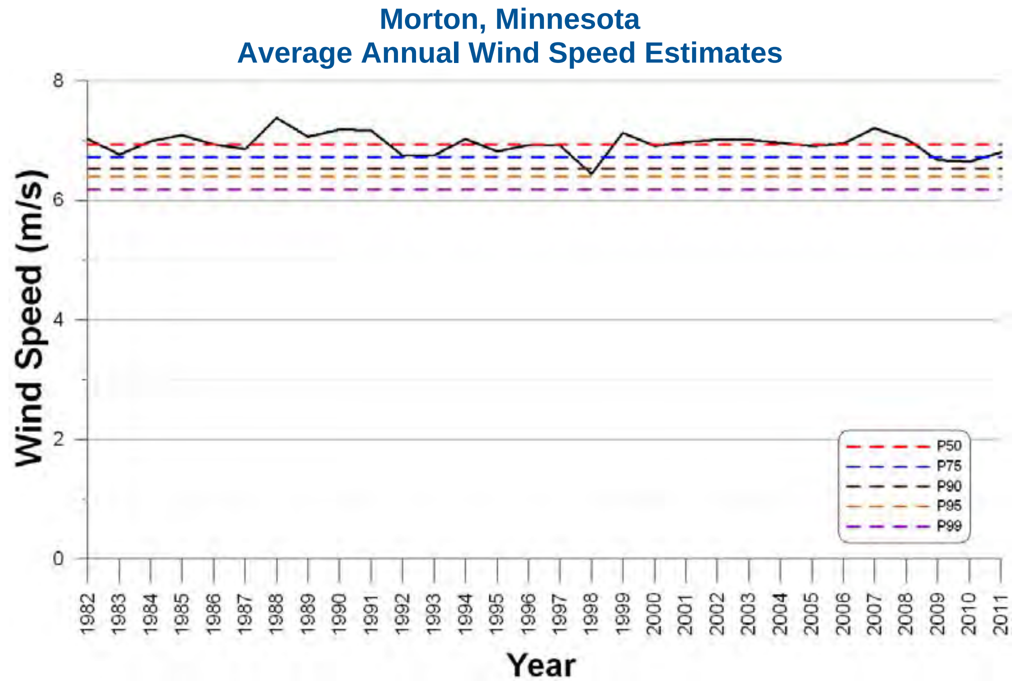


Figure 5: 30-year Time Series of Estimated Annual Average Wind Speeds and Prediction Intervals

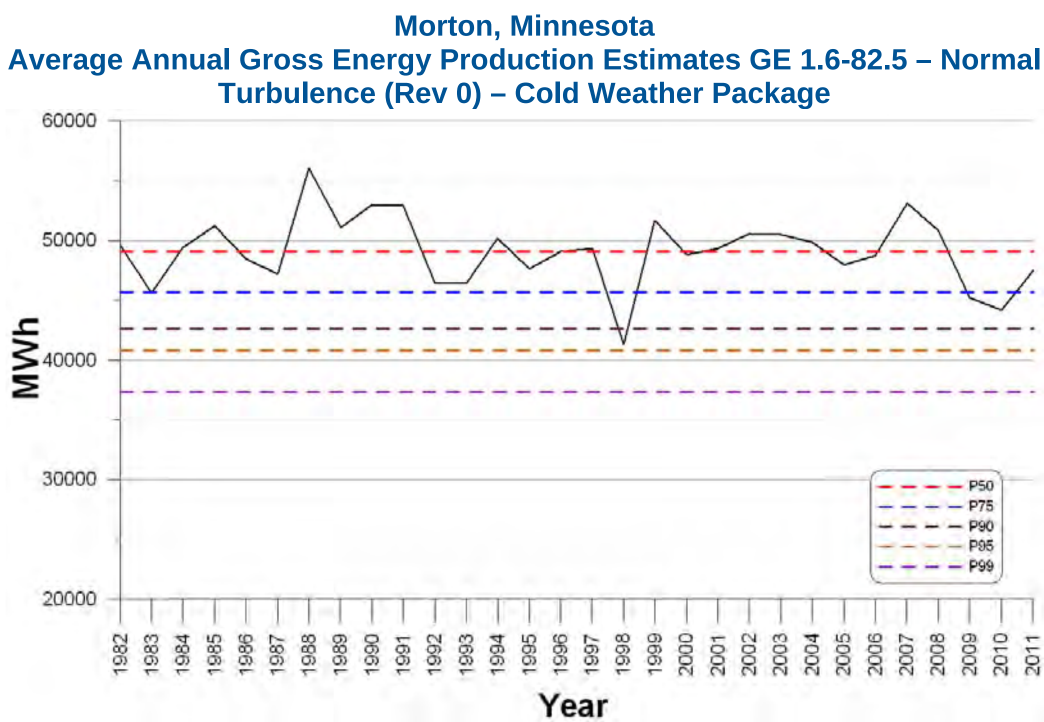


Figure 6: 30-year Time Series of Estimated Annual Average Gross Energy Production and Prediction Intervals

Both Figures 5 and 6 graphically show the inter-annual variability of the wind resource at the Morton, Minnesota site. It is the inter-annual variability of the wind resource that is the main factor in project success – wind is the fuel supply for the windfarm, and it is this type of information that shows how much of it can be expected in any future year.

5.4 Estimated Net Energy Production

Net Energy Production, and the resulting Net Capacity Factor, was estimated by WindLogics to provide Westwood Professional Services, Inc. an initial view of the net potential of the Morton, Minnesota site. To produce a Net Energy estimate, WindLogics applied a constant loss factor of 15% to the P50 Gross Energy Production numbers presented above. Table 9 shows the estimated net energy production and capacity factor for the Morton, Minnesota site.

A loss factor of 15% is consistent with WindLogics' experience working within this region and with this turbine technology, but it is an estimate, and may not accurately represent the true losses observed post construction. It is recommended Westwood Professional Services, Inc. continues to work with WindLogics to conduct a more thorough analysis on the potential for losses at the Morton, Minnesota site, to better quantify the net energy potential.

Energy Estimation - GE 1.6-82.5 - Normal Turbulence (Rev 0) 80m Hub Height		
Cold Weather Package	Annual Average GCF (%)	38.41%
	Annual Average GEP (GWh)	49.06
	Annual Average NCF (%)	**32.65%**
	Annual Average NEP (GWh)	41.72

Table 9: Annual Average Net Energy Production (GWh) and Net Capacity Factor (NCF) at the Met 6765 Location based on a 15% Loss Factor

5.5 Wind Direction

Winds at the Morton, Minnesota site prevail from the northwest with occasional periods of southeasterly flow. Northwesterly flow appears to dominate the winter months while both southeasterly and northwesterly wind directions are common during the spring, summer, and fall months. Figure 7 shows an annual wind rose at the met tower location.

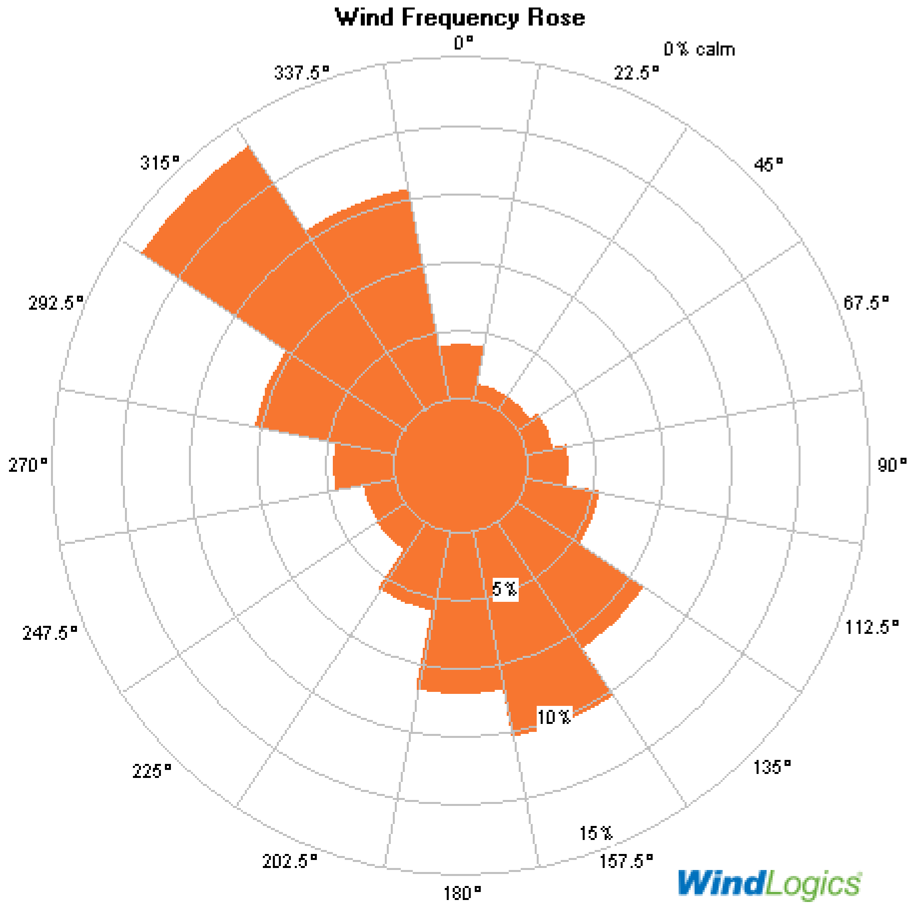


Figure 7: Annual Wind Rose – 80 m at Met 6765

6. CONCLUSIONS

The hub-height wind speed and energy production values calculated using the E-MCP method at the Morton, Minnesota site provide Westwood Professional Services, Inc. the best available long-term estimates for future windfarm planning purposes. The site-specific validation results demonstrate that the E-MCP method shows very strong predictive ability, providing confidence that the E-MCP results are an excellent representation of the long-term wind and power history for the site, both in the mean quantities and the shapes of the wind speed distributions.

The results of this process indicate a long-term wind speed value of 6.94 m/s and gross capacity factor of 38.4% for the GE 1.6-82.5 – Normal Turbulence (Rev 0) – Cold Weather Package turbine at the Met 6765 location. An initial estimate of the net capacity factor based on a constant loss factor of 15% is 32.7% for the GE 1.6-82.5 – Normal Turbulence (Rev 0) – Cold Weather Package turbine.

The analysis presented within this report was derived using a sophisticated methodology to ensure the highest quality estimation of the long term wind resource and energy potential at the Morton, Minnesota site. While WindLogics is confident in the results, the expected energy production will change based on any changes to the turbine technology or based on the actual location and number of turbines to be constructed.

It is recommended that Westwood Professional Services, Inc. continues to work with WindLogics as the potential of the Morton, Minnesota site progresses. WindLogics can provide assistance with Wind Farm Design Optimization, Net Energy Analysis, and several other services to provide solutions to many of your development needs.

APPENDIX B: Generation Interconnection Application Form

WHO SHOULD FILE THIS APPLICATION: Anyone expressing interest to install generation which will interconnect with Xcel Energy (Local electric utility). This application should be completed and returned to the Generation Interconnection Coordinator, in order to begin processing the request.

INFORMATION: This application is used by Xcel Energy to perform a preliminary interconnection review. The Applicant shall complete as much of the form as possible. The fields in BOLD are required to be completed to the best of the Applicant's ability. The Applicant will be contacted if additional information is required. The response may take up to 15 business days after receipt of all the required information.

COST: A payment to cover the application fee shall be included with this application. The application fee amount is outlined in the "State of Minnesota Interconnection Process for Distributed Generation Systems".

OWNER/APPLICANT		
Company / Applicant's Name: Dakota Futures, Inc.		
Representative: Darin Minkel	**Phone Number:** (507) 697-6236	**FAX Number:**
Title: CEO		
Mailing Address: 39375 County Highway 24 Morton, MN 56270		
Email Address: dakotafuturesceo@lowersioux.com		
LOCATION OF GENERATION SYSTEM INTERCONNECTION		
Street Address, legal description or GPS coordinates: 44.533N, 95W		
PROJECT DESIGN / ENGINEERING (if applicable)		
Company: Westwood Renewables, LLC		
Representative: Nathan Franzen	Phone: (952) 697-5700	FAX Number:
Mailing Address: 7699 Anagram Drive Eden Prairie, MN 55344		
Email Address: nfranzen@westwoodrenewables.com		
ELECTRICAL CONTRACTOR (if applicable)		
Company: TBD		
Representative:	Phone:	FAX Number:
Mailing Address:		
Email Address:		

(Continued on Sheet No. 10-103)

APPENDIX B: Generation Interconnection Application Form (Continued)

GENERATOR		
Manufacturer: General Electric (wind) and SMA (solar)		Model: GE 1.5sle, SMA SunnyCentral 500
Type (Synchronous Induction, Inverter, etc): Synchronous induction (wind), inverter (solar)		**Phases: 1 or 3** 3
Rated Output (Prime kW): 2000 (1500 wind, 500solar)	**(Standby kW):** 1	**Frequency:** 60Hz
Rated Power Factor (%): 99	**Rated Voltage (Volts):** 690V wind, 480V solar	Rated Current (Amperes): 2174 wind, 600 solar
Energy Source (gas, steam, hydro, wind, etc.) wind and solar hybrid system		

TYPE OF INTERCONNECTED OPERATION	
Interconnection / Transfer method: ☐ **Open** ☐ **Quick Open** ☐ **Closed** ☐ **Soft Loading** ☑ **Inverter**	
Proposed use of generation: (Check all that may apply) ☐ **Peak Reduction** ☐ **Standby** ☑ **Energy Sales** ☐ **Cover Load**	**Duration Parallel:** ☐ **None** ☐ **Limited** ☑ **Continuous**
Pre-Certified System **Yes / No (Circle one)**	**Exporting Energy** **Yes / No (Circle one)**

ESTIMATED LOAD INFORMATION		
The following information will be used to help properly design the interconnection. This Information is not intended as a commitment or contract for billing purposes.		
Minimum anticipated load (generation not operating):	**kW:** 0	**kVA:** 0
Maximum anticipated load (generation not operating):	**kW:** 1	**kVA:** 1

ESTIMATED START/COMPLETION DATES	
Construction start date: 3/11	**Completion (operational) date:** 9/11

DESCRIPTION OF PROPOSED INSTALLATION AND OPERATION
Attach a single line diagram showing the switchgear, transformers, and generation facilities. Give a general description of the manner of operation of the generation (cogeneration, closed-transition peak shaving, open-transition peak shaving, emergency power, etc.). Also, does the Applicant intend to sell power and energy or ancillary services and/or wheel power over Xcel Energy facilities? If there is an intent to sell power and energy, also define the target market.
The generating facility is a 2MW renewable energy plant, consisting of (1) 1.5MW GE wind turbine and (1) 500kW solar farm. The facility will operate in extended parallel with Xcel Energy. The applicant intends to sell power, energy, and renewable energy attributes to Xcel Energy. The facility will export power and energy direct to the grid.

(Continued on Sheet No. 10-104)

APPENDIX B: Generation Interconnection Application Form (Continued)

SIGN OFF AREA:

With this Application, we are requesting Xcel Energy to review the proposed Generation System Interconnection. We request that Xcel Energy identifies the additional equipment and costs involved with the interconnection of this system and to provide a budgetary estimate of those costs. We understand that the estimated costs supplied by Xcel Energy, will be estimated using the information provided. We also agree that we will supply, as requested, additional information, to allow Xcel Energy to better review this proposed Generation System interconnection. We have read the "State of Minnesota Distributed Generation Interconnection Requirements" and will design the Generation System and interconnection to meet those requirements.

Applicant Name (print): Darin Minkel

Applicant Signature: [signature] **Date:** 7-19-2010

SEND THIS COMPLETED & SIGNED APPLICATION AND ATTACHMENTS TO THE GENERATION INTERCONNECTION COORDINATOR

(Continued on Sheet No. 10-105)

APPENDIX C: Engineering Data Submittal Form

WHO SHOULD FILE THIS SUBMITTALL: Anyone in the final stages of interconnecting a Generation System with Xcel Energy. This submittal shall be completed and provided to the Generation Interconnection Coordinator during the design of the Generation System, as established in the "State of Minnesota Interconnection Process for Distributed Generation Systems".

INFORMATION: This submittal is used to document the interconnected Generation System. The Applicant shall complete as much of the form as applicable. The Applicant will be contacted if additional information is required.

OWNER / APPLICANT		
Company / Applicant: Dakota Futures, Inc.		
Representative: Darin Minkel	Phone Number: 507-697-6236	FAX Number:
Title: CEO		
Mailing Address: 39375 County Highway 24 Morton, MN 56270		
Email Address: dakotafuturesceo@lowersioux.om		

PROPOSED LOCATION OF GENERATION SYSTEM INTERCONNECTION
Street Address, Legal Description or GPS coordinates: 44.533 N, 95W

PROJECT DESIGN / ENGINEERING (if applicable)		
Company: Westwood Professional Services		
Representative: Nathan Franzen	Phone: 952-697-5701	FAX Number: 952-937-5822
Mailing Address: 7699 Anagram Drive Eden Prairie, MN 55344		
Email Address: nathan.franzen@westwoodps.com		

ELECTRICAL CONTRACTOR (if applicable)		
Company:		
Representative:	Phone:	FAX Number:
Mailing Address:		
Email Address:		

(Continued on Sheet No. 10-106)

APPENDIX C: Engineering Data Submittal Form (Continued)

TYPE OF INTERCONNECTED OPERATION	
Interconnection / Transfer method: ☐ Open ☐ Quick Open ☐ Closed ☐ Soft Loading ☒ Inverter	
Proposed use of generation: (Check all that may apply) ☐ Peak Reduction ☐ Standby ☒ Energy Sales ☐ Cover Load	Duration Parallel: ☐ None ☐ Limited ☒ Continuous
Pre-Certified System: (Yes) / No (Circle one)	Exporting Energy (Yes) / No (Circle one)

GENERATION SYSTEM OPERATION / MAINTENANCE CONTACT INFORMATION		
Maintenance Contact for System TBD		
Maintenance Provider:	Phone #:	Pager #:
Operator Name:	Phone #:	Pager #:
Person to Contact before remote starting of units		
Contact Name:	Phone #:	Pager #:
	24hr Phone #:	

GENERATION SYSTEM OPERATING INFORMATION	
Fuel Capacity (gals):	Full Fuel Run-time (hrs):
Engine Cool Down Duration (Minutes):	Start time Delay on Load Shed signal:
Start Time Delay on Outage (Seconds):	

ESTIMATED LOAD		
The following information will be used to help properly design the interconnection. This Information is not Intended as a commitment or contract for billing purposes.		
Minimum anticipated load (generation not operating):	kW: 0	kVA: 0
Maximum anticipated load (generation not operating):	kW: 10	kVA: 10

(Continued on Sheet No. 10-107)

APPENDIX C: Engineering Data Submittal Form (Continued)

REQUESTED CONSTRUCTION START/COMPLETION DATES	
Design Completion:	1/1/2011
Construction Start Date:	3/1/2011
Footings in place:	4/1/2011
Primary Wiring Completion:	7/1/2011
Control Wiring Completion:	8/1/2011
Start Acceptance Testing:	8/15/2011
Generation operational (In-service):	9/1/2011
(Complete all applicable items. Copy this page as required for additional generators.)	

SYNCHRONOUS GENERATOR (if applicable)			
Unit Number:	Total number of units with listed specifications on site:		
Manufacturer:	Type:	Phases: 1 or 3	
Serial Number (each)	Date of manufacture:	Speed (RPM):	Freq. (Hz);
Rated Output (each unit) kW Standby:	kW Prime:	kVA:	
Rated Power Factor (%):	Rated Voltage(Volts):	Rated Current (Amperes):	
Field Voltage (Volts):	Field Current (Amperes):	Motoring Power (kW):	
Synchronous Reactance (Xd):	% on	kVA base	
Transient Reactance (X'd):	% on	kVA base	
Subtransient Reactance (X'd):	% on	kVA base	
Negative Sequence Reactance (Xs):	% on	kVA base	
Zero Sequence Reactance (Xo):	% on	kVA base	
Neutral Grounding Resistor (if applicable):			
I^2t or K (heating time constant):			
Exciter data:			
Governor data: Additional Information:			

(Continued on Sheet No. 10-108)

APPENDIX C: Engineering Data Submittal Form (Continued)

INDUCTION GENERATOR (if applicable) Refer to Attachment 3, "Grid Interconnection"	
Rotor Resistance (Rr): Ohms Rotor Reactance (Xr): Ohms Magnetizing Reactance (Xm): Ohms	Stator Resistance (Rs): Ohms Stator Reactance (Xs): Ohms Short Circuit Reactance (Xd): Ohms
Design Letter:	Frame Size:
Exciting Current:	Temp Rise (deg C°):
Rated Output (kW): 1545	
Reactive Power Required: +/- 200 kVars (no Load) kVars (full load)	
If this is a wound-rotor machine, describe any external equipment to be connected (resistor, rheostat, power converter, etc.) to rotor circuit, and circuit configuration. Describe ability, if any, to adjust generator reactive output to provide power system voltage regulation. Rotor side: IGBT converter w/ variable frequency output, DC intermediate circuit. Grid side: power inverter	
Additional Information: System functions as a PWM converter in 4-quadrant operation.	

PRIME MOVER (Complete all applicable items)			
Unit Number: 1.5 sle	Type: double-fed induction w/ wound rotor		
Manufacturer: General Electric			
Serial Number: TBD		Date of Manufacture: TBD	
H.P. Rated:	H.P. Max:	Inertia Constant:	lb.-ft.^{2}
Energy Source (hydro, steam, wind, wind etc.): Wind			

INTERCONNECTION (STEP-UP) TRANSFORMER (If applicable) See Attachment 1		
Manufacturer:	kVA:	
Date of Manufacture:	Serial Number:	
High Voltage: kV	Connection: delta wye	Neutral solidly grounded?
Low Voltage: kV	Connection: delta wye	Neutral solidly grounded?
Transformer Impedance (Z):	% on	kVA base
Transformer Resistance (R):	% on	kVA base
Transformer Reactance (X):	% on	kVA base
Neutral Grounding Resistor (if applicable)		

(Continued on Sheet No. 10-109)

APPENDIX C: Engineering Data Submittal Form (Continued)

TRANSFER SWITCH (If applicable)	
Model Number:	Type:
Manufacturer:	Rating (amps):

INVERTER (If applicable) See Attachment 2		
Manufacturer:	Model:	
Rated Power Factor (%):	Rated Voltage (Volts):	Rated Current (Amperes):
Inverter Type (ferroresonant, step, pulse-width modulation, etc.):		
Type of Commutation: forced line	Minimum Short Circuit Ratio required:	
Minimum voltage for successful commutation:		
Current Harmonic Distortion	Maximum Individual Harmonic (%): Maximum Total Harmonic Distortion (%):	
Voltage Harmonic Distortion	Maximum Individual Harmonic (%): Maximum Total Harmonic Distortion (%):	
Describe capability, if any, to adjust reactive output to provide voltage regulation:		
NOTE: *Attach all available calculations, test reports, and oscillographic prints showing inverter output voltage and current waveforms.*		

POWER CIRCUIT BREAKER (if applicable)					
Manufacturer:				Model:	
Rated Voltage (kilovolts):				Rated Ampacity (Amperes):	
Interrupting Rating (Amperes):				BIL Rating:	
Interrupting Medium (vacuum, oil, gas, etc.)				Insulating Medium (vacuum, oil, gas, etc.)	
Control Voltage (Closing):	(Volts)	AC	DC		
Control Voltage (Tripping):	(Volts)	AC	DC	Battery	Charged Capacitor
Close Energy (circle one):	Spring	Motor	Hydraulic	Pneumatic	Other
Trip Energy (circle one):	Spring	Motor	Hydraulic	Pneumatic	Other
Bushing Current Transformers (Max. ratio):				Relay Accuracy Class:	
CT'S Multi Ratio? (circle one); No / Yes: (Available taps):					

(Continued on Sheet No. 10-110)

APPENDIX C: Engineering Data Submittal Form (Continued)

MISCELLANEOUS (Use this area and any additional sheets for applicable notes and comments)

Attachment 3 "Grid Interconnection" document by GE lists out equipment operational theory and specific parameters as requested
in this Appendix C.

Please refer to this attached document for expanded information.

"Grid Interconnection" document takes precedence over Attachment 4,
"Turbine Specifications."

SIGN OFF AREA

This Engineering Data Submittal documents the equipment and design of the Generation System. We agree to supply Xcel Energy with an updated Engineering Data Submittal any time significant changes are made in the equipment used or the design of the proposed Generation System. The Applicant agrees to design, operate and maintain the Generation System within the requirements set forth by the "State of Minnesota Distributed Generation Interconnection Requirements".

Applicant Name (print):

Applicant Signature: **Date:**

SEND THIS COMPLETED & SIGNED ENGINEERING DATA SUBMITTAL AND ANY ATTACHMENTS TO THE GENERATION INTERCONNECTION COORDINATOR

(Continued on Sheet No. 10-111)

Attachment 1

Interconnection Transformer Specifications

Wind

Manufacturer: General Electric
kVA: 1750
Date of Manufacture: TBD
Serial number: TBD
High voltage: 23.9kV Connection: delta Neutral solidly grounded?:
Low voltage: 0.69kV Connection: wye Neutral solidly grounded?: yes
Transformer Impedance: 5.75% on 1750kVA base
Transformer Resistance: 1.00% on 1750kVA base
Transformer Reactance: 5.66% on 1750kVA base
Neutral grounding resistor:

Solar

Manufacturer: Cooper Power Systems
kVA: 500
Date of Manufacture: TBD
Serial number: TBD
High voltage: 23.9kV Connection: wye Neutral solidly grounded?: yes
Low voltage: 0.48kV Connection: wye Neutral solidly grounded?: yes
Transformer Impedance: 5.00% on 500kVA base
Transformer Resistance: 1.30% on 500kVA base
Transformer Reactance: 4.83% on 500kVA base
Neutral grounding resistor:

Attachment 2

Inverter Specifications

Wind
Manufacturer: General Electric
Model: ESS
Rated Power Factor: 95%
Rated Voltage: 690V
Rated Current: 2239A
Inverter type: PWM
Type of commutation: line
Minimum Short Circuit Ratio required:
Minimum voltage for successful commutation: 690V
Current harmonic distortion
    Maximum individual harmonic: See Attachment 3
    Maximum THD: See Attachment 3
Voltage harmonic distortion
    Maximum individual harmonic: See Attachment 3
    Maximum THD: See Attachment 3
Describe capability, if any, to adjust reactive output to provide voltage regulation: Power factor 0.95 lagging or leading – see Appendix IV of Attachment 3, "Grid Interconnection" data report.

Solar
Manufacturer: Advanced Energy
Model: Solaron
Rated Power Factor: 99%
Rated Voltage: 480V
Rated Current: 600A
Inverter type:
Type of commutation: line
Minimum Short Circuit Ratio required:
Minimum voltage for successful commutation: 480V
Current harmonic distortion
    Maximum individual harmonic: 0.95
    Maximum THD: 5%
Voltage harmonic distortion
    Maximum individual harmonic: N/A
    Maximum THD: N/A
Describe capability, if any, to adjust reactive output to provide voltage regulation: +/- 150 kVAR setpoint is available.

GE Energy

Technical Documentation
Wind Turbine Generator Systems
GE 1.5 - 60 Hz

Grid Interconnection

GE imagination at work

Gepower.com

Visit us at
www.gewindenergy.com

All technical data is subject to change in line with ongoing technical development!

Table of Contents

1 Technology

The GE 1.5 MW, 60 Hz wind turbine is variable speed and employs a doubly-fed induction generator with a power converter interfacing the rotor to the grid. The wind turbine is capable of supplying/drawing reactive power to/from the grid thus contributing to grid voltage support. The turbine employs the simplified “ESS” electrical system.

The wind turbine is capable of quickly regulating voltage on a continuous basis and providing dynamic reactive power to the power system that corresponds to a selection of under excited/overexcited power factor offerings.

2 General Data

General data for the GE 1.5 MW, 60 Hz wind turbine is presented in Appendix I. Representative equivalent circuit for the generator is presented in Appendix II.

3 Step-Up Transformer

The individual wind turbines are connected through a step-up transformer to the collection system, recommended specification as follows:

- 690 V (Y-grounded) / 34.5 kV (delta) - typical
- 1.75 MVA*
- Impedance Z = 5.75 %, X/R ratio of 7.5, Z = 0.76 + j 5.70 %
- Proper protection in accordance with Appendix III.

4 Frequency Tolerance

The GE wind turbine is capable of continuous operation in the frequency range 57.5-61.5 Hz. The wind turbine trips as the frequency drops below 56.5 Hz or exceeds 63 Hz. As with the voltage, this is a wide range of frequency that enables the wind turbine to meet the most stringent interconnection requirements. Frequency limits for the GE 1.5 MW, 60 Hz wind turbine are as follows.

Under frequency range (Hz)	Over frequency range (Hz)	Trip time (sec)
57.5 - 60	60 - 61.5	Continuous Operation
	61.5 - 63	30
56.5 - 57.5		10
< 56.5	> 63	Instantaneous

Table 1: Frequency tolerance

* Based on WTG max rating; customers can optimize the MVA rating (not applicable for transformer inside tower)

5 Voltage Tolerance & Fault Ride-Thru

The standard GE 1.5 MW, 60 Hz wind turbine drops out as the WTG terminal voltage falls below 70%. Optional Wind Ride-Thru packages enable the wind turbine to continue to operate during ("ride-through") and after transmission system faults resulting in a severe voltage dip at the wind farm - available options are "LVRT" & "ZVRT". Table below summarizes voltage ride through capabilities:

Voltage %	Time (sec)		
	Standard	LVRT	ZVRT
115 - 130	0.1		
110 - 115	1		
90 - 110	Continuous		
85 - 90	600		
75 - 85	10		
70 - 75	1		
15 - 75		0.625 - 2.5	
0 - 75			0.2 - 2.825

Table 2: Voltage tolerance & fault ride-thru

Refer to Appendix V of this document for a graph of the ride-thru options.

6 Protection

The GE wind turbine has the following built-in protection functions:

- Over voltage (59) / Under voltage (27)
- Over frequency (81O) / Under frequency (81U)
- Voltage imbalance (60)

Additionally, the main circuit breaker located in the control cabinet at the bottom of the tower- provides over current protection (51) and comes with instantaneous, short time and long-time settings. Note that these functions are designed for protection of the wind turbine hardware.

7 Reactive Power Capability

The GE wind turbine has a standard reactive power capability corresponding to a power factor of 0.95 lagging (overexcited) to 0.95 leading (under excited).

With reactive power support from the line-side converter and the selection of the appropriate generator, GE Energy offers an expanded reactive power capability option: 0.90 lagging to 0.90 leading. This wide capability could help meet a 0.95 lagging power factor requirement at the point of interconnection.

Refer Appendix IV of this document for the reactive power capability curve.

8 Minimum Grid Strength

GE 1.5 WTG is designed to operate with a composite short circuit ratio of no lower than 2.78 at the high side of the turbine transformer. Composite SCR is defined as the ratio of the Composite short circuit MVA (with the high side of the all the turbine transformers bused together and a 3 phase short circuit applied at that point) to the nameplate MW of the wind farm. Note that the short circuit MVA calculation should reflect the maximum grid impedance corresponding to the minimum condition under which the wind farm is expected to continue normal operation. Operation of the wind farm outside the limits could result in control system instabilities – special studies will be needed to characterize the impact.

9 WindFREE Reactive Power

As an optional feature, GE 1.5 WTG can supply or consume reactive power (+/-200 kVAR) even when there is no active power generation (i.e wind below cut-in speed). This is achieved by utilizing capabilities of the line side converter in the rotor circuit.

10 WindINERTIA

With the optional "WindINERTIA" feature, GE 1.5 WTG can provide inertial response to help stabilize grid frequency. This feature supports the grid during under frequency events by providing a temporary increase in power production (5 – 10% increase in KW) for a short duration (10 sec), contributing towards frequency recovery. This is achieved by tapping into the stored kinetic energy in the rotor mass. The response is equivalent to that of a synchronous generator with an inertia constant of 3.5 sec.

11 Voltage Regulation

GE's WindCONTROL is a voltage / power factor controller that exploits the reactive

power capability of the individual wind turbine to meet a voltage / power factor set point at the point of interconnection. It measures the voltage and current at the point of interconnection (POI) and controls the wind farm's reactive power to regulate the voltage or power factor at POI. Through a graphical user interface (GUI), the user selects the mode of operation (constant power factor or voltage-controlled) and enters the corresponding voltage / power factor set point.

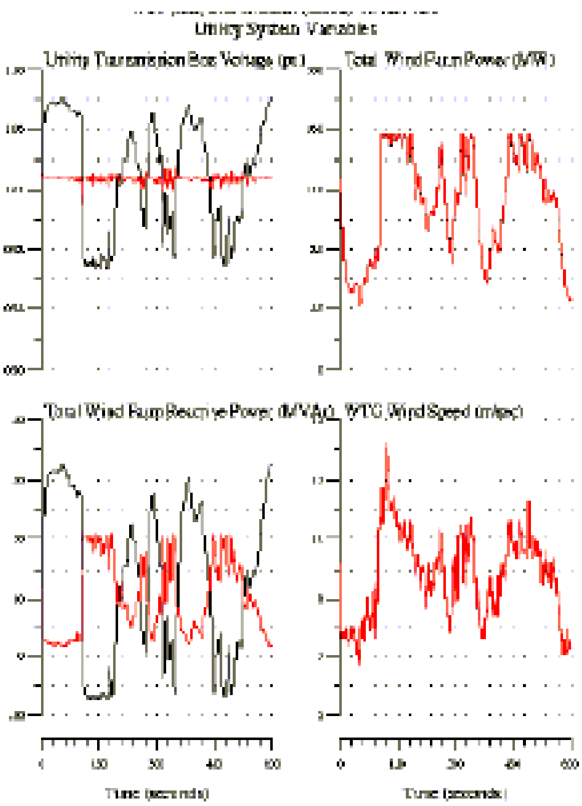
WindCONTROL is available with the following optional grid friendly features:

- Dynamic VAR Control (Voltage and PF control)
- Line Drop Compensation
- Power Curtailment
- Capacitor/Reactor Bank Control
- Ramp Rate/Power Fluctuation Control
- Frequency Droop Control

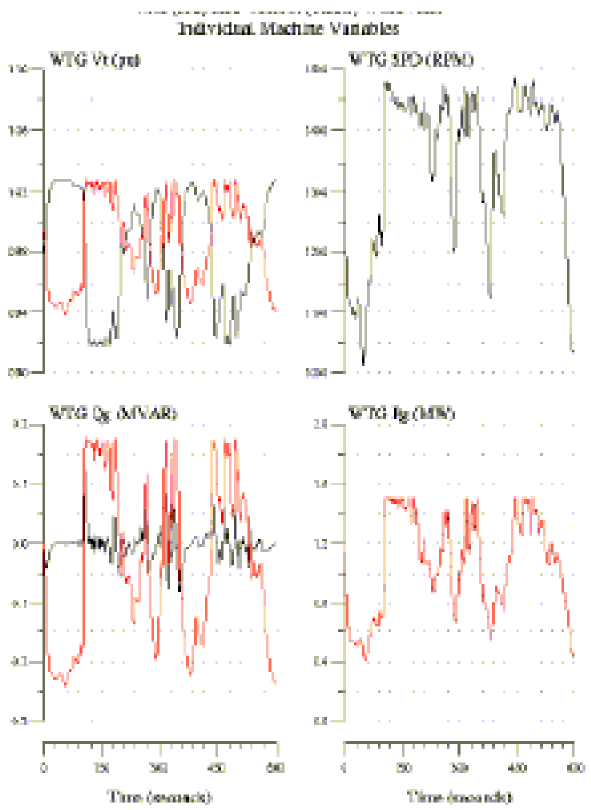
The figures below plot the simulated response of a wind farm with 108 GE 1.5 MW wind turbines connected to a weak grid. The wind farm is subjected to ten minutes of highly variable wind near rated wind speed. The red traces show the response with Dynamic VAR control operational. The black traces show the response with Dynamic VAR control disabled, namely the individual wind turbines operating in conventional local fixed power factor mode. Simulations with the Dynamic VAR control ON shows tight voltage regulation, effectively eliminating concerns about flicker.

Plots to the left present wind farm variables, including voltage and power at POI. At the point of interconnection (44 miles / 71 km from the wind farm), the system voltage with conventional power factor control exhibits unacceptable fluctuations. With the WindCONTROL-controlled system, the host utility voltage is tightly regulated and voltage variation is quite limited. As such, GE's WindCONTROL provides tight voltage regulation, effectively eliminating concerns about flicker.

Plots to the right present key variables for one of the wind turbines. The wind turbine's reactive power and terminal voltage are controlled by commands from WindCONTROL to produce the desired performance at POI. With Dynamic VAR control, the wind turbine's terminal voltage follows the reactive power as commanded.



System performance with and without WFMS



Wind turbine performance with and without WFMS

12 Harmonic Distortion

For North America, harmonic distortion is compared against limits set by IEEE Std. 519-1992 "IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems". These limits are summarized in Table 3 and Table 4 for voltage and current, respectively.

Presented in Table 5 and Table 6, test results on the GE 1.5 MW, 575 V, 60 Hz wind turbine with a GE converter show compliance with IEEE 519; the measured distortion being significantly below the maximum permissible limits. A harmonic spectrum for all harmonics up to h = 51 is presented next. Measurements were done on the low-voltage side of the unit step-up transformer.

Voltage at PCC	Individual Vh, %	Voltage THD, %
V < 69 kV	3.0	5.0
69 ≤ V < 161 kV	1.5	2.5
V ≥ 161 Kv	1.0	1.5

Table 3: IEEE 519 voltage harmonic distortion limits

Voltage at PCC	H < 11	11 ≤ h < 17	17 ≤ h < 23	23 ≤ h < 35	h ≥ 35	Current TDD, %
V < 69 kV	4.0	2.0	1.5	0.6	0.30	5.0
V ≥ 69 kV	2.0	1.0	0.75	0.30	0.15	2.5

Table 4: IEEE 519 current distortion limits

Limits are for $I_{sc}/I_n < 20$ for V < 161 kV and $I_{sc}/I_n < 50$ for V ≥ 161 kV.
PCC is the point of common coupling.
TDD is the total demand distortion (THD normalized by the current I_n).
I_n is the maximum fundamental frequency current at PCC.
I_{sc} is the maximum short-circuit current at PCC.
Even harmonics shall be limited to 25 % of the odd harmonics limits.

%	V_5	V_7	V_{11}	V_{13}	V_{17}	V_{19}	V_{23}	V_{25}	V_{29}	V_{31}	...	THD
IEEE 519 limits	3.0											5.0
Test results	0.628	0.084	0.078	0.121	0.162	0.170	0.009	0.062	0.037	0.011	...	0.75

Table 5: Measured voltage harmonic distortion – phase b – V_i = 580 V

%	I_5	I_7	I_{11}	I_{13}	I_{17}	I_{19}	I_{23}	I_{25}	I_{29}	I_{31}	...	THD
IEEE 519 limits	4.0		2.0		1.5		0.6				0.3	5.0
Test results	1.296	0.286	0.059	0.041	0.062	0.087	0.016	0.020	0.004	0.009	...	1.47

Table 6: Measured current harmonic distortion – phase b – I_1 = 1590 A

f [Hz]	h	V_a [V]	V_a [%]	V_b [V]	V_b [%]	V_c [V]	V_c [%]	I_a [A]	I_a [%]	I_b [A]	I_b [%]	I_c [A]	I_c [%]
60	1	585	100	580	100	581	100	1510	100	1590	100	1620	100
120	2	0.0957	0.01636	0.207	0.03569	0.214	0.03683	1.99	0.13179	2.35	0.1478	2.18	0.13457
180	3	1.28	0.2188	0.913	0.15741	0.365	0.06282	11.1	0.7351	9.3	0.58491	2.45	0.15123
240	4	0.0284	0.00485	0.106	0.01828	0.116	0.01997	1.11	0.07351	1.44	0.09057	0.391	0.02414
300	5	3.44	0.58803	3.64	0.62759	3.23	0.55594	21.7	1.43709	20.6	1.2956	22.6	1.39506
360	6	0.0244	0.00417	0.0679	0.01171	0.0554	0.00954	0.553	0.03662	0.349	0.02195	0.922	0.05691
420	7	0.45	0.07692	0.488	0.08414	0.553	0.09518	4.54	0.30066	4.55	0.28616	5.25	0.32407
480	8	0.0795	0.01359	0.0837	0.01443	0.145	0.02496	0.453	0.03	0.0513	0.00323	0.554	0.0342
540	9	0.138	0.02359	0.13	0.02241	0.146	0.02513	0.405	0.02682	0.338	0.02126	0.51	0.03148
600	10	0.118	0.02017	0.0894	0.01541	0.197	0.03391	0.323	0.02139	0.331	0.02082	0.219	0.01352
660	11	0.346	0.05915	0.451	0.07776	0.498	0.08571	0.722	0.04781	0.938	0.05899	0.636	0.03926
720	12	0.145	0.02479	0.0628	0.01083	0.085	0.01463	0.337	0.02232	0.242	0.01522	0.583	0.03599
780	13	0.563	0.09624	0.701	0.12086	0.579	0.09966	0.666	0.04411	0.646	0.04063	0.319	0.01969
840	14	0.368	0.06291	0.238	0.04103	0.182	0.03133	0.656	0.04344	0.651	0.04094	0.393	0.02426
900	15	0.123	0.02103	0.188	0.03241	0.162	0.02788	0.145	0.0096	0.105	0.0066	0.274	0.01691
960	16	0.159	0.02718	0.179	0.03086	0.241	0.04148	0.131	0.00868	0.308	0.01937	0.278	0.01716
1020	17	0.198	0.03385	0.94	0.16207	0.792	0.13632	0.521	0.0345	0.985	0.06195	1.22	0.07531
1080	18	0.309	0.05282	0.391	0.06741	0.514	0.08847	0.601	0.0398	0.532	0.03346	0.626	0.03864
1140	19	0.811	0.13863	0.988	0.17034	0.192	0.03305	0.919	0.06086	1.38	0.08679	0.81	0.05
1200	20	0.517	0.08838	0.526	0.09069	0.608	0.10465	1.16	0.07682	0.94	0.05912	1.23	0.07593
1260	21	0.0296	0.00506	0.264	0.04552	0.239	0.04114	0.36	0.02384	0.162	0.01019	0.481	0.02969
1320	22	0.532	0.09094	0.74	0.12759	0.75	0.12909	0.983	0.0651	1.1	0.06918	1.26	0.07778
1380	23	0.186	0.03179	0.0496	0.00855	0.202	0.03477	0.205	0.01358	0.25	0.01572	0.241	0.01488
1440	24	0.406	0.0694	0.474	0.08172	0.0791	0.01361	0.245	0.01623	0.783	0.04925	0.567	0.035
1500	25	0.115	0.01966	0.36	0.06207	0.298	0.05129	0.249	0.01649	0.325	0.02044	0.647	0.03994
1560	26	0.18	0.03077	0.0744	0.01283	0.254	0.04372	0.337	0.02232	0.0773	0.00486	0.259	0.01599
1620	27	0.148	0.0253	0.217	0.03741	0.0792	0.01363	0.0688	0.00456	0.283	0.0178	0.184	0.01136
1680	28	0.0543	0.00928	0.195	0.03362	0.147	0.0253	0.0962	0.00637	0.214	0.01346	0.275	0.01698
1740	29	0.148	0.0253	0.216	0.03724	0.276	0.0475	0.275	0.01821	0.061	0.00384	0.31	0.01914
1800	30	0.436	0.07453	0.617	0.10638	0.449	0.07728	0.436	0.02887	0.679	0.0427	0.766	0.04728
1860	31	0.0835	0.01427	0.0619	0.01067	0.0937	0.01613	0.172	0.01139	0.142	0.00893	0.239	0.01475
1920	32	0.23	0.03932	0.177	0.03052	0.129	0.0222	0.294	0.01947	0.325	0.02044	0.165	0.01019
1980	33	0.0922	0.01576	0.0189	0.00326	0.0721	0.01241	0.086	0.0057	0.122	0.00767	0.0827	0.0051
2040	34	0.0929	0.01588	0.156	0.0269	0.106	0.01824	0.0728	0.00482	0.0673	0.00423	0.0885	0.00546
2100	35	0.0401	0.00685	0.04	0.0069	0.0186	0.0032	0.0693	0.00459	0.0867	0.00545	0.0951	0.00587
2160	36	0.0914	0.01562	0.0179	0.00309	0.0766	0.01318	0.0706	0.00468	0.0312	0.00196	0.0815	0.00503
2220	37	0.0531	0.00908	0.0279	0.00481	0.0906	0.01559	0.018	0.00119	0.0179	0.00113	0.11	0.00679
2280	38	0.0408	0.00697	0.0629	0.01084	0.0335	0.00577	0.00943	0.00062	0.0624	0.00392	0.081	0.005
2340	39	0.0423	0.00723	0.0285	0.00491	0.0647	0.01114	0.0262	0.00174	0.0246	0.00155	0.0965	0.00596
2400	40	0.0229	0.00391	0.0912	0.01572	0.0803	0.01382	0.0742	0.00491	0.0804	0.00506	0.0648	0.004
2460	41	0.0518	0.00885	0.0573	0.00988	0.115	0.01979	0.0629	0.00417	0.0841	0.00529	0.0749	0.00462
2520	42	0.0437	0.00747	0.0516	0.0089	0.0846	0.01456	0.053	0.00351	0.0403	0.00253	0.134	0.00827
2580	43	0.0901	0.0154	0.0844	0.01455	0.0977	0.01682	0.0748	0.00495	0.0528	0.00332	0.122	0.00753
2640	44	0.112	0.01915	0.115	0.01983	0.0892	0.01535	0.0914	0.00605	0.0973	0.00612	0.0823	0.00508
2700	45	0.057	0.00974	0.08	0.01379	0.0919	0.01582	0.066	0.00437	0.0343	0.00216	0.186	0.01148
2760	46	0.0862	0.01474	0.102	0.01759	0.101	0.01738	0.135	0.00894	0.0722	0.00454	0.19	0.01173
2820	47	0.0782	0.01337	0.0206	0.00355	0.097	0.0167	0.0601	0.00398	0.112	0.00704	0.0998	0.00616
2880	48	0.0525	0.00897	0.0216	0.00372	0.0639	0.011	0.122	0.00808	0.0516	0.00325	0.0472	0.00291
2940	49	0.0619	0.01058	0.101	0.01741	0.128	0.02203	0.0846	0.0056	0.0641	0.00403	0.0812	0.00501
3000	50	0.0892	0.01525	0.102	0.01759	0.0964	0.01659	0.0493	0.00326	0.08	0.00503	0.0892	0.00551
3060	51	0.0885	0.01513	0.04	0.0069	0.0677	0.01165	0.012	0.00079	0.0922	0.0058	0.0305	0.00188
rms		585.01		580.02		581.012		1510.21		1590.17		1620.17	
THD, %		0.6910		0.7546		0.6512		1.6582		1.4726		1.4603	

Table 7

13 System Modeling

13.1 Wind Turbine Short Circuit Modeling

GE 1.5 turbine is a Doubly fed asynchronous generator - with the stator directly connected to the grid while the rotor is interfaced through a frequency converter to the grid. This arrangement does not lend itself very well to synchronous generator type simplification (Xd" etc). For most faults that occur on the grid, the turbine will act as a controlled current source - contributing up to 3 pu fault current for up to 3 cycles, after which is returns to normal current contribution (i.e 1 pu). For faults on the grid, the contribution from the turbines is minimal compared to that from the grid.

One exception to the above is for "close in" faults (eg: inside the wind farm, at the WF substation etc) - where, depending on the severity, the converter may "crowbar" (i.e disconnect itself to protect the power electronics within) - in which case the turbine rotor is short circuited like that of a squirrel cage induction generator. In this case, the behavior can be approximated to X' = 0.2 , contributing a max of 5 pu fault current.

13.2 Wind Turbine Dynamic Modeling

A dynamic model of the GE wind turbine is available in PSLF (from GE Energy Applications & Systems Eng) and PSS/E. Any user with a valid license and current maintenance and support (M&S) agreement of the respective software can obtain the latest GE wind turbine model in that software directly from GE Energy Applications & Systems Eng or PSS/E. The model comes with documentation and default data. This is intended to save time, reduce data entry efforts and copying errors, and get rid of unnecessary mechanical work. The dynamic model is based on GE's document "Modeling of GE Wind Turbine-Generators for Grid Studies".

13.3 Wind Turbine Transient Modeling

GE Energy Applications & Systems Eng maintains a transient model of the GE wind turbine and can be contracted to do detailed studies.

13.4 Wind Turbine Dynamic Model Validation

The dynamic model of the GE wind turbine implemented in PSLF (GE's dynamic simulation program), has been validated by comparing the response to simulations performed in WindTRAP (transient program). Simulations show closely matching results with a small offset in the wind turbine's reactive power and reactive current. Of course, high-frequency transients in WindTRAP are not expected to show up in PSLF simulations. Details are in the document "Validation of GE 1.5 MW, 60 Hz Wind Turbine-Generator Dynamic Model".

13.5 Wind Turbine Transient Model Validation

The transient model of the GE wind turbine has been validated against factory tests for three-phase and line-to-ground faults at the generator terminals. Results show that simulations closely matched recorded data except for fault recovery in the three-phase fault event.

Appendix I – General Data (reference only)

Parameter	Value	Unit
Rated power	1545*	KW
Rated voltage	690	V
Apparent Power (@ PF = 0.9 lag)	1717	KVA
Rated frequency	60	Hz
Poles	6	
Power factor - standard	+/- 0.90	
Power factor - optional	+/- 0.95	
Rated current		
Stator (PF = 0.9 lag)	1246	A
Rotor (PF = 0.9 lag)	640	A
Locked rotor voltage	1800	V
Connection		
Stator	Delta	
Rotor	Star	
Synchronous speed	1200	rpm
Rated speed	1440	rpm
Slip at rated speed	-20	%
Speed range	800 - 1600	Rpm
Max frequency drift	2	Hz / sec

Table 8: General data

* 1545 KW corresponds to the generator KW rating. Rated output of the turbine is 1500 KW.

Appendix II – Representative Generator Data

Equivalent circuit diagram

All resistances for 25°C.

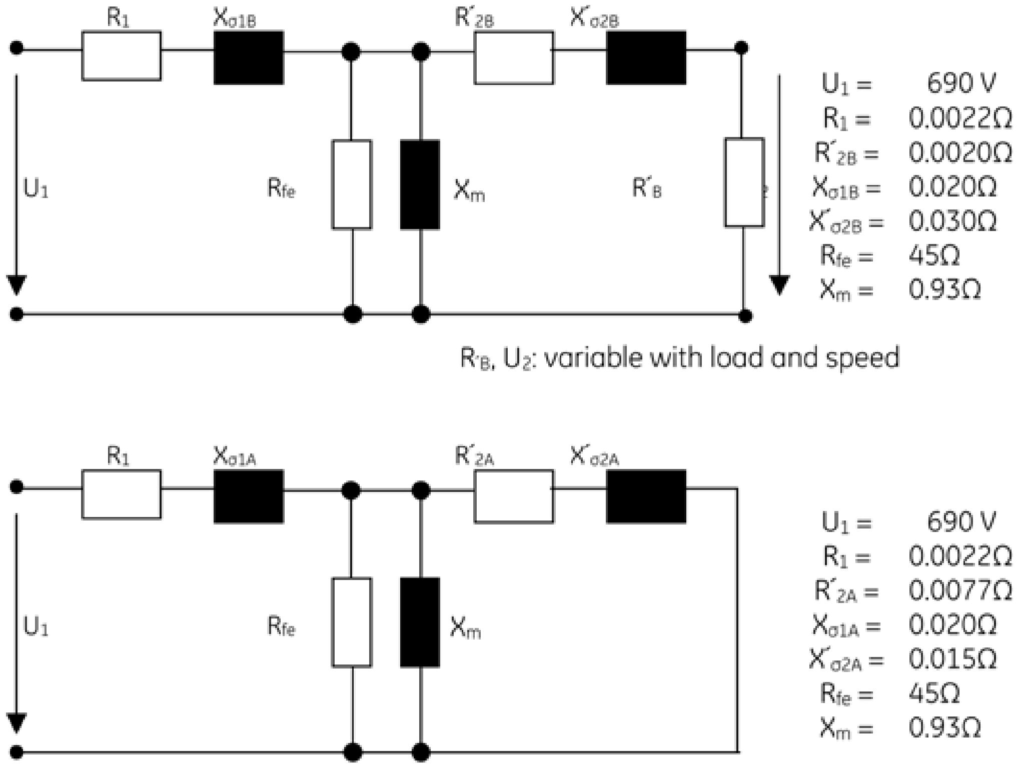


Figure 1: Circuit diagram

Note: The equivalent diagrams are for reference only and should not be directly used for short circuit calculations. Refer section 11.1.

Appendix III Step-Up Transformer Protection

Arc hazard resulting from a phase-to-phase or phase-to-ground fault within the cable entry area of the Power Distribution Cabinet (PDC) of the Down tower Assembly (DTA) can be significant and needs to be controlled. Low-voltage protection at the wind turbine's step-up transformer is the preferred method of controlling the amount of energy released into the cabinet during a fault. Design effort has been taken to increase robustness of the PDC and to isolate incoming conductors.

The result of these improvements has accomplished the following:

1. Restrictive access to the cable entry area of the PDC where incoming cables connect to the circuit breaker. Reinforced enclosure around cable entry area has been incorporated. This configuration aids in the prevention of an arc hazard. No access is allowed to the cable entry area of the PDC when energized. Any special need to troubleshoot this area of the cabinet requires the step-up transformer to be de-energized at the medium-voltage side.
2. All incoming power to the other areas within the DTA are protected by fuses and circuits breakers. Access to these cabinets is acceptable while the incoming power to the PDC is energized as long as LOTO and standard safety precautions are followed and PPE is employed.

Factors that influence the time duration and energy released during a fault include the impedance of the step-up transformer, the medium-voltage fuse on the step-up transformer, and the type of fault (3-phase, line-to-line, or line-to-ground). The larger the impedance of the arcing fault, the longer the fault and the greater the danger potential to personnel and equipment. The decision not to supply protection on the low-voltage side of the wind turbine's step-up transformer can only be taken under the assumption that proper fusing is selected for the medium-voltage side limiting the total duration of a fault to less than 8 seconds. It is to be noted that 8 seconds is based on some experience events and calculations aimed at identifying a high probability that the protection will eventually clear the fault, thus not allowing it to self sustain. Equipment experiencing this level of energy intake will be significantly damaged and full replacement of the panel becomes required. However, safety analysis conducted by the team indicated that the probability of events occurring in the proper sequence is significantly low and that potential harm to workers following proper procedures is highly unlikely.

As such, a wind farm employing medium-voltage fuses and satisfying the above will meet the minimum criteria established for personnel protection, and can be commissioned and maintained per current procedures. Further risk-reduction to personnel safety and damage to equipment requires low-voltage circuit breaker protection, and is at the customer's discretion.

The low-voltage circuit breaker shall be coordinated to clear arcing faults (single-line-to-ground "L-G", double-line-to-ground "L-L-G", line-to-line "L-L", or three-phase "3-ph") with an arc gap of 1 inch (25 mm) at the incoming feeder to the wind turbine's PDC. Recommended settings for the circuit breaker are as follows.

690 V, 60 Hz, 2000 A circuit breaker

I - Instantaneous over current protection: 14,000 A
S - Short-time over current protection: 4,000 A / 0.4 s
L - Long-time over current protection: 2,000 A
G - Ground-fault protection: 500 A / 0.3 s.

Appendix IV - Reactive Power Capability Curve

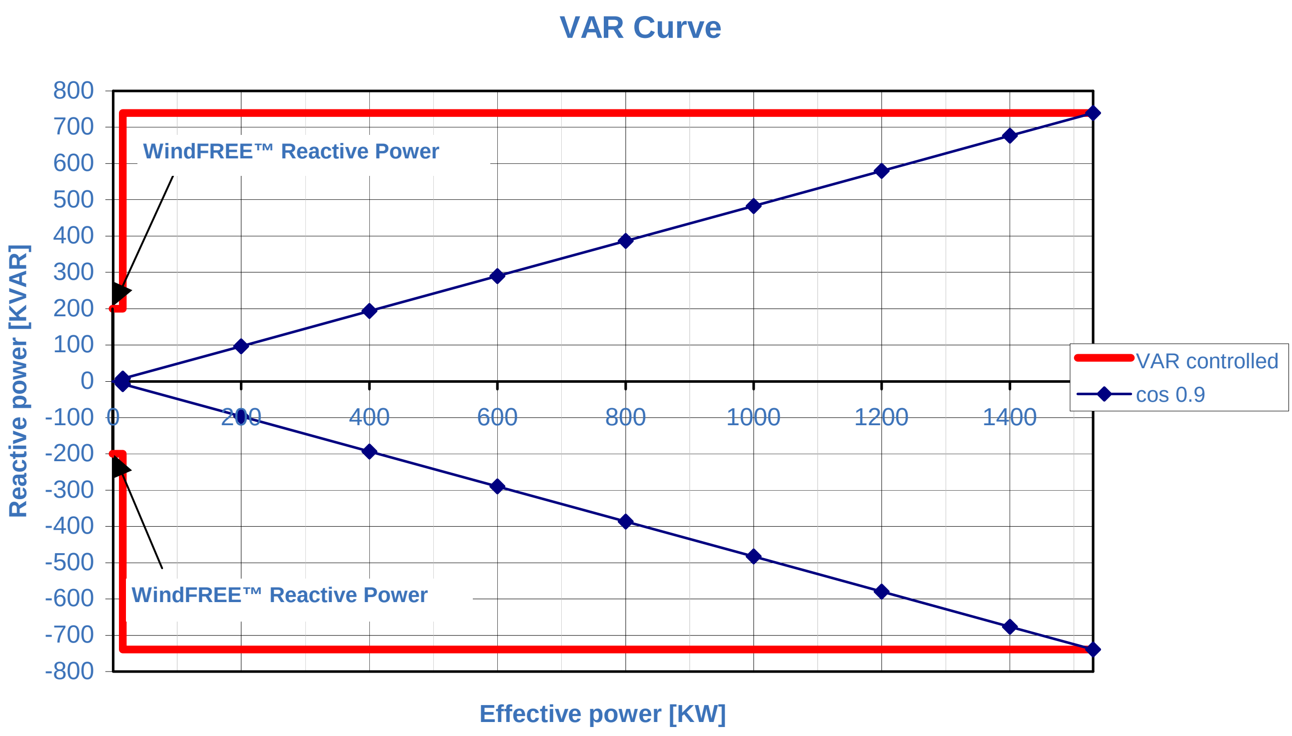


Figure 2: VAR curve

Note: The above graph includes information on the standard PF power option (+/-0.90) and WindFREE option. Full VAR capability corresponding to the selected option (as denoted by the rectangles) is available at all KW values above the cut-in speed. WindFREE option can provide VARs below cut-in speed.

Appendix V – WindRIDE-THRU

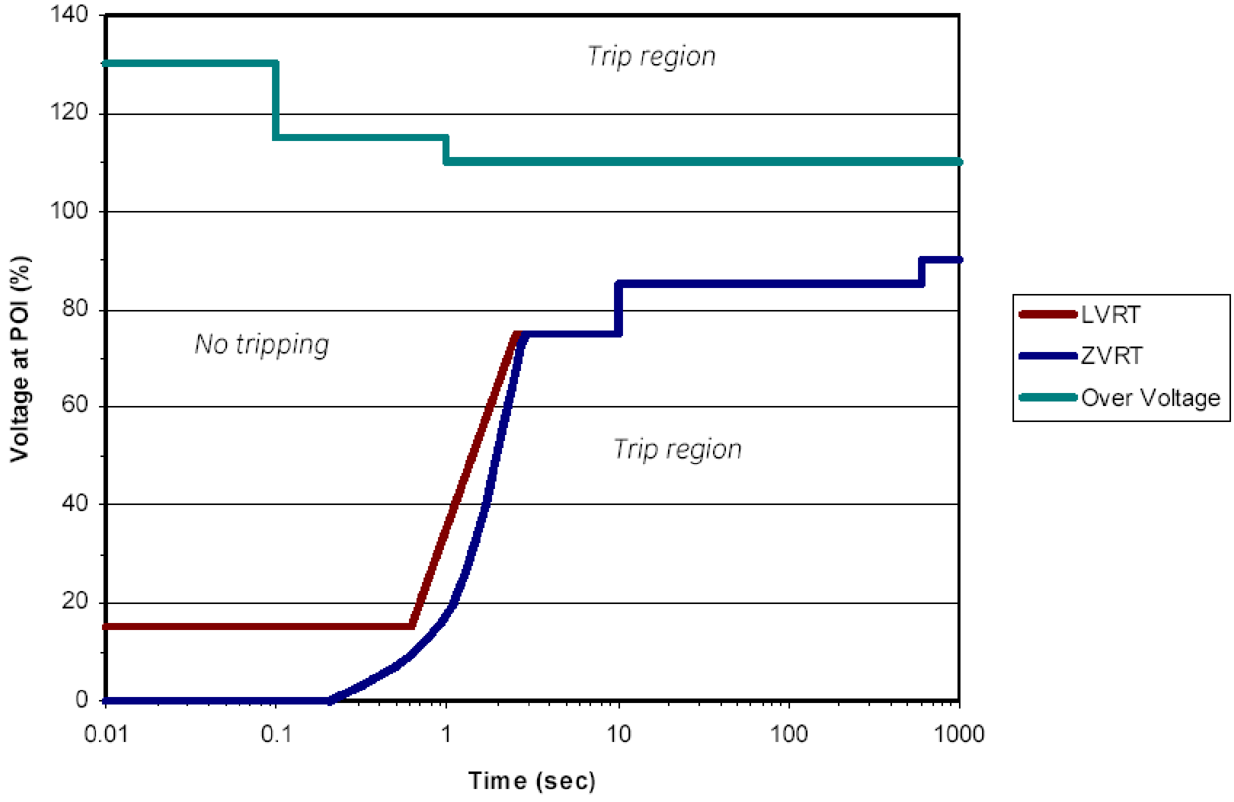


Figure 3: WindRIDE-Thru

Xcel Energy®

1518 Chestnut Avenue
Minneapolis, Minnesota 55403-1232

November 22, 2010

Westwood Renewables, LLC
Attn: Nathan Franzen
7699 Anagram Drive
Eden Prairie, MN 55344

Re: Dakota Futures Interconnection Study and Systems Modifications Indicative Cost Estimate

Dear Mr. Nathan Franzen,

Thank you for the opportunity to respond to your request for engineering analysis and indicative cost estimate information regarding the interconnection of a 1.5 MW wind turbine generator and 500KW in photovoltaic generation at 33082 Jackpot Ave, Morton, MN. Preliminary engineering produced an indicative cost estimate of $1,185,000 for system modifications. The cost is meant to give you an idea of the potential required investment. It is based on typical conditions encountered on past construction projects and utilized historical cost data from other Xcel Energy projects that may or may not be directly comparable. It is intended to provide a broad-based estimate of possible costs that may be incurred during a potential construction project. The following describes the components of the system that are required to be modified for accommodating proposed generation and the associated cost estimates.

An engineering study was performed to determine the system impacts associated with interconnecting 2MW of generation at the location requested. The interconnection location is approximately 11.5 line-miles from the distribution substation and the mainline is constructed using 2AS conductor. Interconnecting this magnitude of generation to the feeder circuit at the proposed location, as it is currently built, causes voltage effects outside of acceptable limits. Please see Xcel Energy's guidelines for flicker, defined as the percent difference in voltage before and after generator/motor startup, in the attached document. Flicker is limited to prevent irritation to customers in the area.

The flicker caused by 2MW of generation is calculated to be approximately 6% under low load conditions. Considering the variable nature of WTG and PV generation resources, the flicker should be under 2%. To limit the voltage effects caused by the generation, the line would have to be rebuilt using conductor with lower impedance. Approximately 10 miles of line from the generation site towards the substation would need to be rebuilt using 336AL conductor to minimize voltage effects within acceptable limits. It is estimated that rebuilding these 10 miles of line costs approximately $1,000,000.

Considering the aforementioned voltage effects, the voltage regulation scheme would need to be modified. Modifications would include moving and reprogramming three capacitor banks. The cost of this work is estimated to be $10,000.

The minimum load at the Morgan substation, from which the feeder circuit of interest originates, is slightly above 2MW. With the load and generation closely matched at times, risk of generation energizing an island exists and must be protected against. The electro-mechanical breaker protecting the feeder would need to be replaced with a recloser utilizing microprocessor based control. This would allow the relaying to be programmed with sync-check functionality and mitigate the risk of the circuit breaker closing out-of-sync into an energized line. Out-of-sync reclosing poses serious risks to customer equipment and the generators which are not rated to experience the high voltages associated with such an event. The cost of modifying the protection scheme to prevent islanding is approximately $100,000. Included in this estimate is a NOVA recloser with Form 6 control as well as substation engineering, design, documentation, programming, and labor associated with the installation.

The interconnection proposed would require installing SCADA monitoring telemetry to allow Xcel Energy dispatch and operations view generator status and output information in real time. This would most likely be accomplished utilizing a dedicated four-wire phone circuit from the generation site to the Morgan substation. The on-going O&M costs of the phone circuit are the responsibility of the interconnection customer. The estimated cost of installing a SCADA monitoring system at this location is $75,000.

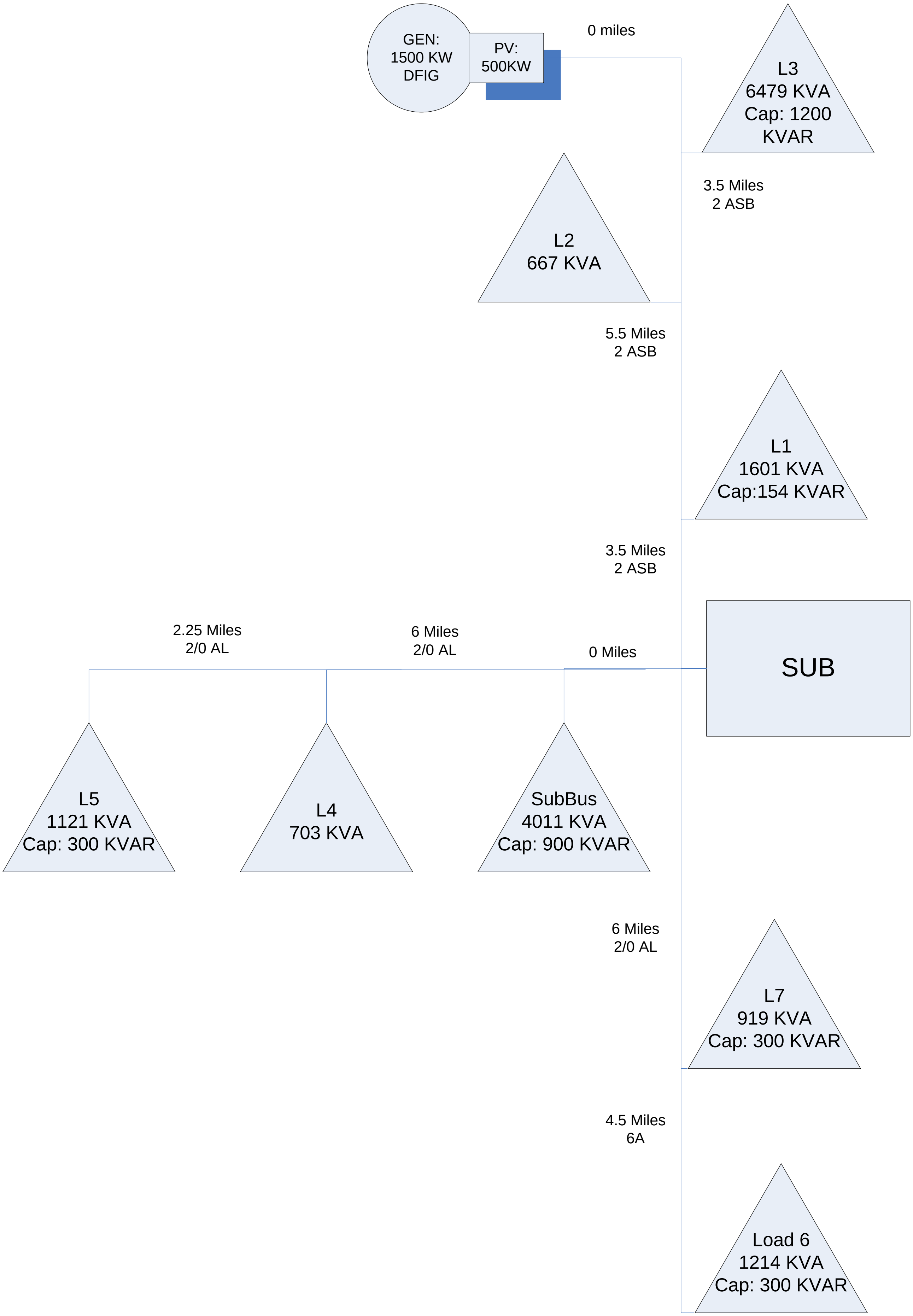
Should Dakota Futures choose to proceed with the project; a Statement of Work Requested will be issued for signature and payment before start of construction.

If you have questions, please contact Patrick Dalton at (612)-330-6375

Sincerely,

Pat Dalton

Patrick Dalton
Distribution Engineer
Xcel Energy
Patrick.L.Dalton@xcelenergy.com


GEN:
1500 KW
DFIG
PV:
500KW
0 miles
L3
6479 KVA
Cap: 1200
KVAR
3.5 Miles
2 ASB
L2
667 KVA
5.5 Miles
2 ASB
L1
1601 KVA
Cap:154 KVAR
3.5 Miles
2 ASB
2.25 Miles
2/0 AL
6 Miles
2/0 AL
0 Miles
SUB
L5
1121 KVA
Cap: 300 KVAR
L4
703 KVA
SubBus
4011 KVA
Cap: 900 KVAR
6 Miles
2/0 AL
L7
919 KVA
Cap: 300 KVAR
4.5 Miles
6A
Load 6
1214 KVA
Cap: 300 KVAR

Bus Voltages, pf=1

Load Generator	Min Off	Max Off	Min 1500KW	Max 1500KW	Min 2000KW	Max 2000KW	
Source Bus	40051.2	39478.6	39856.2	39552.1	39861.1	39572.8	L-L
Sub Bus	14185.9	14172.4	14171.6	14135.2	14171.9	14148.2	PH
L1	14182.5	13725.2	14183.8	13888.8	14233.4	13966.2	1.05pu
L2	14220.6	13183.1	14233.9	13654.2	14362	13830.1	0.96pu
L3	14265.1	12890.9	14278.9	13551.9	14457.6	13789	
G4	14265.2	12891	14444.6	13725.7	14673	14013.6	
L6	14183.4	14158.8	14169	14121.7	14169.3	14134.6	
L7	14106.8	13752.4	14092.6	13716.3	14092.9	13728.9	
L8	13990.7	13310.4	13976.5	13275.5	13976.8	13287.7	
L4	14184.1	14083.5	14169.7	14045.9	14170	14059.1	
L5	14188.5	14067.9	14174.1	14030.3	14174.3	14043.4	
Gen Site	411.841	372.166	417.902	397.144	424.61	405.548	

Voltage Rise, pf=1

Load Generator	Min Off	Max Off	Min 1500KW	Max 1500KW	Min 2000KW	Max 2000KW
Source Bus	40051.2	39478.6	-0.49%	0.19%	-0.47%	0.24%
Sub Bus	14185.9	14172.4	-0.10%	-0.26%	-0.10%	-0.17%
L1	14182.5	13725.2	0.01%	1.19%	0.36%	1.76%
L2	14220.6	13183.1	0.09%	3.57%	0.99%	4.91%
L3	14265.1	12890.9	0.10%	5.13%	1.35%	6.97%
G4	14265.2	12891	1.26%	6.48%	2.86%	8.71%
L6	14183.4	14158.8	-0.10%	-0.26%	-0.10%	-0.17%
L7	14106.8	13752.4	-0.10%	-0.26%	-0.10%	-0.17%
L8	13990.7	13310.4	-0.10%	-0.26%	-0.10%	-0.17%
L4	14184.1	14083.5	-0.10%	-0.27%	-0.10%	-0.17%
L5	14188.5	14067.9	-0.10%	-0.27%	-0.10%	-0.17%
Gen Site	411.841	372.166	1.47%	6.71%	3.10%	8.97%

Voltages, Gen lead 0.95 pf

Load Generator	Min Off	Max Off	Min pf .95 1500KW	Max pf .95 1500KW	Min pf .95 2000KW	Max pf .95 2000KW
Source Bus	40051.2	39478.6	39806	39500.9	39792.8	39502.3
Sub Bus	14185.9	14172.4	14126.9	14173.9	14111.1	14169.3
L1	14182.5	13725.2	14102	13893.1	14121.8	13938.7
L2	14220.6	13183.1	14096.3	13601.7	14175	13723.9
L3	14265.1	12890.9	14107.4	13461.6	14225.5	13631.4
G4	14265.2	12891	14241.7	13601.6	14399.7	13811.9
L6	14183.4	14158.8	14124.4	14160.3	14108.6	14155.7
L7	14106.8	13752.4	14048.1	13753.8	14032.4	13749.3
L8	13990.7	13310.4	13932.4	13311.8	13916.9	13307.5
L4	14184.1	14083.5	14124.8	14085	14108.9	14080.3
L5	14188.5	14067.9	14129.1	14069.4	14113.2	14064.7
Gen Site	411.841	372.166	405.693	386.897	408.284	390.907

Voltage Rise, Gen pf=0.95 lead

Load Generator	Min Off	Max Off	Min 1500KW	Max 1500KW	Min 2000KW	Max 2000KW
Source Bus	40051.2	39478.6	0.62%	0.06%	-0.65%	0.06%
Sub Bus	14185.9	14172.4	0.42%	0.01%	-0.53%	-0.02%
L1	14182.5	13725.2	0.57%	1.22%	-0.43%	1.56%
L2	14220.6	13183.1	0.88%	3.18%	-0.32%	4.10%
L3	14265.1	12890.9	1.12%	4.43%	-0.28%	5.74%
G4	14265.2	12891	0.17%	5.51%	0.94%	7.14%
L6	14183.4	14158.8	0.42%	0.01%	-0.53%	-0.02%
L7	14106.8	13752.4	0.42%	0.01%	-0.53%	-0.02%
L8	13990.7	13310.4	0.42%	0.01%	-0.53%	-0.02%
L4	14184.1	14083.5	0.42%	0.01%	-0.53%	-0.02%
L5	14188.5	14067.9	0.42%	0.01%	-0.53%	-0.02%

Gen Site	411.841	372.166	1.52%	3.96%	-0.86%	5.04%

the power to help you succeed.

A Professional Study for
Westwood Professional Services

Redwood County, MN Screening Study Near Morton, MN

October 4, 2011

Contact: Jeffrey Norman, P.E.
10710 Town Square Drive NE, Suite 201
Blaine, MN 55449
Direct: 763-783-5352
Fax: 763-755-7028
Email: PorterR@powersystem.org
Web Site: www.powersystem.org

Table of Contents

1.0 <u>Certification</u>

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Minnesota.

Jeffrey Richard Norman
Registration Number 44951

2.0 Background

The technical analysis summarized in this Report was performed at the request of Westwood Professional Services to identify the potential Point(s) of Interconnection ("POI's"), determine the outlet capacity, and identify the local transmission system limiters which would be likely be encountered for a proposed 14 MW wind generation project in Redwood County near Morton, MN.

This Report summarizes the results of the outlet capacity screening "TLTG" analysis performed to identify the thermal (line or transformer loading) limiters sequentially encountered as the generation at the site of interest was incremented from 0 to 100 MW. No voltage adequacy, voltage stability, or dynamic stability simulation was included within the scope of this study. The analysis was performed starting with the 2016 Summer Off-Peak (70% of peak) MRO model. Up to 100 MW of power was injected at the site of interest in 5 MW increments, and the limiting facilities encountered were noted for each level of generation. In this analysis, the incremental generation output was simulated as displacing existing generation.

The study is an "out of queue order" study which includes only existing or "under construction" generation projects; it does not include any other prior-queued generation or any associated Network Upgrades. Study assumptions have been based on PSE's knowledge of the electric power system and Client's study specifications. The accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to other generation additions and transmission improvements being contemplated by other entities. A change in the assumptions of the timing of other generation additions or transmission improvements will affect the accuracy of this study's conclusions. Thus a future MISO System Impact Study ("SIS") may yield different results if it utilizes different assumptions.

The final phase of the analysis was to identify the projects in the MISO queue that could impact the facilities this project would utilize for generation outlet.

3.0 Analysis Method

The Siemens Power Technologies, Inc. "PSS/E" digital computer powerflow simulation program was used to identify the MW levels at which the limiting facilities were sequentially encountered as the power injection (generation output) was incrementally increased at the interconnection site of interest.. This program is the standard transmission system modeling software utilized in MISO studies.

PSE used the most recent MRO summer off-peak model, the 2016 Summer Off-Peak (70% of peak) model, for this study. The "Summer Off-Peak" scenario is the "worst case" scenario, resulting in a highly stressed transmission system due to low local loads to utilize the excess local generation and the lower (than winter) summer line ratings.

In preparation for this analysis, the North Dakota Export (NDEX), Manitoba Hydro Export (MHEX) and Minnesota Wisconsin Export (MWEX) levels in the model were increased to their limits in order to stress the system to its design limits, thus maximizing the number of limiters that would show up as the level of power being injected was ramped from 0 to 100 MW and dispatched to the Twin Cities area.

Under the MISO study process, new generators are not responsible for mitigating a limiter if the distribution factor ("DF") for their generation on the limiter is less than 5% under system intact conditions and has a post-contingent DF of less than 20%. The distribution factor is calculated as follows:

$$\boldsymbol{DF = \frac{Branch\ FLow\ Post\ New\ Generation - Branch\ Flow\ Pre\ New\ Generation}{New\ Generation\ Power\ Output\ Level}}$$

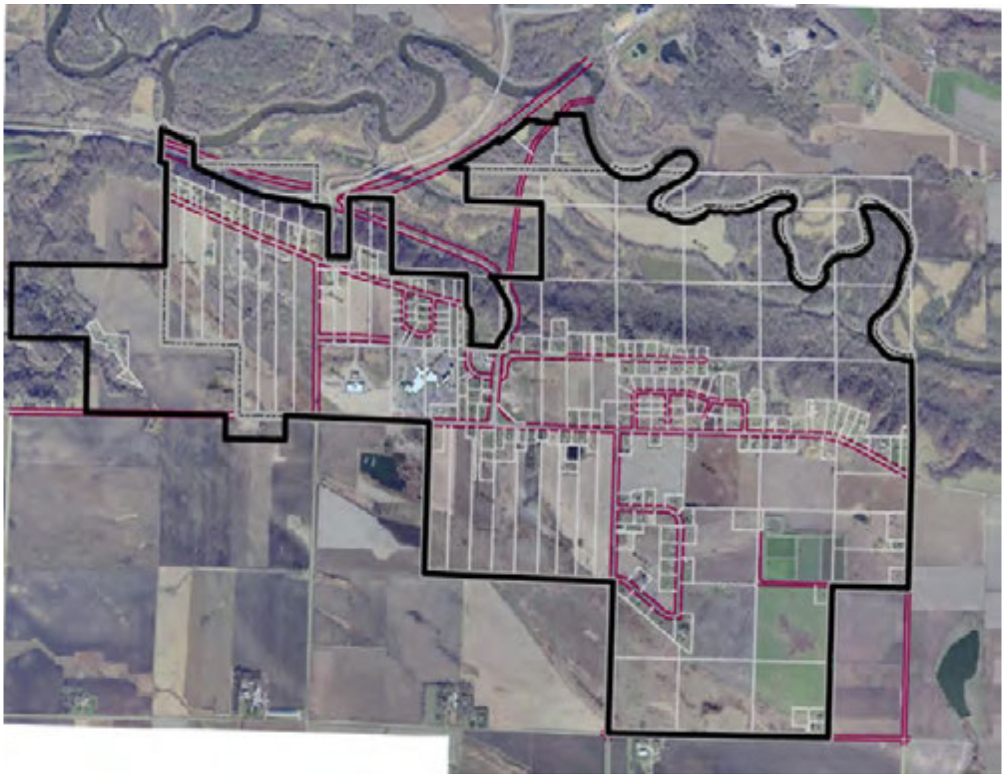
The analysis described in this report is based on the "generation to generation" method of modeling new generation resources; consistent with MISO evaluation practice, existing remote generation was scaled back rather than scaling-up local load to utilize this new generation.

After running this analysis, the results were filtered using the above distribution factor criteria. No limiters were identified until the generation at the point of interconnection reached 35 MW, at which point the Franklin-Morton Tap 69 kV line overloads for outage of the Sheridan Tap-Wabasso 69 kV line. At 35 MW of generation the Redwood-Sheridan Tap 69 kV line also overloads for outage of the Morton-Franklin 69 kV line.

Based on this analysis, the Redwood Falls Tap-Franklin 69 kV line can support the interconnection of 14 MW of proposed new generation at this location.

4.0 <u>Point of Interconnection</u>

The map provided by Westwood Professional Services below shows the project footprint.



The point of interconnection was chosen through research and process of elimination.

The Minnesota River runs to the north and east of the proposed project site. The lack of transmission lines less than 100 kV north of the river and the cost and permitting issues that a river crossing poses eliminated facilities in these directions as cost effective interconnection options. To the west and south, the closest interconnection option is approximately 1.5 miles south of the proposed site of the project's collection system substation on the Franklin-Redwood Falls Tap 69 kV line.

The optimal Point of Interconnection identified during this screening study was on the Redwood Falls Tap-Franklin 69 kV line, approximately 5.5 miles west of the Franklin substation. This would place the point of interconnection approximately 1.5 miles south of the proposed wind farm collection system substation. The DC linear analysis performed during this screening study indicated that the Redwood Falls Tap-Franklin 69 kV line can support the 14 MW of proposed new generation at this location.

5.0 Steady State (Thermal) Analysis

The following table shows the generation levels (MW) at which various facilities become subject to overloads when project generation is gradually increased from 0 to 100 MW. Table 1 identifies the limiting facilities when the proposed generation is dispatched to the Twin Cities.

Table 1: Thermal Limiters for Morton 69 kV Interconnection

MW	Limiting Facility	Outage	DF
35	Morton-Franklin 69 kV at 100 % of 34.8 MVA	Sheridan Tap-Wabasso 69 kV	81.9%
35	Redwood-Sheridan Tap at 100% of 31.6	Morton-Franklin 69 kV	100.0%
55	Morton-Franklin 69 kV at 100% of 34.8	System Intact	76.9%
100	(no additional limiters at this level)		

The thermal analysis indicates the transmission system can support the 14 MW of generation at the proposed point of interconnection.

6.0 MISO Queue Analysis

PSE reviewed the MISO queue for prior queued projects that could impact the outlet capacity of the proposed wind farm. Table 2 provides a list of all active MISO projects in Brown, Cottonwood, and Redwood Counties, MN.

Table 2: MISO Queue

MISO Project Num	Project Transmission Owner (TO)	County	Point of Interconnection	MW
G341	ITC Midwest	Cottonwood		2
G375	ITC Midwest	Cottonwood	Bat Lake - Mt. Lake 69kV	20
G442	**ITC Midwest**	**Cottonwood**	**Storden 69 KV**	**50**
G517	ITC Midwest	Cottonwood	Storden Junction Substation 161 kV	130
G532	ITC Midwest	Cottonwood	Odin 69 kV	20
G626	XEL (NSP)	Brown	Morgan to Sleepy Eye line #0719 69 kV	32
G628	ITC Midwest	Brown	Comfrey - Mountain Lake 69 kV line	32
G759	ITC Midwest	Cottonwood	Dotson 161kV Substation	101
G769	ITC Midwest	Cottonwood	Storden to Heron Lake 161kV	50
H017	XEL (NSP)	Cottonwood	South connected to the 345 kV line running from Lakefield Junction Substation	100
H018	XEL (NSP)	Cottonwood	Storden - Heron Lake 161kV	150
H045	ITC Midwest	Cottonwood	Alliant Mountain Lake, MN 69 kV Switching Station	50
H052	**GRE**	**Brown**	**Dotson, MN 69 kV substation**	**50**
H055	**XEL (NSP)**	**Redwood**	**Right next to GRE's Sheridan 69 kV sub**	**40**
J033	ALTW	Cottonwood	1 pole north of sub, Alliant 69 kV line	4.95
J058	ITC Midwest	Cottonwood	Section 21, Midway Township	4.95

The interconnections in **bold** indicate that if these projects move forward, the Morton Tap-Franklin 69 kV line will overload. Prior-queued projects should be responsible for upgrading the line. However, under the current MISO tariff, the proposed Morton wind project would be responsible for cost sharing based on the 14 MW of impact the project has on the line. Assuming the limiter could be mitigated by a reconductor of the line, the cost would be approximately $1,100,000. The proposed Morton project would likely have to contribute approximately a third of the cost of the network upgrades back to their builders if all the bold projects move forward.

Future changes to the area transmission configuration are possible and would change the results of this analysis. If system changes occur further analysis to determine the impacts of the changes is advised.

7.0 <u>Conclusions & Recommendations</u>

PSE performed an engineering analysis of the transmission system in the vicinity of the proposed wind farm and identified tapping Franklin-Redwood Falls Tap 69 kV approximately 1.5 miles south of the project collection substation and 5.5 miles west of the Franklin substation as the optimal point of interconnection. This preferred point of interconnection has approximately 35 MW of outlet capacity using the study assumptions identified above. This analysis shows that under these assumptions, the proposed point of interconnection has adequate outlet capacity to accommodate the proposed 14 MW project without requiring local network upgrades.

As noted, the accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to other generation additions and transmission improvements being contemplated by other entities. Changes in the assumptions of the timing of other generation additions or transmission improvements will affect the accuracy of this study's conclusions; thus, a future MISO System Impact Study ("SIS") may yield different results if it utilizes different assumptions. Also, a MISO SIS goes beyond the scope of this screening study, and thus may allocate additional interconnection costs to mitigate regional transmission system issues or problems due to Dynamic Stability, Voltage Stability, or Voltage Adequacy issues.

Fredrikson & BYRON, P.A.

MEMO

TO: Westwood Professional Services

FROM: Daniel Yarano; Emily Chad

DATE: September 27, 2011

RE: Draft Memorandum Regarding Lower Sioux Project: Summary of Federal Incentives for Wind Energy

Overview

The Lower Sioux Community, with assistance from Westwood Professional Services, is studying the feasibility of constructing one or more wind turbines on its tribal lands near Morton, Minnesota. Depending on project costs, constraints and other factors, the Lower Sioux Community may move forward with 1) a single 600 kW wind turbine that provides power for Jackpot Junction Casino and other tribal needs or 2) one or more utility-scale wind turbines (up to 14 MW in aggregate project size) that produce power to be sold to a utility and generate revenue for the Community.

This memorandum provides a general description of tax incentives for energy and the types of entities that can use each incentive, and gives a brief description of the taxpayer qualifications and structures necessary to use the incentives.

I. Description of Federal Tax Incentives:

The U.S. federal government currently provides several incentives to encourage construction of renewable projects. These credits are: (1) the Investment Tax Credit; (2) the Section 1603 cash grant; and (3) the Production Tax Credit.

A. Investment Tax Credit

The first such incentive is the "Investment Tax Credit," which is a tax credit against federal income tax equal to 30% of the cost basis of the energy property (wind turbines and other qualifying equipment) placed in service during that year. This tax credit is not available if the facility will be owned by or used by a tax-exempt entity or government. To avoid recapture of all or a portion of the tax credit, a qualified taxpayer must own the property for 5 years after placing it in service, or may transfer the property to another eligible owner. A taxpayer who claims this credit must have sufficient U.S. tax liability to absorb the credit, which is received entirely in the year the property is placed in service.

B. 1603 Cash Grant

Alternatively, a taxpayer may elect to use the Section 1603 cash grant in lieu of Investment Tax Credit. Like the Investment Tax Credit, the cash grant is equal to 30% of the cost basis of the energy property placed in service. To qualify, recipients must begin construction of the qualifying energy property on or before December 31, 2011; and must have placed wind energy property in service prior to January 1, 2013, among other qualifications. A safe harbor provides that the project is treated as under construction if (1) physical work of a significant nature has begun or (2) more than 5% of the total cost of the property has been paid or incurred prior to December 31, 2011. This grant expires at the end of 2011, so it is critical that the project begin construction in 2011 by qualifying for a safe harbor if it intends to apply for the 1603 cash grant.

C. Production Tax Credit

Finally, there is a "Production Tax Credit," which is based on the kilowatt hours produced by the taxpayer during the 10-year period starting on the date the project was placed in service (which must be prior to January 1, 2013). To qualify for the credit in a given year, the energy must be sold to an unrelated person during the taxable year. An unrelated person is a person who owns less than 50% of the taxpayer, and IRS guidance looks through to the ultimate end user of the energy to determine who "uses" the energy and whether the end user is a related party. The taxpayer must have sufficient U.S. tax liability to absorb the credits over 10 years, but is allowed to sell the property during the 10-year period without recapture.

II. Qualification for Incentives

The Production Tax Credit as set forth in Section 45 of the Internal Revenue Code (IRC) and the Investment Tax Credit as set forth in Section 48 both offset taxable business income. The rules for applying these credits against income are provided in IRC Sections 38 and 39. IRC Section 38(c) provides that both of these credits are available to offset alternative minimum tax, unlike most business tax credits. IRC Section 39 states that, if the tax credits generated by the project exceed a taxpayer's tax liability for the year the credits are earned, the taxpayer may carry the excess tax credits back one year and forward 20 years to offset against past and future income. The taxpayer must use as much of the credit as possible as a carryback, and then may carry any remaining credits forward to offset future tax liabilities.

However, the "passive loss" rule in IRC Section 469 limits certain investors' ability to use the Investment Tax Credit and the Production Tax Credit. The passive loss rule does not affect the 1603 cash grant. An investor subject to the passive loss rule may only use the credits to offset income generated by similar energy projects; it cannot use the credits to offset income from other types of activities. Investors subject to the passive loss rule are: individuals, trusts and estates, personal service corporations and certain C Corporations owned by 5 or fewer individuals or tax-exempt pension and benefits funds. Broadly speaking, this rule makes it difficult for individuals to invest in tax credit projects. As a result, tax credit investors are generally corporate entities, and not entities subject to the passive loss rule. Until we establish the structure for this transaction, we cannot evaluate whether the tribe or a potential investor will be subject to this limitation.

Unless the tribe can qualify for the 1603 cash grant or has business income taxed by the federal government, it will need to partner with an investor who could use the credits and is not subject to the passive loss rule. Note that the size of the project may make it difficult to attract a third party investor. Therefore, the 1603 cash grant is likely a good option if the project can qualify.

III. Assumptions Regarding Structure

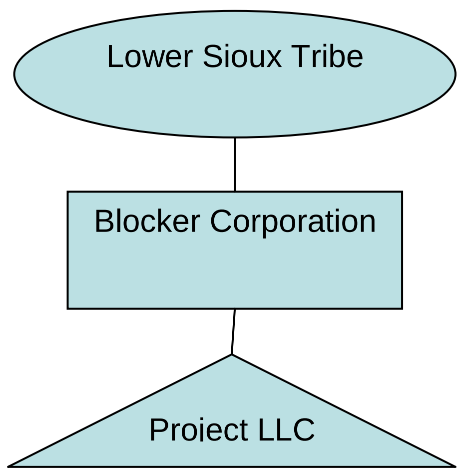
For the purposes of this memorandum, we rely on the following assumptions – if these assumptions are incorrect, we will need to reevaluate the structuring alternatives available to determine if the tribe can make use of the various tax incentives outlined above.

1. The Lower Sioux tribe cannot directly own or invest in an energy project and qualify for the incentives because it is a tax-exempt entity.
2. The Lower Sioux tribe can legally form and own a domestic corporation taxable as a C Corporation for federal tax purposes.

IV. Industry-Used Tax Structures

A. Direct Ownership Through Blocker Corporation

First, and the best option if the tribe does not secure an outside investor, is for the tribe to form an entity taxed as C Corporation that would either directly own the wind energy equipment or own interests in a limited liability company which directly owns the equipment:



A1. Investment Tax Credit

Under this structure, the blocker corporation will have taxable income, and therefore be able to use the Investment Tax Credit, only if it sells energy (rather than allowing the tribe to use the energy for free). Even if it sells the energy, it may not have sufficient taxable income in the year in which it places the energy property in service to take the entire Investment Tax Credit.

Generally, wind energy projects are eligible for accelerated "bonus" depreciation through the end of 2011, and are otherwise eligible for 5 year depreciation. The tribe may instead want to elect a longer depreciation period (10 years or 40 years), rather than take the accelerated depreciation allowed for wind property, as it may not have sufficient income to absorb accelerated depreciation. This would offset any taxable income from the sale of energy. However, the blocker corporation may not have sufficient taxable income to make full use of the depreciation even if the corporation elects a longer depreciation life.

A2. 1603

In this structure, the blocker corporation will receive the 1603 grant regardless of whether it has taxable income, if it begins construction in 2011 by qualifying for a safe harbor and places the project in service by January 1, 2013. The blocker corporation does not need taxable income to use the 1603 grant proceeds. Using the 1603 grant in a direct ownership structure is likely the best option if the tribe does not partner with an investor.

However, unless the blocker corporation sells the energy, it cannot use the depreciation generated by the property. It is unclear if sales of the energy would generate sufficient income to completely utilize the depreciation.

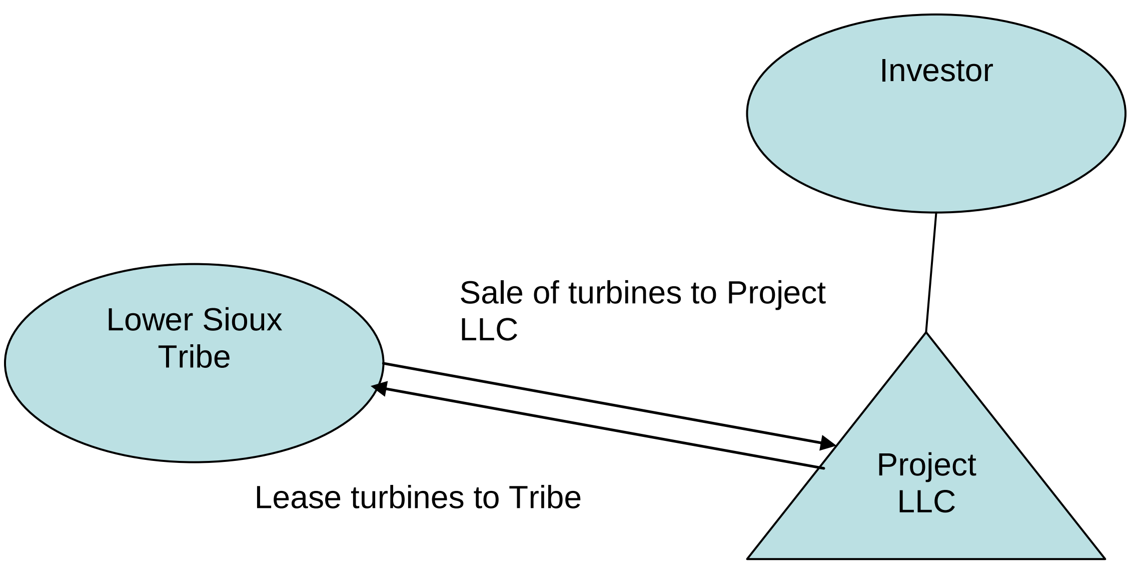
A3. Production Tax Credit

Under this structure, the blocker corporation will have taxable income only if it sells energy to a third party (for instance, a utility). We are not able to determine whether the tribe would qualify for this credit until we understand who the owner is and who the owner will sell power to. It is unclear whether the blocker corporation can sell enough energy each year to fully absorb the benefits of the 10-year tax credit.

In addition, the blocker corporation may not generate sufficient taxable income to fully absorb both the tax credit and the depreciation.

B. Sale-Leaseback

Second, the tribe could secure a third-party investor and structure a sale-leaseback of the energy property. In a sale-leaseback, the tribe would construct and sell the energy equipment to the investor. The investor would lease the project back to the tribe, which would operate it and either use the energy or sell it to a utility:



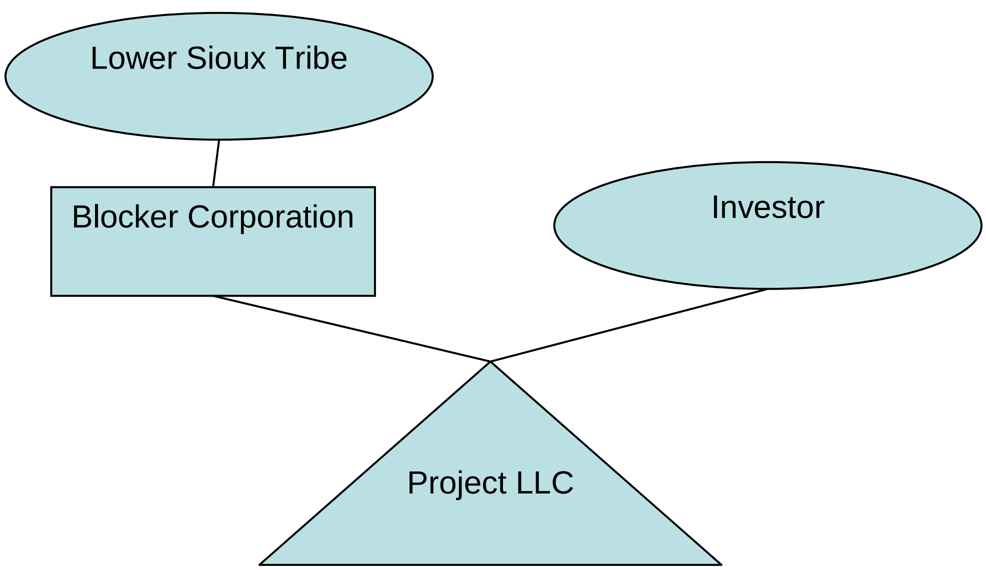
Once the investor has achieved its target rate of return, based on cash flow, tax credits and depreciation, the tribe would have an option to purchase the project at fair market value. The Production Tax Credit cannot be used in a sale-leaseback transaction because the property is not owned and operated by the same entity.

B1. 1603/Investment Tax Credit

Under this structure, the investor would receive the benefit of the up-front Investment Tax Credit or 1603 grant. The investor will also receive the benefit of depreciation as long as it owns the property. However, the investor will need to own the property for at least 5 years before it can sell the property back to the tribe. The investor will likely use either bonus depreciation or the 5-year accelerated depreciation available for wind energy, and therefore there will be no remaining depreciation for the tribe to absorb once it exercises the purchase option.

C. Partnership Flip

Third, the tribe could engage in a "partnership flip" structure. In a partnership flip, the developer sells part of its interest in the energy property to the investor. The partnership is structured so that the investor receives 90% or more (usually 99%) of the cash flow from operations, tax credits, depreciation and other incentives until the investor has achieved its targeted internal rate of return on investment. At this point, the structure flips (typically 5% investor and 95% developer) and the developer receives a larger share of the remaining benefits and has an option to purchase the investor's interest at fair market value. In this situation, the tribe would be the developer. However, ownership by the tribe would constitute "tax-exempt use" and make tax credits unavailable. Fortunately, the tribe can participate in this structure if it uses a blocker corporation:



C1. 1603/Investment Tax Credit

Under this structure, the investor would receive the benefit of the 1603 cash grant or the Investment Tax Credit. The investor will also receive the benefit of depreciation as long as it holds the property. However, the investor, or other qualified entity, will need to own the property for at least 5 years to avoid recapture before it can sell the property back to the tribe.

C2. Production Tax Credit

Under this structure, the investor would receive the benefit of the Production Tax Credit only if the energy is sold to an unrelated party. The unrelated party could be a utility or unaffiliated entity. In this structure, the investor will receive the benefit of depreciation deductions until the structure flips. Presumably, the investor would use the 5-year accelerated depreciation and there would not be any depreciation remaining for the tribe to absorb after the flip.

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Project	Facility Project
Simulation	$0.03 PPA
System installed cost ($)	$ 1,877,000.00
Annual Production (kWh)	1,205,909
Energy Rate ($/kWh)	$ 0.03
Energy Rate Inflation (%)	2%
Standard Inflation	3%
O&M ($/kW-yr)	$ 100.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 1,877,000.00												
$ Fixed O&M		$ 13,766.08	$ 14,179.07	$ 14,604.44	$ 15,042.57	$ 15,493.85	$ 15,958.66	$ 16,437.42	$ 16,930.55	$ 17,438.46	$ 17,961.62	$ 20,822.44	$ 24,138.91
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 1,877,000.00	$ 13,766.08	$ 14,179.07	$ 14,604.44	$ 15,042.57	$ 15,493.85	$ 15,958.66	$ 16,437.42	$ 16,930.55	$ 17,438.46	$ 17,961.62	$ 20,822.44	$ 24,138.91
kWh Production		1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909
$ kWh Sell Rate		$ 0.0300	$ 0.0306	$ 0.0312	$ 0.0318	$ 0.0325	$ 0.0331	$ 0.0338	$ 0.0345	$ 0.0351	$ 0.0359	$ 0.0396	$ 0.0437
$ Production		*$ 36,177.27*	*$ 36,900.82*	*$ 37,638.83*	*$ 38,391.61*	*$ 39,159.44*	*$ 39,942.63*	*$ 40,741.48*	*$ 41,556.31*	*$ 42,387.44*	*$ 43,235.19*	*$ 47,735.14*	*$ 52,703.45*
$ Incentives	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ -	$ 36,177.27	$ 36,900.82	$ 37,638.83	$ 38,391.61	$ 39,159.44	$ 39,942.63	$ 40,741.48	$ 41,556.31	$ 42,387.44	$ 43,235.19	$ 47,735.14	$ 52,703.45
$ Annual Net Revenue	$ (1,877,000.00)	$ 22,411.19	$ 22,721.75	$ 23,034.39	$ 23,349.04	$ 23,665.59	$ 23,983.96	$ 24,304.06	$ 24,625.76	$ 24,948.97	$ 25,273.57	$ 26,912.70	$ 28,564.54
$ Cumulative Net Revenue	$ (1,877,000.00)	$ (1,854,588.81)	$ (1,831,867.07)	$ (1,808,832.67)	$ (1,785,483.64)	$ (1,761,818.05)	$ (1,737,834.08)	$ (1,713,530.02)	$ (1,688,904.26)	$ (1,663,955.29)	$ (1,638,681.72)	$ (1,507,405.61)	$ (1,367,887.34)

20-Year Gross Expenses	$ 2,246,899.85
20-Year Gross Revenue	$ 879,012.51
20-Year IRR	-9.868%
20-Year Net Revenue	$ (1,367,887.34)

Project	Facility Project
Simulation	$0.058 Offset
System installed cost ($)	$ 1,877,000.00
Annual Production (kWh)	1,205,909
Energy Rate ($/kWh)	$ 0.05806
Energy Rate Inflation (%)	4%
Standard Inflation	3%
O&M ($/kW-yr)	$ 100.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 1,877,000.00												
$ Fixed O&M		$ 13,766.08	$ 14,179.07	$ 14,604.44	$ 15,042.57	$ 15,493.85	$ 15,958.66	$ 16,437.42	$ 16,930.55	$ 17,438.46	$ 17,961.62	$ 20,822.44	$ 24,138.91
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 1,877,000.00	$ 13,766.08	$ 14,179.07	$ 14,604.44	$ 15,042.57	$ 15,493.85	$ 15,958.66	$ 16,437.42	$ 16,930.55	$ 17,438.46	$ 17,961.62	$ 20,822.44	$ 24,138.91
kWh Production		1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909
$ kWh Sell Rate		$ 0.0581	$ 0.0604	$ 0.0628	$ 0.0653	$ 0.0679	$ 0.0706	$ 0.0735	$ 0.0764	$ 0.0795	$ 0.0826	$ 0.1005	$ 0.1223
$ Production		*$ 70,015.08*	*$ 72,815.68*	*$ 75,728.31*	*$ 78,757.44*	*$ 81,907.74*	*$ 85,184.05*	*$ 88,591.41*	*$ 92,135.06*	*$ 95,820.47*	*$ 99,653.29*	*$ 121,243.46*	*$ 147,511.21*
$ Incentives	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ -	$ 70,015.08	$ 72,815.68	$ 75,728.31	$ 78,757.44	$ 81,907.74	$ 85,184.05	$ 88,591.41	$ 92,135.06	$ 95,820.47	$ 99,653.29	$ 121,243.46	$ 147,511.21
$ Annual Net Revenue	$ (1,877,000.00)	$ 56,248.99	$ 58,636.61	$ 61,123.87	$ 63,714.87	$ 66,413.89	$ 69,225.38	$ 72,153.98	$ 75,204.52	$ 78,382.00	$ 81,691.67	$ 100,421.02	$ 123,372.29
$ Cumulative Net Revenue	$ (1,877,000.00)	$ (1,820,751.01)	$ (1,762,114.40)	$ (1,700,990.53)	$ (1,637,275.66)	$ (1,570,861.77)	$ (1,501,636.39)	$ (1,429,482.41)	$ (1,354,277.89)	$ (1,275,895.89)	$ (1,194,204.22)	$ (731,081.20)	$ (161,985.39)

20-Year Gross Expenses	$ 2,246,899.85
20-Year Gross Revenue	$ 2,084,914.45
20-Year IRR	-0.751%
20-Year Net Revenue	$ (161,985.39)

Project	Facility Project
Simulation	$0.058 Offset
System installed cost ($)	$ 1,877,000.00
Annual Production (kWh)	1,205,909.00
Energy Rate ($/kWh)	$ 0.05806
Energy Rate Inflation (%)	4%
Standard Inflation	3%
O&M ($/kW-yr)	$ 100.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 1,877,000.00												
$ Fixed O&M		$ 13,766.08	$ 14,179.07	$ 14,604.44	$ 15,042.57	$ 15,493.85	$ 15,958.66	$ 16,437.42	$ 16,930.55	$ 17,438.46	$ 17,961.62	$ 20,822.44	$ 24,138.91
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 1,877,000.00	$ 13,766.08	$ 14,179.07	$ 14,604.44	$ 15,042.57	$ 15,493.85	$ 15,958.66	$ 16,437.42	$ 16,930.55	$ 17,438.46	$ 17,961.62	$ 20,822.44	$ 24,138.91
kWh Production		1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909	1,205,909
$ kWh Sell Rate		$ 0.0581	$ 0.0604	$ 0.0628	$ 0.0653	$ 0.0679	$ 0.0706	$ 0.0735	$ 0.0764	$ 0.0795	$ 0.0826	$ 0.1005	$ 0.1223
$ Production		*$ 70,015.08*	*$ 72,815.68*	*$ 75,728.31*	*$ 78,757.44*	*$ 81,907.74*	*$ 85,184.05*	*$ 88,591.41*	*$ 92,135.06*	*$ 95,820.47*	*$ 99,653.29*	*$ 121,243.46*	*$ 147,511.21*
$ Incentives	*$ 970,000.00*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ 970,000.00	$ 70,015.08	$ 72,815.68	$ 75,728.31	$ 78,757.44	$ 81,907.74	$ 85,184.05	$ 88,591.41	$ 92,135.06	$ 95,820.47	$ 99,653.29	$ 121,243.46	$ 147,511.21
$ Annual Net Revenue	$ (907,000.00)	$ 56,248.99	$ 58,636.61	$ 61,123.87	$ 63,714.87	$ 66,413.89	$ 69,225.38	$ 72,153.98	$ 75,204.52	$ 78,382.00	$ 81,691.67	$ 100,421.02	$ 123,372.29
$ Cumulative Net Revenue	$ (907,000.00)	$ (850,751.01)	$ (792,114.40)	$ (730,990.53)	$ (667,275.66)	$ (600,861.77)	$ (531,636.39)	$ (459,482.41)	$ (384,277.89)	$ (305,895.89)	$ (224,204.22)	$ 238,918.80	$ 808,014.61

20-Year Gross Expenses	$ 2,246,899.85
20-Year Gross Revenue	$ 3,054,914.45
20-Year IRR	6.019%
20-Year Net Revenue	$ 808,014.61

Project	Commercial Project
Simulation	$0.03 PPA
System installed cost ($)	$ 30,450,350.00
Annual Production (kWh)	41,728,200.00
Energy Rate ($/kWh)	$ 0.03
Energy Rate Inflation (%)	2%
Standard Inflation	3%
O&M ($/kW-yr)	$ 60.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 30,450,350.00												
$ Fixed O&M		$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 30,450,350.00	$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
kWh Production		41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200
$ kWh Sell Rate		$ 0.0300	$ 0.0306	$ 0.0312	$ 0.0318	$ 0.0325	$ 0.0331	$ 0.0338	$ 0.0345	$ 0.0351	$ 0.0359	$ 0.0396	$ 0.0437
$ Production		*$ 1,251,846.00*	*$ 1,276,882.92*	*$ 1,302,420.58*	*$ 1,328,468.99*	*$ 1,355,038.37*	*$ 1,382,139.14*	*$ 1,409,781.92*	*$ 1,437,977.56*	*$ 1,466,737.11*	*$ 1,496,071.85*	*$ 1,651,784.21*	*$ 1,823,703.24*
$ Incentives	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ -	$ 1,251,846.00	$ 1,276,882.92	$ 1,302,420.58	$ 1,328,468.99	$ 1,355,038.37	$ 1,382,139.14	$ 1,409,781.92	$ 1,437,977.56	$ 1,466,737.11	$ 1,496,071.85	$ 1,651,784.21	$ 1,823,703.24
$ Annual Net Revenue	$ (30,450,350.00)	$ 966,036.41	$ 982,499.04	$ 999,205.19	$ 1,016,157.14	$ 1,033,357.16	$ 1,050,807.49	$ 1,068,510.32	$ 1,086,467.81	$ 1,104,682.07	$ 1,123,155.16	$ 1,219,471.56	$ 1,322,534.39
$ Cumulative Net Revenue	$ (30,450,350.00)	$ (29,484,313.59)	$ (28,501,814.55)	$ (27,502,609.36)	$ (26,486,452.23)	$ (25,453,095.07)	$ (24,402,287.58)	$ (23,333,777.25)	$ (22,247,309.44)	$ (21,142,627.36)	$ (20,019,472.20)	$ (14,117,403.14)	$ (7,713,595.50)

20-Year Gross Expenses	$ 38,130,160.69
20-Year Gross Revenue	$ 30,416,565.19
20-Year IRR	-2.515%
20-Year Net Revenue	$ (7,713,595.50)

Project	Commercial Project
Simulation	$0.045 Cent PPA
System installed cost ($)	$ 30,450,350.00
Annual Production (kWh)	41,728,200.00
Energy Rate ($/kWh)	$ 0.045
Energy Rate Inflation (%)	2%
Standard Inflation	3%
O&M ($/kW-yr)	$ 60.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 30,450,350.00												
$ Fixed O&M		$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 30,450,350.00	$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
kWh Production		41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200
$ kWh Sell Rate		$ 0.0450	$ 0.0459	$ 0.0468	$ 0.0478	$ 0.0487	$ 0.0497	$ 0.0507	$ 0.0517	$ 0.0527	$ 0.0538	$ 0.0594	$ 0.0656
$ Production		*$ 1,877,769.00*	*$ 1,915,324.38*	*$ 1,953,630.87*	*$ 1,992,703.48*	*$ 2,032,557.55*	*$ 2,073,208.71*	*$ 2,114,672.88*	*$ 2,156,966.34*	*$ 2,200,105.66*	*$ 2,244,107.78*	*$ 2,477,676.32*	*$ 2,735,554.86*
$ Incentives	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ -	$ 1,877,769.00	$ 1,915,324.38	$ 1,953,630.87	$ 1,992,703.48	$ 2,032,557.55	$ 2,073,208.71	$ 2,114,672.88	$ 2,156,966.34	$ 2,200,105.66	$ 2,244,107.78	$ 2,477,676.32	$ 2,735,554.86
$ Annual Net Revenue	$ (30,450,350.00)	$ 1,591,959.41	$ 1,620,940.50	$ 1,650,415.47	$ 1,680,391.63	$ 1,710,876.34	$ 1,741,877.06	$ 1,773,401.28	$ 1,805,456.59	$ 1,838,050.63	$ 1,871,191.09	$ 2,045,363.67	$ 2,234,386.01
$ Cumulative Net Revenue	$ (30,450,350.00)	$ (28,858,390.59)	$ (27,237,450.09)	$ (25,587,034.61)	$ (23,906,642.98)	$ (22,195,766.64)	$ (20,453,889.58)	$ (18,680,488.29)	$ (16,875,031.70)	$ (15,036,981.07)	$ (13,165,789.98)	$ (3,293,055.75)	$ 7,494,687.10

20-Year Gross Expenses	$ 38,130,160.69
20-Year Gross Revenue	$ 45,624,847.79
20-Year IRR	2.067%
20-Year Net Revenue	$ 7,494,687.10

Project	Commercial Project
Simulation	$0.05 PPA
System installed cost ($)	$ 30,450,350.00
Annual Production (kWh)	41,728,200.00
Energy Rate ($/kWh)	$ 0.05
Energy Rate Inflation (%)	2%
Standard Inflation	3%
O&M ($/kW-yr)	$ 60.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 30,450,350.00												
$ Fixed O&M		$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 30,450,350.00	$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
kWh Production		41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200
$ kWh Sell Rate		$ 0.0500	$ 0.0510	$ 0.0520	$ 0.0531	$ 0.0541	$ 0.0552	$ 0.0563	$ 0.0574	$ 0.0586	$ 0.0598	$ 0.0660	$ 0.0728
$ Production		*$ 2,086,410.00*	*$ 2,128,138.20*	*$ 2,170,700.96*	*$ 2,214,114.98*	*$ 2,258,397.28*	*$ 2,303,565.23*	*$ 2,349,636.53*	*$ 2,396,629.26*	*$ 2,444,561.85*	*$ 2,493,453.09*	*$ 2,752,973.69*	*$ 3,039,505.40*
$ Incentives	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ -	$ 2,086,410.00	$ 2,128,138.20	$ 2,170,700.96	$ 2,214,114.98	$ 2,258,397.28	$ 2,303,565.23	$ 2,349,636.53	$ 2,396,629.26	$ 2,444,561.85	$ 2,493,453.09	$ 2,752,973.69	$ 3,039,505.40
$ Annual Net Revenue	$ (30,450,350.00)	$ 1,800,600.41	$ 1,833,754.32	$ 1,867,485.57	$ 1,901,803.13	$ 1,936,716.07	$ 1,972,233.58	$ 2,008,364.94	$ 2,045,119.52	$ 2,082,506.81	$ 2,120,536.40	$ 2,320,661.04	$ 2,538,336.55
$ Cumulative Net Revenue	$ (30,450,350.00)	$ (28,649,749.59)	$ (26,815,995.27)	$ (24,948,509.69)	$ (23,046,706.57)	$ (21,109,990.49)	$ (19,137,756.91)	$ (17,129,391.97)	$ (15,084,272.46)	$ (13,001,765.64)	$ (10,881,229.24)	$ 315,060.05	$ 12,564,114.63

20-Year Gross Expenses	$ 38,130,160.69
20-Year Gross Revenue	$ 50,694,275.32
20-Year IRR	3.326%
20-Year Net Revenue	$ 12,564,114.63

Project	Commercial Project
Simulation	$0.05 PPA
System installed cost ($)	$ 30,450,350.00
Annual Production (kWh)	41,728,200.00
Energy Rate ($/kWh)	$ 0.05
Energy Rate Inflation (%)	2%
Standard Inflation	3%
O&M ($/kW-yr)	$ 60.00

Year	0	1	2	3	4	5	6	7	8	9	10	15	20
$ Materials	$ 30,450,350.00												
$ Fixed O&M		$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
$ Variable O&M		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ Annual Expenses	$ 30,450,350.00	$ 285,809.59	$ 294,383.88	$ 303,215.39	$ 312,311.85	$ 321,681.21	$ 331,331.65	$ 341,271.60	$ 351,509.74	$ 362,055.04	$ 372,916.69	$ 432,312.65	$ 501,168.84
kWh Production		41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200	41,728,200
$ kWh Sell Rate		$ 0.0500	$ 0.0510	$ 0.0520	$ 0.0531	$ 0.0541	$ 0.0552	$ 0.0563	$ 0.0574	$ 0.0586	$ 0.0598	$ 0.0660	$ 0.0728
$ Production		*$ 2,086,410.00*	*$ 2,128,138.20*	*$ 2,170,700.96*	*$ 2,214,114.98*	*$ 2,258,397.28*	*$ 2,303,565.23*	*$ 2,349,636.53*	*$ 2,396,629.26*	*$ 2,444,561.85*	*$ 2,493,453.09*	*$ 2,752,973.69*	*$ 3,039,505.40*
$ Incentives	*$ 6,600,000.00*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*	*$ -*
$ Annual Revenue	$ 6,600,000.00	$ 2,086,410.00	$ 2,128,138.20	$ 2,170,700.96	$ 2,214,114.98	$ 2,258,397.28	$ 2,303,565.23	$ 2,349,636.53	$ 2,396,629.26	$ 2,444,561.85	$ 2,493,453.09	$ 2,752,973.69	$ 3,039,505.40
$ Annual Net Revenue	$ (23,850,350.00)	$ 1,800,600.41	$ 1,833,754.32	$ 1,867,485.57	$ 1,901,803.13	$ 1,936,716.07	$ 1,972,233.58	$ 2,008,364.94	$ 2,045,119.52	$ 2,082,506.81	$ 2,120,536.40	$ 2,320,661.04	$ 2,538,336.55
$ Cumulative Net Revenue	$ (23,850,350.00)	$ (22,049,749.59)	$ (20,215,995.27)	$ (18,348,509.69)	$ (16,446,706.57)	$ (14,509,990.49)	$ (12,537,756.91)	$ (10,529,391.97)	$ (8,484,272.46)	$ (6,401,765.64)	$ (4,281,229.24)	$ 6,915,060.05	$ 19,164,114.63

20-Year Gross Expenses	$ 38,130,160.69
20-Year Gross Revenue	$ 57,294,275.32
20-Year IRR	5.991%
20-Year Net Revenue	$ 19,164,114.63

LOWER SIOUX WIND PROJECT

Request for Proposal

For BOP Construction Services

April 2012

Prepared For:

Lower Sioux Indian Community
39527 Res. Highway 1, PO Box 308
Morton, MN 56270

Prepared By:

Westwood

TABLE OF CONTENTS

PROJECT DESCRIPTION

The Lower Sioux Wind Project is located on the Lower Sioux Indian Reservation in Redwood County, Minnesota. As contemplated today, the project will consist of 9 GE 1.6 MW wind turbines built on multiple tower sections achieving an 80 meter hub height. It will utilize a 34.5 kV underground feeder collection system consisting of approximately 5 miles of trenching. At the collector substation, the power will be stepped up to 69 kV, interconnecting with the Transmission Owner's (Great River Energy) Interconnection Substation, which will tap Great River Energy's existing 69 kV transmission line.

The project will also consist of approximately 2 miles of new and/or improved site roads.

1. PROJECT CONTACTS

Owner/Developer

Lower Sioux Indian Community Tribal Council
Gabe Prescott, President
39527 Res. Highway 1, PO Box 308
Morton, MN 56270

Phone: 507-697-6185
Fax: 507-697-8617

RFP Preparation Team

Westwood Professional Services
Chris Carda
7699 Anagram Drive
Eden Prairie, MN 55344

Phone: 952.937.5150
Fax: 952.937.5822
Email: chris.carda@westwoodps.com

2. PROPOSAL SUBMITTALS

All questions, comments, and submittals corresponding to this RFP shall be directed to Chris Carda at Westwood Professional Services via email (chris.carda@westwoodps.com). If during the biding project information changes, all participants will be notified of change and updated information will be made available.

All costs related to the preparation, completion, submittal, phone calls, meetings, negotiations, and all other costs related to this bid are the sole responsibility of the RFP participant. All Proposals are submitted at the RFP participant's own free will. RFP participants will not be reimbursed for any cost associated with this RFP.

Contractor shall provide two hard copies and one pdf (via email) version of the proposal. All Proposals shall be submitted to Chris Carda at the address listed above. The proposal shall include at a minimum:

- Executive Summary
- QA / QC Plan
- Bill of Estimated Quantities
- Construction Milestone Schedule

Owner reserves at all times the right to reject all Proposals that result from this RFP, to invite additional parties to participate in this RFP, change the technical requirements of the project, add or subtract work from the final scope of work, or cancel this RFP process entirely.

Owner may also request additional information or proposal prior to awarding or rejecting your bid. Owner also reserves the right to revise the RFP documents prior to the date for receipt of proposals. Such revisions will be announced by addendum. Copies of such addenda as may be issued will be furnished to all RFP participants. If a bidder submits a question regarding a component of the RFP that is unclear, an addendum will be issued to all bidders. If the revisions require material changes in quantities or price bid, or both, the date set for reviewing bids may be extended by such number of days as, in the opinion of Owner, will enable RFP participants to revise their Proposals. In such case, the addendum will include an announcement of the new date for receipt of Proposals. Oral instructions or information concerning the RFP documents provided to RFP participants by employees or agents of Owner shall not bind Owner.

Bidders are encouraged to seek unique cost-savings ideas and methods. The Owner agrees to keep these methods in confidence throughout the bidding process.

Actual award of the Contract is contingent upon execution of contracts and other documentation to the satisfaction of both parties including but not limited to:

- Pricing
- Performance bonds
- Labor and maintenance payment bonds
- Warranty Obligations
- Surety qualifications
- Insurance Coverage
- Liquidated damages
- Payment procedures

Contractor is encouraged to submit an outline of their qualifications along with proposed obligations as they relate to the above-referenced materials. This may include anticipated warranty period, proposed performance and payment bonds, and insurance limits.

RFP participant may, without prejudice to itself, modify or withdraw a Proposal by written request, provided that the Proposal and any request is received by Owner prior to the closing time for receiving Proposals at the place where Proposals are to be received. Following withdrawal of its Proposals, RFP participants may submit a new Proposal, provided the Owner receives it prior to the closing time.

3. SCHEDULE

The contractor shall provide a detailed project milestone schedule outlining the proposed plan for each element of the project. The schedule should show anticipated milestones and interrelationship of project activities. Schedule shall be submitted in Primavera or MS Project format.

4. CONFIDENTIALITY

The Owner will take reasonable precautions and use reasonable efforts to protect any claimed proprietary and confidential information contained in a proposal provided that such information is clearly identified by the Respondent as "Proprietary and Confidential" on the page on which proprietary and confidential information appears. Such information may, however, be made available under applicable state or federal law or other governmental agencies having an interest or jurisdiction in these matters. The Owner also reserves the right to release such information to its agents for the purpose of evaluating the Respondent's proposal but such agents will be required to observe the same care with respect to disclosure. Under no circumstances will the Owner or their directors, officers, employees, agents or contractors, be liable for any damages resulting from any disclosure of Respondent's claimed confidential information during or after the solicitation process. The Respondent acknowledges and agrees that all contents of the RFP are proprietary to the Owner, and shall not be disclosed to anyone not a director, officer, employee or agent of the Respondent.

5. PRICING

Pricing shall be submitted on the Bill of Estimated Quantities contained in this RFP (Appendix D). All pricing shall be in U.S. dollars (USD).

All Proposals shall offer an estimated cost to complete (hereinafter "Contract Price") for completion of all Work (as defined in the Scope of Work) based upon the Bill of Estimated Quantities (Appendix D) submitted with this RFP.

The Contract Price shall include, among other things, all materials, supervision, labor, services, equipment, tools, consumables, supplies, testing, warehousing, temporary facilities, utilities, insurance, Contractor permits, overhead, and profit in accordance with this RFP. Contract Price shall also include all sales and use taxes.

The Unit Cost identified in the submitted Bill of Estimated Quantities shall remain valid for a minimum of sixty (60) days from the Bid Due Date and include any anticipated price adjustments (due to escalation or de-escalation) which may occur through the completion of the Contractor's work.

6. PERMITTING

The Owner will acquire Federal Regulatory permits, State Regulatory permits and Local Approval permits. The contractor shall comply with all permits already obtained by the owner and be responsible for acquisition of all construction permits, transportation permits, road entrance, road crossing permits, utilities crossing permits and shall provide copies of all permits to the Owner prior to construction.

OWNER'S SCOPE OF WORK

Owner will provide WTG locations, Facility locations, the ALTA survey, environmental studies and permitting. In addition to these documents, the following identifies the services and supplies to be provided by the Owner:

1. Landowner Property Rights

The Owner is responsible for obtaining necessary approval and lease use rights for the construction of all project facilities. The Contractor will be responsible for incorporating the Owner provided approval and lease use rights requirements into the overall project design and subsequent construction.

2. Interconnect Agreement

An Interconnect Agreement has not yet been completed, but an Interconnect Study was finished. The Owner shall be responsible for obtaining the Interconnect Agreement and for communicating applicable results and associated criteria from the Interconnect Agreement to the Contractor. The Contractor will be responsible for incorporating the Owner provided Interconnection Agreement obligations and requirements into the overall project design and subsequent construction upon receipt of the Interconnect Agreement.

For reference the Interconnect Study is included in Appendix E.

3. Turbine Supply Agreement

The Turbine Supply Agreement (TSA) between the Owner and Turbine Manufacturer has not yet been completed. The TSA establishes a summary of the Owner's Scope activities, with additional details specified in TSA, including:

A. Wind Turbine Generator (WTG) Components.

B. Delivery dates and quantities of turbines to be delivered to Owner designated WTG locations.

C. Provide turbine completion and in the event of WTG delivery with no grid interconnect, provide pre-commissioning and temporary backfeed power for WTGs.

D. The Owner will provide grid interconnect at the Final Point of Interconnect so that it may be used by Contractor for backfeed power supply.

E. Commissioning schedule - linked to the Contractor's required mechanical completion.

F. Grid Interconnect Support related to any required WTG control studies and associated recommended adjustments.

G. SCADA system for Contractor interface at the collector substation and WTGs for contractor's installation and termination of all fiber optic cable.

H. Insurance Requirements for Major Turbine Component Delivery to project Site, up to the point of Contractor acceptance for offloading.

4. Studies / Reports

The Owner has completed a Wetland Delineation Report. The Contractor shall complete all necessary requirements for development of the wind project including but not limited to:

A. Avian Survey

B. Cultural Resources Survey

C. Rare and Natural Community Study

D. Phase I Environmental Assessment

E. Shadow Flicker Study

5. Turbine Micrositing

The Owner is responsible for providing Turbine coordinate locations.

6. Reviews and Approvals

The Owner will review and approve designs and specifications prior to the construction phase of the project. This includes review of civil, electrical and structural design components for the project. Owner or Owner's representative shall review and approve the design drawings in two stages:

- Preliminary review
- Final review prior to issue for construction.

The Owner's approval of the drawings does not replace the Contractor's responsibility for the work. All drawings, reports and calculations will be sealed and signed by an engineer with license to work in the state where the project is located.

The Contractor shall provide all design drawings and engineering calculations as requested by the Owner for official review and approval by the Transmission Owner.

CONTRACTOR'S SCOPE OF WORK

With the exception of the Owner's Scope of Service and Supply, all engineering design, procurement and construction documents necessary for the construction and permitting of this project shall be the Contractor's responsibility. The Work includes the provision of all services, labor, material, and equipment necessary to build the Project in accordance with any potential Contract.

This RFP requests the Contractor to provide pricing to furnish and install both pad mounted transformers at the WTG for the collector system and step-up power transformers at the collector substation for connection to the Transmission Owner's system for the project.

Contractor is advised that the RFP was developed to organize and consolidate the specifications and design and construction criteria for all Project components. However, the technical requirements do not specifically describe every detail of the work required. It is the contractor's responsibility to review all pertinent Project requirements and criteria, as contained in the entirety of the RFP. However, the Contractor shall not rely on the physical description contained in the RFP to identify ALL Project components. The Contractor shall determine the full scope of the Project through thorough examination of the RFP, the Project Site, and any reasonable inferences to be gathered there from.

1. Project Management

The BOP / EPC Contractor shall serve as the Project Manager and shall provide and lead a project management team. The Project Manager will be present at the jobsite at all times during the construction of the BOP infrastructure. The Project Manager and his project management team will be responsible for the following:

A. Implement and manage a QA/QC program that insures that the BOP Infrastructure is installed in accordance with industry best practices and with the highest quality materials.

B. Prior to the commencement of any construction activities, the Project Manager shall implement and manage an Environmental, Health, and Safety program.

C. Ensure all construction activities on and off-site related to the Project are in compliance with any and all applicable Federal, State, and local laws, decrees, or ordinances and in compliance will applicable permits, including but not limited to the Special Use Permit, Building permits, county and township road agreements, lease agreements, the Project SWPP plan, and applicable utility crossing agreements.

D. Ensure the Project is constructed and installed in accordance with the construction specifications provided for all categories in the Project scope.

E. Maintain scheduled communications with Owner and Owner's representatives as to schedule and/or other factors affecting the on-time delivery of the Project.

F. Manage the Project so that it is installed in accordance with the project Milestone Schedule.

G. Develop and submit a detailed project schedule and providing regular updates to the Owner as to the status of the schedule.

H. Maintain QA/QC documentation and as-built documentation during the course of the project and have such documentation readily available to Owner for review.

I. Provide as-built documentation upon completion of the project. Note that ALTA Survey updates will be the responsibility of the Owner.

J. Ensure that the project is installed in accordance with the terms and conditions of the BOP / EPC Contract.

K. Coordinate and supervise any work performed by Contractor's Subcontractors.

L. Provide necessary utilities to the Project construction compound in the Project Laydown Yard including electrical, water, trash service, portable outhouses (at least one dedicated women's outhouse), data, and telephone.

M. Acquire building permits and arrange necessary inspections by regulatory officials for verification and/or approval of location and staking as required.

2. Community Outreach

A. Contractor shall prepare and implement a community outreach program that promotes open communication with community members and a better understanding of the wind project.
   1. Plan should include the contractor's intention to use local labor and resources.
   2. Plan shall establish chain of command to address any concerns of the community related to the project.
   3. Participate / lead landowner and community meetings and events.

3. Performance Standards

A. Contractor shall perform (and cause its Subcontractors to perform) all Work in a safe, diligent, expeditious and workmanlike manner, using new equipment, parts and components, and in accordance with:
   1. All manufacturers' instructions and warranties.
   2. Specifications.
   3. Project Milestone Schedule.
   4. Prudent Wind Industry Practices.
   5. Applicable Laws.
   6. Quality Assurance Documentation.
   7. Safety and Security Plan.
   8. Landowner, Turbine Supply, Interconnect, Encroachment, and/or County Road Agreements.
   9. Permits.
   10. Site Layout.
   11. Requirements of applicable policies of insurance required by the Contract or for the Wind Farm.
   12. All other standards, obligations and requirements of the Contract.

B. The standard of performance and all criteria and Requirements set forth in this Section shall apply to all aspects of the Work, and this Section shall be deemed to be incorporated by reference into each provision of this Contract describing the Work, Contractor's obligations hereunder, or referring to any or all of the "Requirements" or words of similar effect. Contractor shall be responsible for performing and completing the Work in accordance with all Requirements. Notwithstanding anything herein to the contrary contained in this Contract.

C. Contractor shall not use any used, reconditioned, refurbished or out-of-warranty equipment, parts or components, without the advance prior written consent of Owner.

4. Public Roads

A. Contractor acknowledges and agrees that it will abide by the final Public Road Agreement. Contractor will be required to upgrade, maintain and repair all public roads utilized during construction including, but not limited to roads used by: Concrete trucks, gravel trucks, material delivery trucks, and turbine component trucks. Contractor agrees to perform and be responsible for all duties and obligations of Owner in any Public Road Agreements, which relate to the construction of the Project and completion of the Work.

B. Contractor shall comply with all Applicable Laws, Specifications, Road Agreements and the Requirements, and Contractor shall maintain the Public Roads and signage, including dust control as needed. Contractor shall comply (and cause any of its Subcontractors to comply) with all Applicable Laws regarding weight limits on Public Roads and Access Roads and Contractor shall be responsible for and shall indemnify and hold harmless Owner against any penalty or fine assessed for such non compliance.

C. Contractor shall repair and maintain the Access Roads and Public Roads on an ongoing basis to allow for consistent and uninterrupted vehicular traffic, including the delivery of the Wind Turbines and other Project Equipment. After completion of the erection of the Wind Turbines, Contractor shall repair damage to the Public Roads, Access Roads and Wind Turbine sites to the satisfaction of the County and Owner at no additional costs.

D. Contractor acknowledges and agrees that the Access Roads may be used by other Persons performing work at the Project Site, including the Turbine Supplier.

E. Contractor shall be responsible for making necessary improvements to Public Roads outside the Project Area, as required, to allow delivery of components. Temporary construction roads, bypasses, and intersection widening areas shall be completely removed after construction is complete and restored in strict accordance with all permit requirements.

F. Contractor shall be responsible for a pre-construction and post-construction analysis of all roads utilized as part of the project. Existing roadway analysis will be in accordance with any County or Owner requirements and may include: Roadway surface condition inventory and video, thickness testing, and subgrade stability testing.

5. QA/QC

A. The Contractor shall submit to the Owner a Project Quality Assurance Plan and relevant supporting quality control specifications and procedures to be utilized on the Project. The Project Quality Assurance Program shall be sufficient to satisfy the current industry standards necessary to assure the level of quality expected for a utility grade wind energy facility.

B. The Owner may request additional documents that will be required to be submitted to the Owner as they are generated during the normal course of the project and upon completion as turnover documents to include documentation.

C. The implementation Contractor of the above described plan and procedures will be verified by the Owner through the performance of audits and inspections, and any deficiencies noted during these audits and inspections shall be resolved within the framework of the Contractor's quality assurance program.

6. Testing

A. All testing/inspections shall be performed by a qualified, Owner-approved third party unless otherwise noted. Contractor shall coordinate testing with Owner and schedule testing a minimum of three days in advance of any test. Notification procedures shall be agreed upon by Contractor and Owner at the Preconstruction Conference. Owner may observe testing at their discretion.

7. Civil Infrastructure

The Contractor shall be responsible to construct site infrastructure required to access the turbine sites for construction and long term maintenance. The following provides a framework for bidding based on known constraints and manufacturer's recommendations. Final design will incorporate BOP Contractor and Geotechnical recommendations.

A. The Contractor is responsible for design of new access roads and compacted shoulders for the transport of WTG equipment and erection cranes. The contractor will construct and maintain as detailed in the Civil Construction Plans.

B. Construct and maintain new access roads, turn-arounds, and compacted shoulders in accordance with the construction plans provided by the Owner and the turbine manufacturer's general requirements for the transportation of the WTG equipment and the transportation and movement of the erection cranes.

C. Construct new 16'-0" wide access roads, radii and turn-arounds plus compacted shoulders in accordance with the information guidelines below. Scope of work shall include access road maintenance and dust control in normal conditions. Construct and/or compact 10'-0" wide shoulders on either side of the road as crane paths to allow for crane travel on the access roads during the wind turbine erection process. Minimum requirement are as follows:

1. Road Surface – The road shall be constructed, utilizing stabilization fabric overlaid by a minimum of 8" of aggregate material, so that it will support the weight of loaded transports making multiple trips. Roads shall have a minimum of 95% compaction to support the loaded axle weight required by Siemens. Roads and shoulders shall be constructed to allow sufficient water runoff and maintain

compaction during normally expected weather conditions. Diagonal roads through fields will not be allowed unless authorized by the landowner. Decompaction of the shoulders will be required at the completion of the project. Contractor may propose concrete stabilization in lieu of the aggregate road section described above.

2. Width – Straight-line roads must be no less than 16’-0” wide. Road width will need to be increased through turns and curves.
3. Road vertical curves – 6” in 50’-0” and 12” in 100’-0” are the maximum allowable for crests and sags.
4. Road Crown/ Side Slope – Roads shall have no more than 2% side slope.
5. Turn Radii – Radii shall have a cleared area, of 55’-0” on the outside of the turn to allow for blade tip swing. Radii shall be constructed with a minimum inner radius of 150’-0”. Turn Radii shall have no more than 2% side slope through the duration of the curve.

D. As necessary, clear, grub, and site preparation for all areas where work is to occur.

E. Design, install, extend, repair or replace culverts as specified or required to maintain stormwater management.

F. Construct a laydown yard that will allow for storage of all construction materials, equipment and components as well as construction trailers and parking facilities. The laydown area shall be constructed such that it is functional in all types of weather and shall be removed and reclaimed at the completion of the construction activities.

G. Provide and maintain trailers for exclusive use by the Owner.?

H. Install crane pads in accordance with the manufacturer’s requirements including compaction to meet required bearing capacity at all WTG sites necessary for the safe operation of erection cranes.

I. Utilize the services of a professional surveyor as necessary to perform construction tasks.

J. The Contractor is responsible for providing the SWPPP and obtaining the NPDES Permit.

K. Install and maintain stormwater infrastructure including sediment and erosion control best management practices (BMP’s) as required by permit. Record and Log information relevant to storm water pollution prevention measures including but not limited to erosion and dust control measures in accordance with all applicable permits.

L. Re-grade and repair access roads after WTG installation.

M. Temporary seeding as required by the timeframes defined in the NPDES permit.

N. Re-establishment of permanent vegetative cover on all disturbed areas with native grasses within the time frame specified in the stormwater pollution prevention plans.

8. Geotechnical Investigation

A. Contractor shall provide all geotechnical engineering services required to perform the structural, civil, and electrical engineering and to satisfy North American wind industry independent engineering practices.

B. The Contractor's Geotechnical Engineer shall determine the subsurface exploration procedures and laboratory testing program. Sampling methods and laboratory testing shall comply with the all applicable ASTM standards.

C. Testing is required at all WTG sites, the O&M building and substation sites, along the transmission line corridor, and along the highest loaded collection system circuit.

D. Subsurface investigation may be by a combination of borings with standard penetration tests (SPT) and where suitable, cone penetrometer testing (CPT). If CPT testing is deemed feasible at the site, SPT tests will be required at a minimum of 10% of WTG sites and CPT testing will be required at 100% of the sites.

E. All boreholes will be backfilled in accordance with state and local standards and laws.

F. Groundwater measurements should be performed to provide a design groundwater depth at each WTG site. Porewater dissipation tests should be performed in a minimum of 25% of the CPT soundings and direct groundwater level measurements shall be performed in all SPT borings (1) during advancement of the auger and sampler, (2) immediately after withdrawal of the auger from the hole, and (3) one day after withdrawal of the auger.

G. In areas in which the CPT soundings and SPT boreholes do not provide adequate groundwater data, the installation of temporary piezometers may be necessary. For purposes of this bid, assume piezometers will be required at 10% of the WTG sites.

H. The following soil laboratory testing will be required. It is the responsibility of the contractor or the contractor's engineer to determine if additional testing is required.

1. Moisture Content (ASTM D2216) – 1 per SPT sample
2. Unit Weight (ASTM D2937) – 2 per SPT boring
3. Unconfined Compression (ASTM D2166) – 70% of SPT borings
4. U-U Triaxial Strength (ASTM D2850) – 30% SPT borings
5. Atterberg Limits (ASTM D4318) – 1 per SPT boring
6. Direct Shear (ASTM D3080) – 1 per granular soil type
7. Particle Size Analysis (ASTM D422) – 1 per SPT boring

8. 1-D Consolidation (ASTM D2435) – 1 per soft clay
9. Maximum Swell Pressure (ASTM D4546) – 1 per swelling soil type
10. Standard Proctor (ASTM D698) – 1 per surface soil type
11. Corrosion Potential Suite – 1 per surface soil type
12. Specific Gravity (ASTM D854) – 1 per soil type
13. California Bearing Ratio (ASTM D1883) – 1 per surface soil type
14. Thermal Resistivity (ASTM D5334 – 5 total on the site

I. Seismic refractory testing will be performed at 10% of the turbine locations in conjunction with their respective CPT soundings using a biaxial geophone (SCPTu method). The CPT soundings should be advanced to a depth of 60 feet at each of these locations, during which both S (shear) and P (compression) waves will be measured to establish the required dynamic properties (shear modulus and Poisson's ratio). The S and P wave measurements should be performed at 1-meter intervals.

J. Electrical resistivity tests should be performed at 10% of the WTG sites and at all substation and switchyard locations.

K. Provide a geotechnical evaluation report certified by a professional engineer registered in the state where the work is performed. Report shall include the following:

1. SPT boring logs and CPT sounding logs describing the materials encountered,
2. Site cross-sections indicating soil changes with distance,
3. A CAD sketch showing the boring locations and project constraints,
4. Laboratory test results,
5. Results and findings of the site reconnaissance,
6. Field exploration methods and deviations,
7. A summary of the project's site geology and groundwater conditions and descriptions of the soil/rock units encountered,
8. A hazards evaluation for the project site (i.e. flood potential, expansive or collapsible soils, mining, subsidence, etc.),
9. Groundwater measurements and their implications on the design and construction of the project structures,
10. Discussion of the site's seismicity and Site Class.
11. Earthwork procedures for the construction of foundations, roadways and other transmission-related structures, including subgrade preparations, backfill material type, placement, and compaction requirements,
12. Dewatering requirements and procedures,

13. Treatments to mitigate soft or compressible soils, swelling soils, collapsible soils, etc.,
14. Frost heave discussion and foundation embedment,
15. Soil design parameters to assist the structural consultant in preparation of foundation designs for wind turbine generators (allowable bearing pressure, dynamic shear modulus, Poisson's ratio, subgrade modulus, allowable passive pressure, friction coefficient, and backfill unit weight),
16. Soil design parameters to assist the structural/electrical consultant in preparation of foundation designs for substation structures (unit weight, cohesion, friction angle, lateral pressures, allowable adhesion/skin friction, allowable bearing pressure),
17. Estimated settlements at the design pressures for shallow mat foundation designs,
18. Deep foundation design criteria (if warranted),
19. Slope stability analyses and recommendations for turbines located near areas of steep slopes and potential instability,
20. Cement type for below-grade concrete construction,
21. Pavement sections for turbine access roads

9. Wind Turbine Generator Foundations

A. Design and construct nine (9) WTG foundations. For purposes of bidding, assume the following minimum requirements:

   1. Inverted T foundation
   2. Minimum 3000 psf net allowable soil bearing pressure
   3. No groundwater in upper 8' of foundation
   4. 5,000 psi 28-day Type V concrete for base
   5. 5,500 psi 28-day Type V concrete for pedestal
   6. Two drain tile repairs per foundation

B. Provide all labor, material and equipment necessary to construct all wind turbine foundations, including all concrete, turbine grounding grid, reinforcing bars, anchor bolts, anchor bolt corrosion protection, anchor bolt embed rings, anchor bolt installation template rings, padmount vaults and conduit.

C. Install a turbine foundation grounding grid for each foundation with grounding mechanisms provided in accordance with the specifications.

D. Install and compact the necessary backfill and overburden for each foundation.

E. Install anchor bolts and embedment ring. Grease anchor bolts and install contractor supplied anchor bolt protective cap within 14 days after tower erection.

10. Wind Turbine Generator Erection and Mechanical Completion

A. Provide all necessary materials and equipment to unload and store all turbine components at each turbine site in accordance with the specifications.

B. Unload and store all WTG components at the turbine site.

C. Clean and wash all WTG components related to exterior dirt generated by delivery, storage and erection.

D. Provide all tools, materials, labor, and equipment to erect all wind turbine components in accordance with the manufacturer's installation manual and/or technical documentation.

E. Provide all crane mats necessary to perform the erection work.

F. Install any FAA lights and brackets.

G. Complete all WTG mechanical components including all electrical installations in accordance with the manufacturer's installation manual and/or technical documentation.

H. Grout the tower base flange and tension all foundation anchor bolts after the turbine tower base has been installed.

I. Terminate the WTG ground to the ground grid strap.

11. Underground Collection System

A. Engineer, procure, and construct a 34.5 kV underground electrical collection system meeting 2% or less losses from the 690 volt connection located at base of the turbine to the point of interconnection, including WTG transformers, collection system, and collector substation.

B. Contractor shall design an underground collection system in accordance with all state approved American electrical codes and standards, local, state, and federal laws, rules, and regulations. Contractor shall procure equipment required for the collector.

Contractor shall utilize the corridors for cable construction as prescribed by the Owner to minimize impacts to wetlands and natural resources in accordance with permitting.

C. Contractor shall prepare Engineering Details and Technical Documentation for construction of the underground collector system. This includes, but is not limited to;

1. Reports and Calculations
   a. Explanatory report describing the final configuration of the collector system and facility rating methodology.
   b. Losses estimation study
   c. Conductor selection criteria including thermal rating, voltage regulation, insulation coordination, cross bonding.
   d. Grounding study
   e. Fault Study including phase to phase and phase and ground faults for the cable and WTG transformer system.
   f. Protection coordination for the WTGs, WTG transformers and cable system.
   g. Insulation coordination and transient overvoltage (TOV) study to determine the exposure to operational overvoltage in the collection system and to verify grounding practices

2. Drawings;
   a. Collection system layout drawings.
   b. Electronic shape files are available upon request to show detailed information of the above named drawing.
   c. A general collection system one line diagram.
   d. One line diagram of each of the circuits with cable lengths.
   e. Detail of terminations, splices and any other element to be installed.
   f. Detail of the electrical conduits in the foundations.
   g. Technical specifications sheet (to be followed by the construction contractor)
   h. Collector system as-built drawings showing cable locations (GPS), equipment locations, cable depths, road crossings, splices, conductor types, grounding details, trench details.

3. Technical Specifications and Manuals:
   a. Underground cables data sheets.
   b. Switchgear data sheet.
   c. Surge arrestor data sheet.
   d. Data sheet of each size/type of cable.
   e. Reference price for each cable size used in the design.
   f. WTG transformer data sheets.
   g. Optical fiber data sheets and instructions.

4. Spare Parts List

D. The Contractor shall provide SCADA system to develop an optical fiber system that connects all the wind turbines and pad mounted transformers (if applicable) of the wind farm to the collector substation. The meteorological towers must be also connected to this SCADA system. The Owner, under the Turbine Supply Contract, will define the minimum requirements for the Optical fiber network design. Owner may chose to supply this component through the turbine supplier.

E. Install fiber optic communications cables in the same trench with the 34.5 kV cable circuits. Contractor shall provide materials for splicing in the field as necessary. The optic fiber cable must be located in conduit or must be rodent proof. If it is installed in conduit, the conduit must be large enough to accommodate the optic fiber cable but will not allow rodents to access. No junction boxes or other accessible boxes shall be used.

F. Engineer and install a grounding grid for the project. The grounding grid shall have resistance rating that meets the turbine manufacturer requirements and meet IEEE 80 step and touch requirements.

G. The layout will be in accordance with the existing agreements between Owner and participating landowners of this project. The Owner will provide the Contractor with all information required concerning agreements and permits.

H. Trenches shall run in locations specified by the Owner. The final layout shall optimize materials, construction costs and safety requirements. When trenches do not follow the layout due to site conditions or a less expensive installation, these revisions shall be submitted to the Owner and include cost estimates for the recommended alternative route.

I. The Contractor shall recommend revisions to the cable routes following to optimize the materials, selection of cable sizes and minimize requirements for splicing following completion of thermal rating and short circuit currents studies and final route selection.

J. Clearing and grubbing the path for the collection system along with restoration shall be included in this scope of work.

K. Collection System installation method shall include application of colored locating tape.

L. WTG pad mounted transformers sized as appropriate for WTG requirements will be furnished by the Owner. Installation and testing done by contractor.

M. Assume approximately 50 drain tile repairs for collection system. Provide unit price for changes.

N. Assume no utility crossing requirements.

O. Assume 42” trench depth and screened sand or earth for coverage over electrical collection system cabling. Trenches shall be designed according to the state’s approved standards

P. Assume rock will not be encountered within the collection system trenching route.

Q. Assume boring under all paved and/or chip and sealed roads. Contractor may trench through gravel roads, if so elected. Contractor is responsible to repair road to a condition not less than previous.

R. Furnish and install grounding transformer for each collection system circuit, if required.

S. Contractor required to compact cable trench to a minimum of 90% of the standard proctor density unless otherwise specified on drawings. Compaction tests shall be performed at roughly a depth of 2 feet and 3 feet above the cables. Compaction tests shall be performed every 500 feet for the first mile of testing per feeder and every mile thereafter.

T. Contractor to perform testing on all 34.5 kV cables in accordance to industry testing standard.

U. A ground test will be required at each wind turbine ground grid to verify wind turbine requirements. The test shall be preformed prior to the connection of the trench ground and cable shields.

V. Pad mount WTGSU transformers shall be tested as follows:

1. Contractor shall perform a Megger check of phase-to-phase and phase-to-ground insulation levels.
2. Contractor shall perform continuity test.
3. Contractor shall perform a transformer turns ratio (TTR) test.
4. Contractor to perform onsite oil testing of each transformer.

W. All fiber shall be bi-directional OTDR tested prior to installation and following installation.

12. Collector Substation

A. Contractor shall provide complete engineering, procurement, assembly/installation, and testing & commissioning for the substation.

B. Contractor shall construct one 34.5 kV-69 kV substation in accordance with industry standards and shall follow all local, state, and federal laws, rules and regulations, where applicable.

C. Contractor shall procure equipment required for the substation not limited to receipt, storage, installation, testing and commissioning.

D. Contractor shall prepare Engineering Details and Technical Documentation for construction of the substation. This includes, but is not limited to:

1. Reports and Calculations:
   a. Explanatory report describing the final configuration of the substation and facility rating methodology.

b. Protection Coordination Study including grounding design study and short circuit study
c. ARC Flash Study
d. Insulation coordination study (lightning) including transient overvoltage assessment.
e. Auxiliary services (AC and DC distribution, CT, PT) load study
f. Station bus design calculations
g. Steel structures and foundation design calculations
h. Metering
i. Losses calculation study

2. Drawings:
   a. Drawing list
   b. One-Line Diagram
   c. General Equipment Arrangement Plan and Elevations
   d. Relay Control Panel Arrangement and Bill of Materials
   e. Lighting
   f. AC and DC Local Services including lighting
   g. Misc. Connection Details
   h. Ground Grid Plan & Grounding Details
   i. Conduit Plan & Details
   j. Foundation Layout & Details
   k. Grading Plan and Sections
   l. Erosion and Sedimentation Plan
   m. Oil Containment Plan & Details
   n. Structural Steel Details
   o. Control Building Plan
   p. Control Building Sections
   q. Three-line Diagrams
   r. AC & DC Schematics
   s. External Connection Diagrams
   t. Communication Network Diagram
   u. Communication Schematics and Wiring Diagrams
   v. Control Cable Schedule
   w. Lightning Protection
   x. Bill of Materials
   y. Fence Plan & Details
   z. Metering
   aa. Yard Grading and Drainage
   bb. Anti-theft
   cc. Fire system
   dd. Manufacturers' Drawings

3. Technical Specifications and User Manuals
   a. Protection and control embedded system (logical diagrams, automatic operations and control, list of remote control issues and user manual)

b. Measurement transformers (verification protocol of measurement equipments and user manuals)
c. Power transformers (user manual and drawings).
d. Breakers (user manual).
e. Reactance (technical description)
f. Auxiliary services transformer (user manual)
g. Switches (technical description and user manual)
h. Automatic valves (user manual)
i. Insulators (technical description)
j. Optical fiber (technical description)
k. MV switch breakers (user manual)
l. Counters and recorders (technical description and user manual)
m. Protections (technical description, setting files, and protocol of tests and adjustments)
n. SCADA system (technical descriptions, drawings, users manuals, software)
o. Communications system (technical descriptions, drawings, users manuals, software)
p. Batteries (technical description and user manual)
q. Cables (technical description)
r. Anti-theft system (user manual)
s. Fire system (user manual)

4. Interlocking List

5. Computer Programs
   a. Software for the protection relays
   b. Software for the protection and control embedded system

6. Protocol for the preventive maintenance of the substation

7. Spare Parts List

8. Quality
   a. Measurement transformers (tests)
   b. Power transformers (certificates and manuals).
   c. Breakers, reactance, auxiliary services transformers, switches, automatic valves, insulators, MV switch cabinets, counters and recorders, protection relays, batteries, cables (certificates and manuals)
   d. Soil tests.
   e. Foundation tests.

9. Other Documents
   a. Technical Specifications for the Civil Works and Assembly.
   b. Commissioning tests protocol.
   c. Commissioning reports.
   d. Collector Substation Operation Manual.

E. Complete a grounding study for design of the substation ground grid system. The substation ground grid shall be designed in accordance with the latest version of IEEE Standard 80.

F. Complete a lightning shielding study for the substation.

G. Supply grading design.

H. Detailed structural steel design, foundation design and oil containment to satisfy environmental regulations. The Contractor shall determine the location of soil tests that are required to design the foundations. Assume deep foundation solutions are not required.

I. Include all electrical interconnects and tie-in's from the underground collection system and transmission system interconnection.

J. Provide relay settings/programming for the substation protective relays, as well as testing and commissioning services.

13. SCADA System

A. The Contractor shall design a SCADA System for the collector system and collector substation.

B. Supply, install, test and commission all communication hardware and software required that is excluded from the Owner's Turbine Supply Agreement that will be located at the collector substation for communication between the collector substation and utility interconnect, and all other required communications with third parties. Substation alarm & status points shall be developed for the substation RTU. Develop a network communications diagram for the relays, substation SCADA system and the physical interface to the wind farm SCADA system.

C. The Contractor shall prepare technical specifications, drawings and standards for the SCADA System.

D. The SCADA system will allow readings and control signals remotely (from the collector substation and the interconnection substation to be specified by the Owner) to each wind turbine of the wind farm on a singlemode ring configured fiber optic network.

E. Elements of the substation must also be controlled remotely. Readings of voltage and current in different bushings shall be sent by remote control via the SCADA system. The Contractor shall design and determine the additional features including protection and controls required to control and monitor the collector substation and transmission system interconnection.

F. The Owner will supply the hardware (server panel, grid measuring station and work station) and the software to be installed in the collector substation control building as part of the Turbine Supply Agreement.

G. Contractor shall supply and install cabling (optical fiber, conduits) between panels and connect all other associated cables (optical fiber cables) associated with establishing the wind farm LAN.

H. Contractor is responsible for supplying and connecting splice trays, pig tails and miscellaneous materials for all optical fiber terminations.

I. Contractor shall supply and install all ancillary services required to power the SCADA system and workstation.

J. Contractor shall supply and install a broadband connection to the internet and connect to the Owner provided VPN router.

K. The Contractor shall terminate and splice the fiber optical cable to an Interface module controller board at each WTG.

14. Transmission System Interconnection

The Transmission Owner will provide the Interconnection Substation.

A. Contractor shall design and construct the transmission line interconnection and SCADA interconnection between the Collector Substation and the Interconnection Substation.

B. Contractor shall design and construct the transmission line interconnection and SCADA interconnection between the Collector Substation and the Interconnection Substation.

C. Contractor shall design the transmission interconnection according to the specifications and drawings supplied by Owner and the requirements specified by Transmission Owner, but shall follow all local, state, and federal laws, rules, and regulations, where applicable.

D. Contractor shall design the foundations and provide the owner (Transmission Owner) with all the technical specifications and drawings to define the characteristics of the foundation needed for the transmission interconnection.

E. Contractor shall design, supply and install all main elements of the collector substation control, protection, SCADA and metering equipment located inside the collector substation control building.

F. Contractor shall provide all acceptance testing and inspections as required by the Transmission Owner.

G. Contractor shall provide all design drawings and engineering calculations as required for official review and approval by the Transmission Owner.

H. Contractor will meet and interface the Transmission Owner as per the Owner's request.

I. The Owner shall always be informed of all meetings, communications or interfaces between the Contractor and the Transmission Owner.

15. Met Towers

A. Engineer, procure, and construct one guyless meteorological tower, including foundation, power, roads, and communication.
B. Install mast instrumentation, supplied by owner, at various heights
C. Furnish and install one FAA light at the tower

16. FAA Lighting

Contractor shall obtain all necessary FAA permits. Contractor shall supply lights, mounting brackets and associated hardware for installation of the FAA lights. Contractor shall install and wire FAA lights on designated turbines according to the requirements of the FAA light manufacturer and turbine supplier. Contractor shall install temporary FAA lights if required by FAA until power is available at the turbine. The FAA lights shall be synchronized so they flash simultaneously.

17. General

A. Remove, relocate and/or install new fences, gates, and cattle guards as may be required during the construction of the Project.

B. Contractor shall receive, store, maintain, relocate, and install all Owner Supplied Materials.

C. Removal of all debris due to the Work each night and upon completion of each area before Contractor leaves that area.

18. Start-up & Commissioning

Contractor shall be responsible for supporting the startup and commissioning of all equipment within the facility in strict accordance with equipment manufacturer's guidelines. The Wind Turbine Generators shall be started up and commissioned by Wind Turbine Manufacturer personnel assisted by Contractor personnel as required.

19. Project Reporting

A. The Contractor shall, beginning on the Award Date and ending on the Date of Final Acceptance, prepare and submit to Owner bi-weekly a written progress report (the "Progress Report") to be deliverable electronically in accordance with the Contract or otherwise in a form reasonably satisfactory to Owner. The Progress Report shall include as a minimum the following sections:

1. Executive level summary of project status and progress.
2. Safety performance statistics.
3. Summary of completed milestones and tasks.
4. A narrative of what was completed in the preceding month compared to what was planned and an explanation of variance and recovery plan should progress have fallen behind the plan.
5. Expected progress during next reporting period.
6. Report of potential problems.
7. Progress Schedule update.
8. Drawing specification/document control log.
9. Change Order status.
10. List of Subcontractors working on site.
11. Graphic project completion S curve, depicting actual vs. schedule completion.
12. Quality Assurance/Quality Control statistics and open issues.
13. Photographs showing progress.
14. Material On Hand and On Order Inventory Sheets.

B. Weekly project status review meetings shall be conducted with the appropriate Owner, Contractor, and Subcontractor personnel present.

C. Should any problem, emergency, strike, injury, work stoppage, or legal problem be anticipated, or any unanticipated event occur which might materially adversely affect Contractor's ability to perform the Work and its obligations hereunder in a timely manner, Contractor shall promptly prepare and deliver to Owner a written significant event report detailing all available information and steps being taken to correct such problem or event.

SPECIAL PROVISION OF THE PROJECT

1. SAFETY

A. Contractor shall be solely responsible to initiate, maintain and supervise all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
- all persons on the Site or who may be affected by the Work;
- all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
- other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Owner may provide Supplementary Conditions to identify any Owner's safety programs that are applicable to the Work.

D. Contractor shall inform Owner of the specific requirements of Contractor's safety program with which Owner's employees and representatives must comply while at the Site.

E. Contractor shall not obstruct any public roadway or other access without obtaining prior permission from the appropriate agency. Any damage to such facilities caused by Contractor or its Subcontractors shall be repaired at the Contractor's expense. Contractor shall, at its expense, provide any required temporary guards, lights, signals etc. required for its Work.

F. Contractor shall be responsible for the security and protection of the Project, including all Project Equipment through the date of Project Substantial Completion (including the Wind Turbines until Mechanical Completion has been met with respect to each Wind Turbine). Contractor shall use due care to protect any of the property or equipment of Owner or Turbine Supplier at the Project Site or in its possession or under its control while performing the Work, which shall, at a minimum, be the standard of care required by Prudent Wind Industry Practices and exercised by Contractor with its own property. Contractor shall be responsible for any damage to such property and equipment resulting from its failure to use such care.

G. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

H. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

I. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Owner prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Owner determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

2. INSURANCE COVERAGE

A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;

2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;

3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;

4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

    a) by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or

    b) by any other person for any other reason;

5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting there from; and

6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

B. The policies of insurance shall:

1. be written on an occurrence basis, include as additional insured (subject to any customary exclusion regarding professional liability) Owner and any other individuals or entities identified by Owner, all of whom shall be listed as additional insured, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insured, and the insurance afforded to these additional insured shall provide primary coverage for all claims covered thereby;

2. include at least the specific coverages and be written for not less than the limits of liability provided in the Contract or required by Laws or Regulations, whichever is greater;

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued;

4. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work;

5. include completed operations coverage:

    a. Such insurance shall remain in effect for one year after final payment.

    b. Contractor shall furnish Owner and each other additional insured identified by Owner, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

C. Failure of Owner to demand such certificates or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

3. HOURS OF OPERATION

Normal Project hours will be confined between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday to minimize and avoid impacts to the community from construction noise. Contractor shall not deviate from these hours without prior approval of the Owner. Owner reserves the right to adjust the normal project hours. Contractor reserves the right to adjust actual work hours or work weekends as agreed to by Owner.

4. WASTE MATERIALS

A. Contractor shall implement waste disposal programs that comply with applicable law and Project requirements for the control and disposal of wastes.

B. Contractor shall provide trash dumpsters or other suitable containers for proper disposal of construction debris, garbage, food wastes and other similar trash created from Contractor's work. Contractor shall be responsible for the off-site disposal of such wastes.

C. Contractor shall be responsible for collection and disposal of any hazardous materials brought to the project site for its Work. Contractor shall not dump or dispose of fuel, oils, chemicals, paints, or other hazardous materials on the Project Site.

D. Contractor shall maintain its equipment so that it does not leak oil, hydraulic fluids, fuels, greases, cutting oils, anti freeze or other chemicals. If leaks or spills of these or other similar materials occur, Contractor shall promptly clean up the spill and shall promptly notify the Owner's Manager of the incident. Contractor shall be responsible for off-site disposal of resulting waste materials in full compliance with applicable law.

E. If, after written notice from Owner, at any time the Contractor fails to maintain its Work and storage areas free of accumulated waste material and rubbish or hazardous materials or conditions or otherwise keep such areas in a neat clean and orderly condition, the Owner may cause such maintenance to be performed and all costs associated therewith will be charged to Contractor.

5. FUEL STORAGE

Contractor may use and store in reasonable quantities the following substances required to perform the Work, but only in accordance with applicable Environmental Laws: gasoline, diesel fuel, fuel oil, grease, lube oil, sealants, form oil, solvents, adhesives and other substances of a type and quantity consistent with normal and customary construction practices for construction of a project similar in nature and scope to the Project. Any other Hazardous Substances to be brought to or stored on the Project Site shall require specific written authorization of Owner. Contractor shall comply, and shall cause its Subcontractors to comply, with all applicable Environmental Laws.

6. VEHICLE OPERATION

A. Operation of motor vehicles on the Project Site shall be in accordance with general safe driving practices and specified speed limits. Vehicular accidents involving personal injury or property damage shall be promptly reported to Owner.

B. The Contractor shall indentify the Owners against all actions, suites, claims demands, costs, charges and expenses arising from the death of or bodily injury to any person or damage to any property (except where such death or injury arises out of and in the course of employment of such person by the Owners) as a result of an accident caused by or through or in connection with any motor vehicle brought on to the site by a Contractor's or its subcontractor's employee engaged on the Work.

C. Specific measures shall be taken to reduce Project-related traffic impacts on local residents during Project construction. These measures include signage notifying local residents of the work, and compliance with any requirements of the County. Any damage caused by Contractor to existing roads, curbs, sidewalks, signs, etc. shall be repaired by Contractor at its expense.

D. All Contractor vehicles on the Project Site shall be clearly identified with the Contractor’s name and/or logo. Personal vehicles shall be parked in designated areas.

E. Contractor vehicles shall not be loaded beyond their capacity as prescribed by the manufacturer and/or Applicable Law.

F. The Contractor and its subcontractors are advised to satisfy themselves that employees' vehicles are in a roadworthy condition and are insured for third party risks.

G. Carpooling among the Contractor's employees and its subcontractors' employees is encouraged to minimize construction related traffic and associated emissions.

7. TRAFFIC MANAGEMENT

A. Contractor shall develop a traffic control plan including both temporary and permanent signage for all public roadways, intersections, and crossings to comply with all Local, State and County requirements.

B. Contractor shall be responsible for providing, operating, and maintaining equipment, services, and personnel with traffic control and protective devices in conformance with the requirements of the Manual of Uniform Traffic Control Devices (MUTCD) as required to allow safe traffic flow on haul routes and on site access roads.

C. Single lane closures may be authorized. Such closures shall be in accordance with State and Local regulations and authorizations.

8. SITE VISITS

Prior to the start of work on the project, all visitors must check in with the Owner's Administrator. Once work has been started, all visitors to the site must check in with the Contractor. All site visits must be performed in accordance with the site rules.

9. SITE RULES

A. All Site visits will be coordinated with Owner's Administrator one week in advance.

B. Respondents shall submit a plan of the general area they will need access to so the appropriate Land Owners can be contacted. Also included in this notification shall be the number of personnel as well as the number of trucks or ATV's.

C. All gates need to be securely closed unless obviously rigged to stay open for the purpose of moving livestock from one pasture to another.

D. Under no circumstance shall the Respondents contact the landowners without consent from the Owner's Administrator.

E. ALL Respondents shall be respectful of grazing animals on the Land and shall avoid, to the extent reasonably possible, any contact with any animals on the Land.

F. Contractor and all employees are representatives of the Wind Project Owner and shall conduct themselves in a professional manner when out in the community.

10. LANDOWNER AGREEMENTS

Contractor shall, cooperate with Owner to address reasonable concerns of owners or occupants of real property comprising or adjacent to the Project Site, and shall comply with any and all landowner agreements. Contractor shall not enter into any agreement, contract or understanding (oral, written or otherwise) affecting the Project with any Landowner without the prior written consent of Owner.

APPENDIX

A. PROPOSED TURBINE COORDINATES LIST

B. CIVIL LAYOUT

C. DELIVERY ROUTING PLAN

D. ELECTRICAL ONE-LINE DIAGRAM

E. BILL OF ESTIMATED QUANTITIES

F. INTERCONNECT STUDY

PROPOSED TURBINE COORDINATES LIST

Turbine Description	Minnesota DOT: Redwood County, US Foot		WGS 84	
Struct_Num	EASTING	NORTHING	LONGITUDE	LATITUDE
MET-1	558507.550	223078.564	-95.00898745	44.53209168
T-1	567595.454	220817.717	-94.97416774	44.52581705
T-2	566674.948	220305.578	-94.97770313	44.52442030
T-3	567278.236	218351.737	-94.97541376	44.51905614
T-4	566514.487	218005.612	-94.97834580	44.51811335
T-5	562754.222	220679.412	-94.99273080	44.52547824
T-6	561866.508	220673.686	-94.99613438	44.52546964
T-7	556601.795	223402.011	-95.01629170	44.53299291
T-8	557486.994	223111.417	-95.01290038	44.53218939
T-9	558398.137	223531.696	-95.00940223	44.53333534

CIVIL LAYOUT

NO.	DATE	REVISION	SHEETS
.	.	.	.

Preliminary Civil Construction Plans

for

Wind Turbine Generators, Access Roads, Drainage and Erosion Control

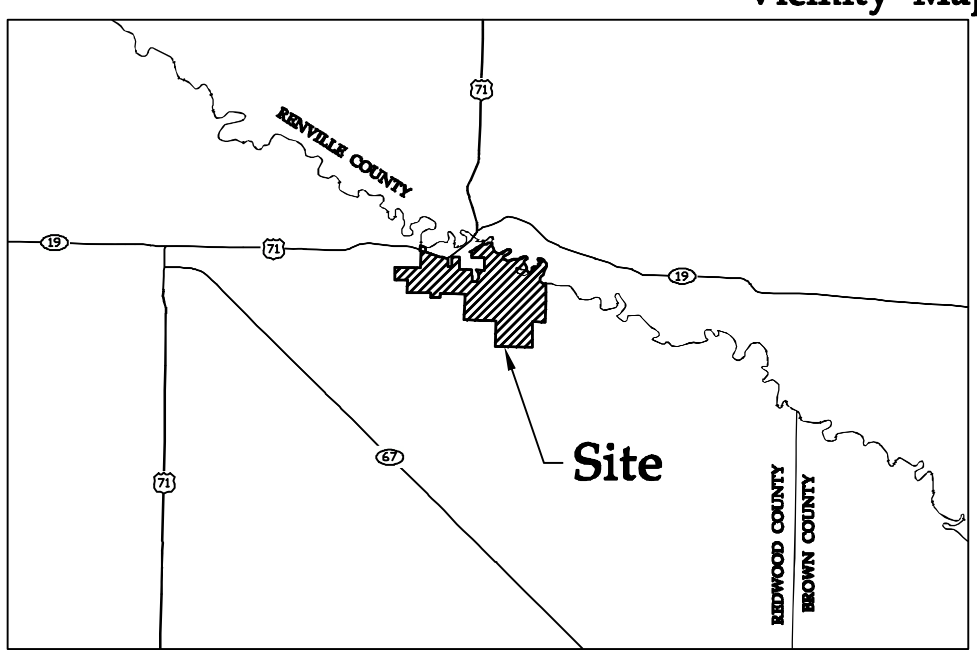
for

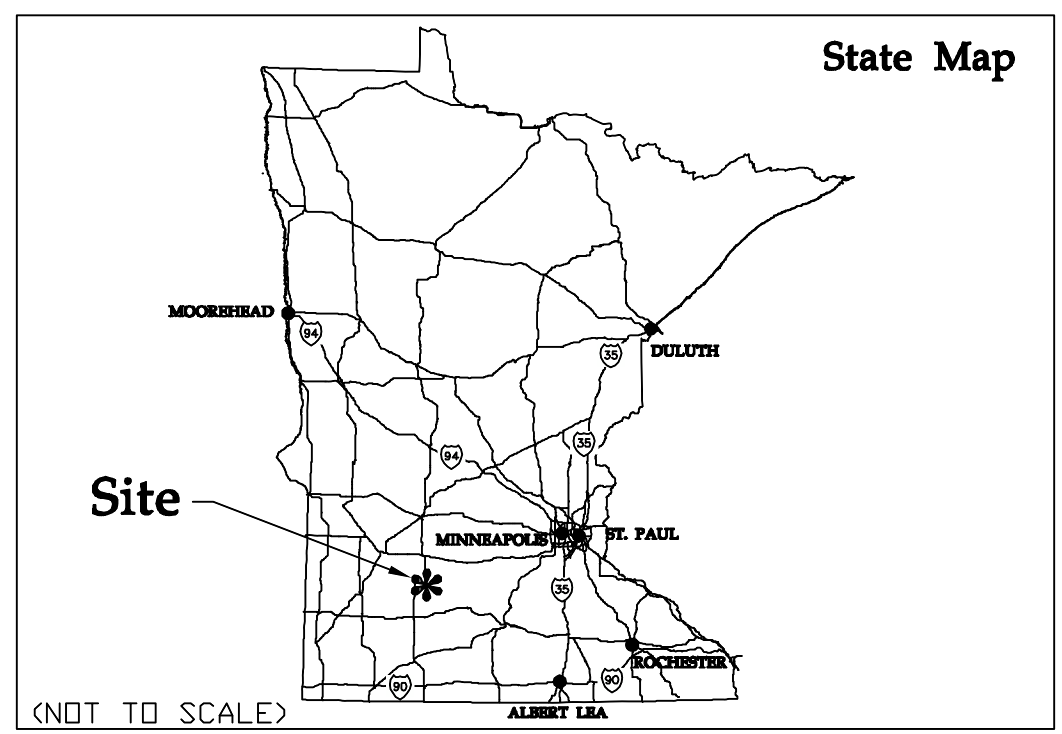
Lower Sioux Wind Project

Redwood County, Minnesota

Sheet List Table	
Sheet Number	Sheet Title
1	Cover
2	Overall Civil Site Plan
3	Construction Details
4	Construction Details
5	Construction Details
6	Civil Plan Set T-7 T-8 T-9 Met-1
7	Civil Plan Set T-5 T-6
8	Civil Plan Set T-1 T-2 T-3 T-4

Vicinity Map





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FAX 952-937-5822
TOLL FREE 1-888-937-5150

www.westwoodps.com

Designed: SJB
Checked: CJC
Drawn: SJB
Record Drawing by/date:

Revisions:

#	DATE	DESCRIPTION
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Prepared for:

Lower Sioux Wind Project
Redwood County, Minnesota

Cover

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Date: 02/08/12
Sheet: 1 OF 8

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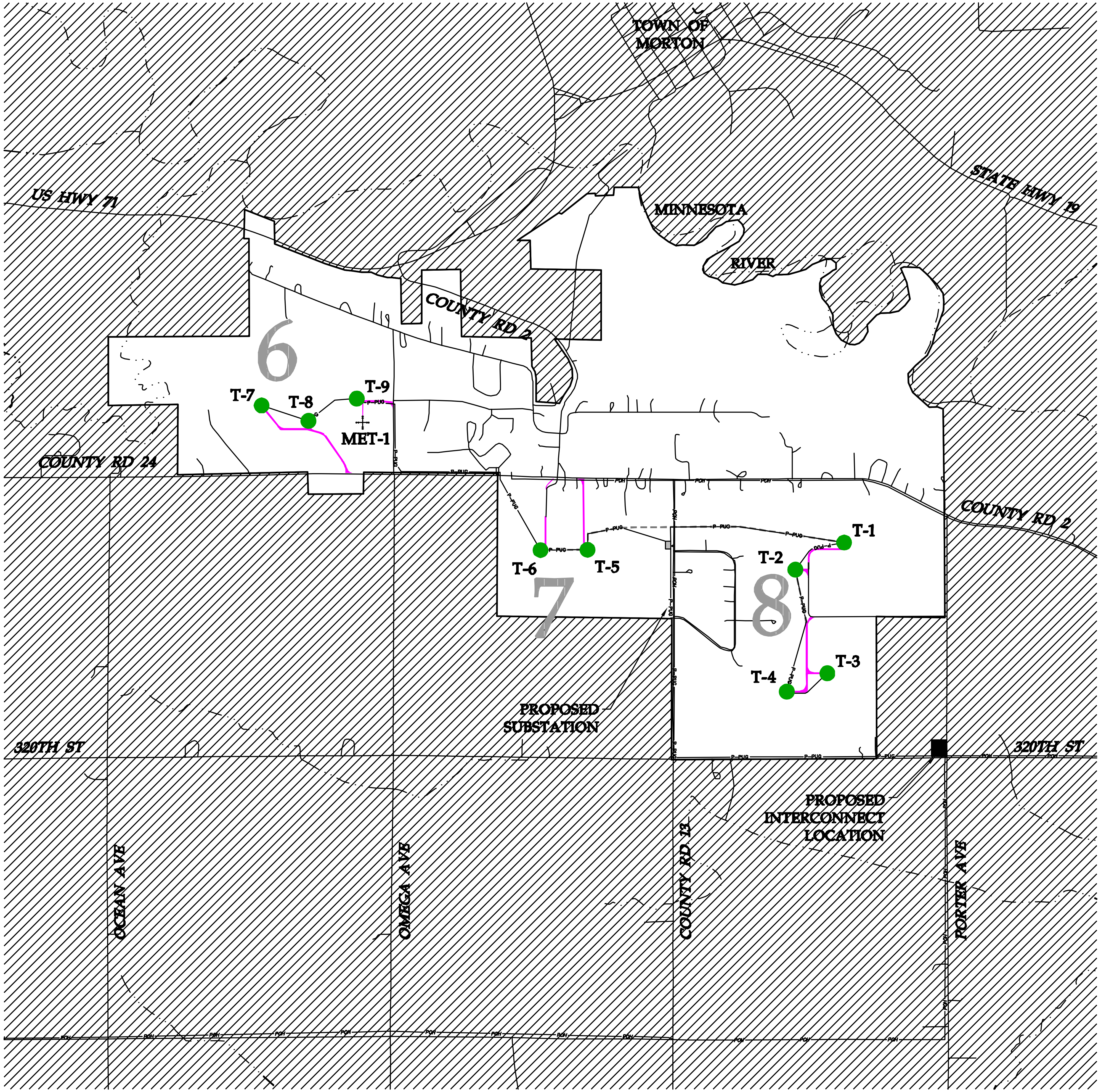

LEGEND:

- PROPOSED TURBINE LOCATION
- XX PROPOSED TURBINE NUMBER
- PROPOSED MET TOWER LOCATION
- PROPOSED ACCESS ROADS
- PROPOSED CRANE PATH
- PROPOSED UNDERGROUND ELECTRIC*
- EXISTING ROAD
- EXISTING WATERWAY
- OUTSIDE OF PROJECT BOUNDARY
- 8 DENOTES SHEET NUMBER

** UNDERGROUND COLLECTION LINE IS CONCEPTUAL ONLY, SEE ELECTRICAL CONSULTANT PLANS FOR FINAL ROUTING AND DETAILS.*

0' 1000' 2000' 3000'

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Redwood County, Minnesota

Overall Civil Site Plan

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Date: 02/08/12

Sheet: 2 OF 8

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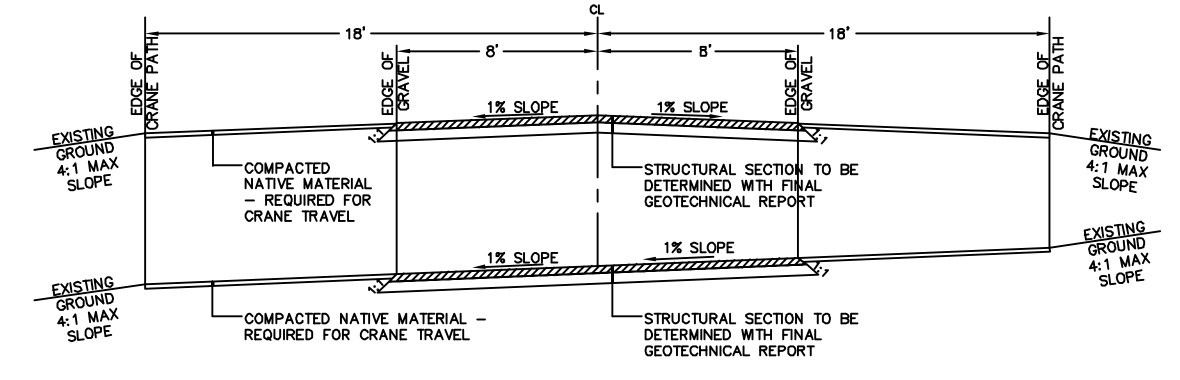
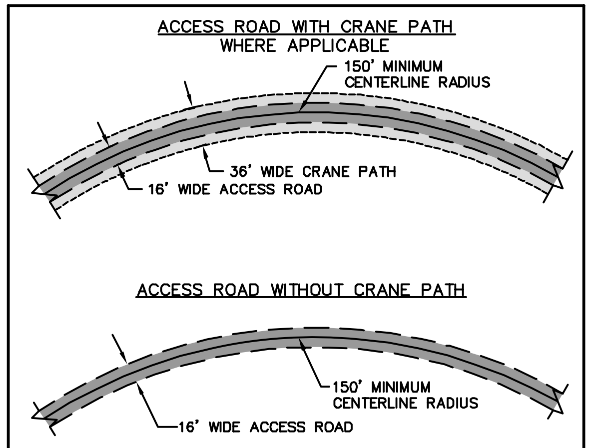


NOTES:

1. CONSTRUCT CROSS-SLOPE ROAD SECTION WHERE ACCESS ROADS ARE CONSTRUCTED ON A SIDE SLOPE, AND WHERE OTHERWISE NOTED ON PLANS, TO ENSURE THAT ROADS AND SHOULDERS REMAIN WELL DRAINED AT ALL TIMES.
2. MAXIMUM CROSS SLOPE FOR CRANE TRAVEL IS 1.0%
3. WHEN CRANE PATH IS NOT NEEDED, MATCH THE ACCESS ROAD DIRECTLY INTO EXISTING GROUND SURFACE
4. ROADS TO GENERALLY FOLLOW EXISTING CONTOURS EXCEPT IF GRADES EXCEED TURBINE DELIVERY VEHICLE CAPABILITIES, IF THIS OCCURS GENERAL CONTRACTOR MAY PROVIDE ASSIST VEHICLE OR MODIFY GRADE

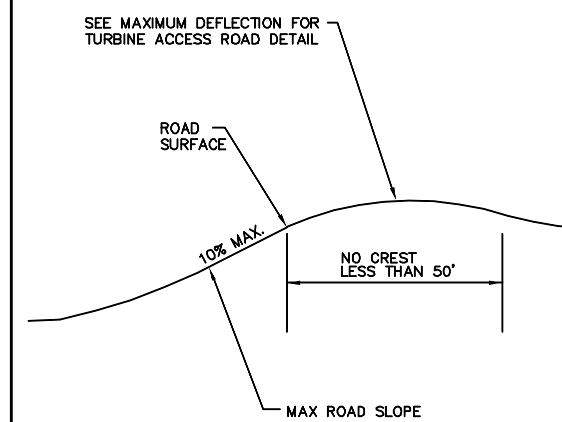
TYPICAL TURBINE ACCESS ROAD — LAST REVISED: 04/08/09 — RD01



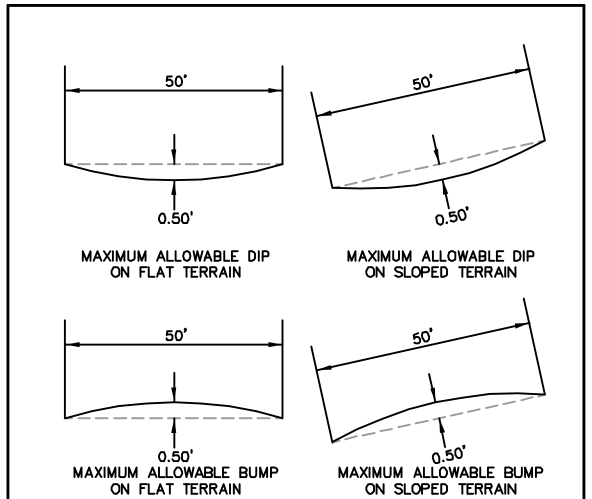
NOTE:

1. SOME RADII MAY REQUIRE ADDITIONAL SOIL COMPACTION OR GRAVEL OUTSIDE OF THE WIDTH SHOWN ABOVE TO ACCOMMODATE TRACTORS OR TRAILERS TRACKING OFF THE ACCESS ROAD.

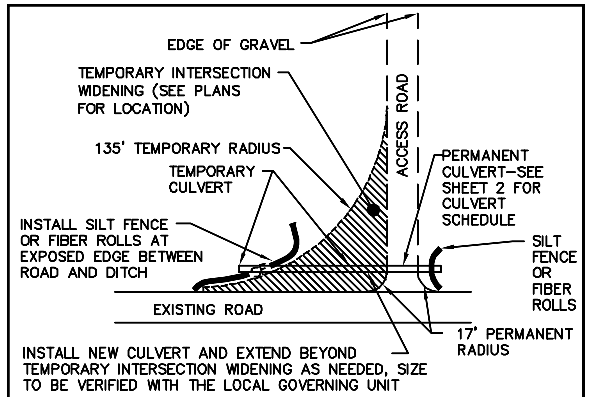
MINIMUM RADIUS FOR TURBINE ACCESS ROAD — LAST REVISED: 01/02/08 — RD02



MAXIMUM VERT. SLOPE FOR TURBINE ACCESS ROAD/CRANE TRAVEL PATH — LAST REVISED: 01/02/08 — RD03



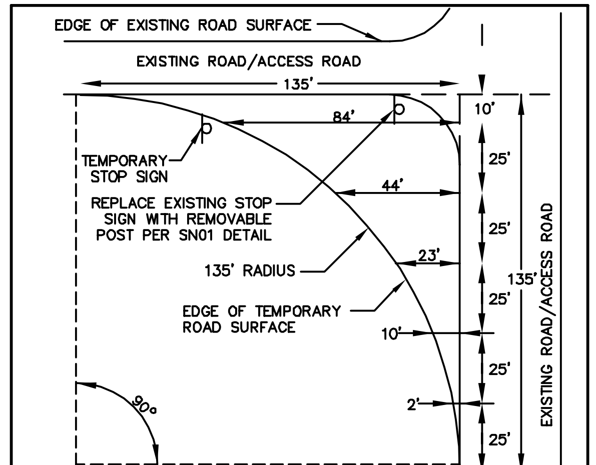
MAXIMUM DEFLECTION FOR TURBINE ACCESS ROAD — LAST REVISED: 01/02/08 — RD04



NOTE:

1. UPON DELIVERY VEHICLE COMPLETION, TEMPORARY INTERSECTION WIDENING AND TEMPORARY CULVERT TO BE REMOVED AND ALL DISTURBED AREA RESTORED TO NATIVE CONDITIONS.
2. CULVERTS AND SILT FENCE/FIBER ROLLS SHALL BE INSTALLED AND MAINTAINED AT INTERSECTIONS WHERE THE ACCESS ROAD IS CROSSING AN EXISTING COUNTY DITCH.

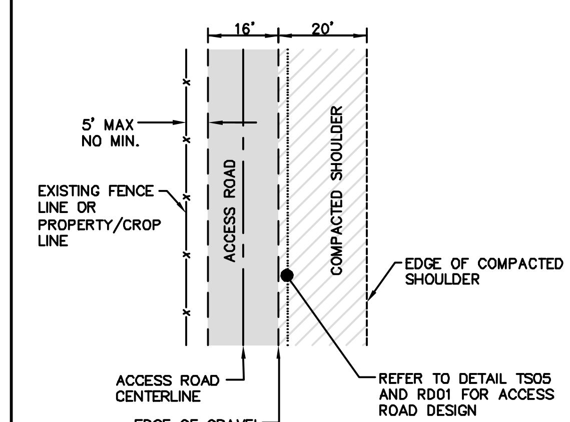
TURBINE ACCESS ROAD TYPICAL INTERSECTION WIDENING — LAST REVISED: 01/02/08 — RD05



NOTE:

1. UPON DELIVERY VEHICLE COMPLETION, TEMPORARY INTERSECTION WIDENING TO BE REMOVED AND ALL DISTURBED AREA RESTORED.

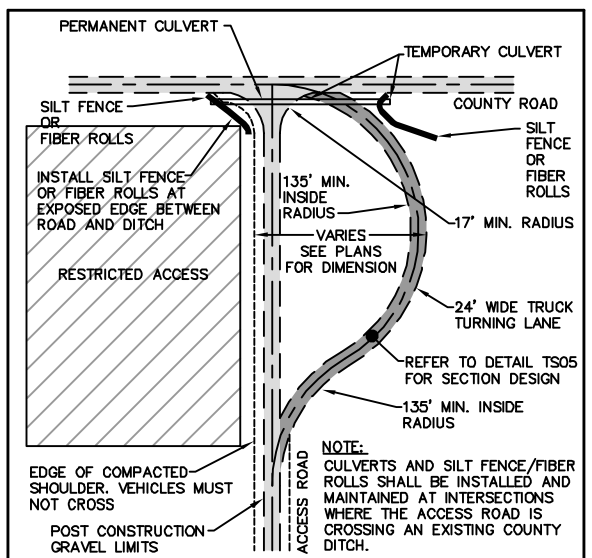
INTERSECTION WIDENING DIMENSIONS — LAST REVISED: 01/02/08 — RD06



NOTE:

1. COMPACTED SHOULDER SHALL BE RETURNED TO NATIVE CONDITION FOLLOWING TURBINE GENERATOR CONSTRUCTION.
2. THE ACCESS ROAD MAY NEED TO BE CONSTRUCTED FARTHER FROM THE PROPERTY LINE IF OBSTRUCTIONS SUCH AS TREES FOLLOW THE PROPERTY LINE.

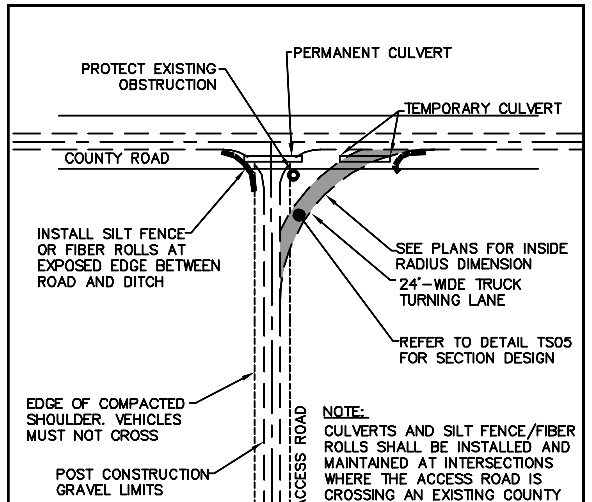
TURBINE ACCESS ROAD ALONG FENCE/PROPERTY/CROP LINE — LAST REVISED: 04/08/09 — RD07



NOTE:

CULVERTS AND SILT FENCE/FIBER ROLLS SHALL BE INSTALLED AND MAINTAINED AT INTERSECTIONS WHERE THE ACCESS ROAD IS CROSSING AN EXISTING COUNTY DITCH.

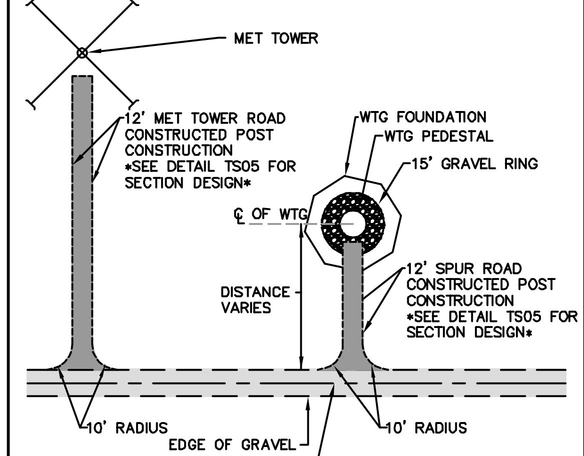
TRUCK TRAFFIC TURNING LANE A — LAST REVISED: 01/02/08 — RD08–A



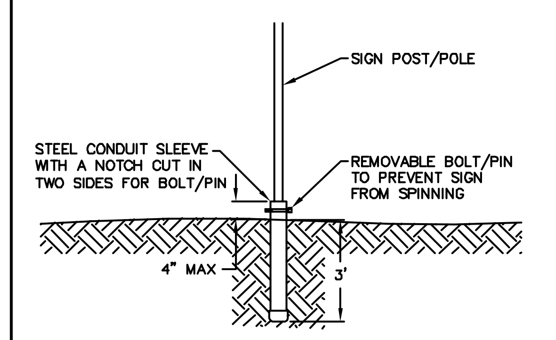
NOTE:

CULVERTS AND SILT FENCE/FIBER ROLLS SHALL BE INSTALLED AND MAINTAINED AT INTERSECTIONS WHERE THE ACCESS ROAD IS CROSSING AN EXISTING COUNTY DITCH.

TRUCK TRAFFIC TURNING LANE B — LAST REVISED: 01/02/08 — RD08–B



TYPICAL SPUR AND MET TOWER ROAD — LAST REVISED: 01/02/08 — TS06



NOTE:

1. TO BE USED AT INTERSECTIONS WHERE SIGNS ARE TO BE REMOVED FOR THE TURNING MOVEMENT OF DELIVERY TRAFFIC.
2. REMOVE SIGN UPON THE APPROACH OF DELIVERY TRAFFIC, REPLACE SIGN IMMEDIATELY FOLLOWING THE TURNING MOVEMENT OF THE DELIVERY VEHICLE.
3. UPON THE REMOVAL OF THE TEMPORARY INTERSECTION IMPROVEMENT, THE SIGN SHALL BE PERMANENTLY REINSTALLED IN ITS ORIGINAL LOCATION.

TYPICAL SIGN MOUNT — LAST REVISED: 04/13/10 — SN01

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Designed: sjs
Checked: CJC
Drawn: sjs
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Revisions: # DATE DESCRIPTION

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Date: 02/08/12
Sheet: 3 OF 8

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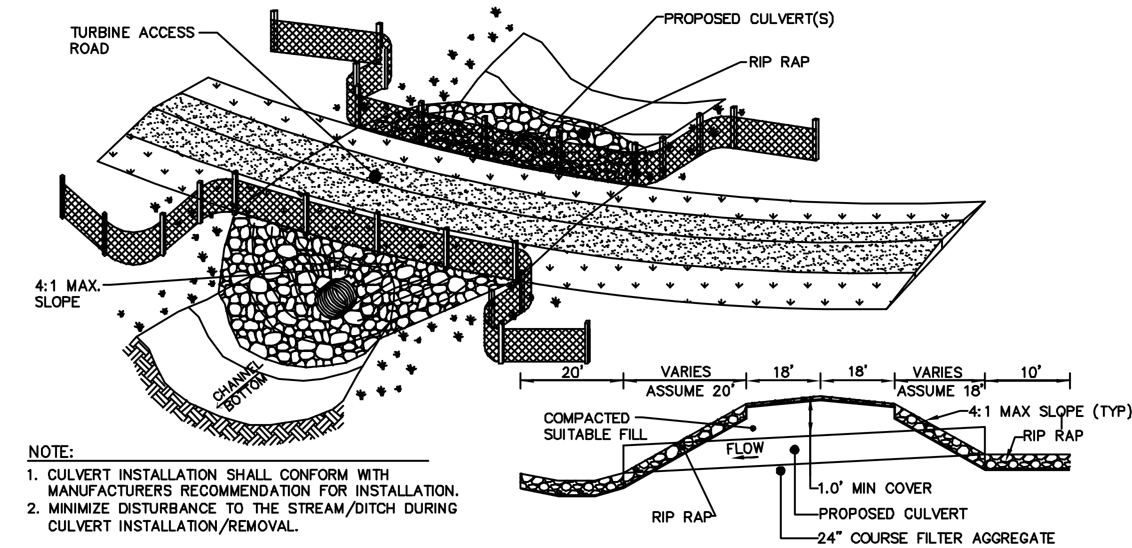
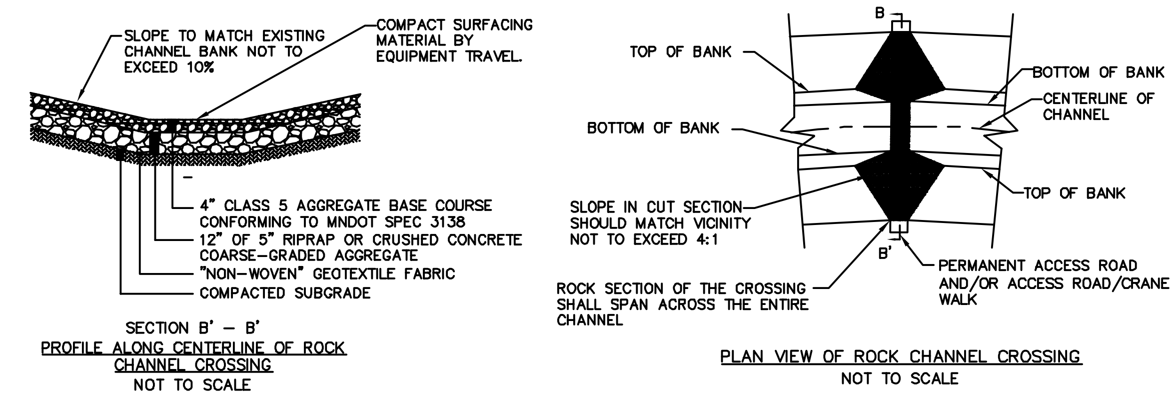


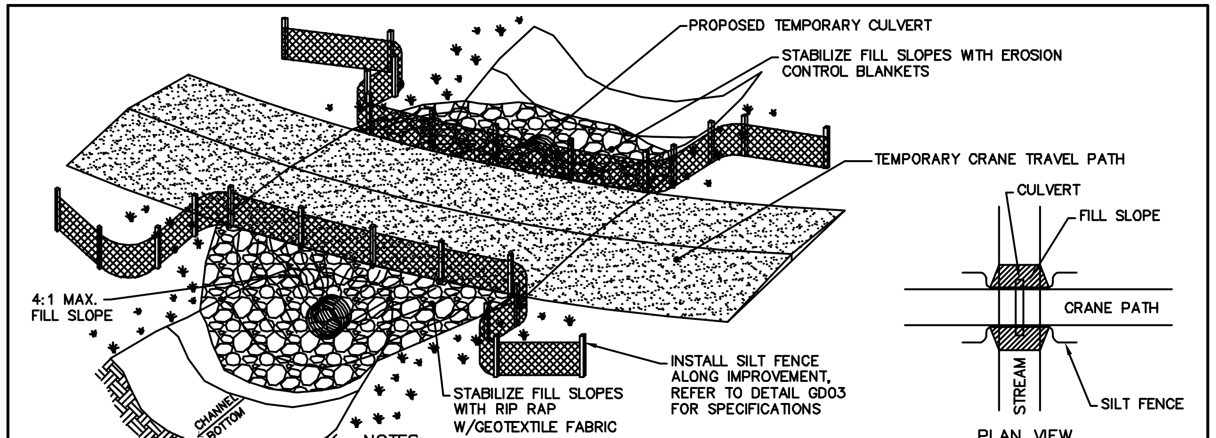
NOTE:
1. CULVERT INSTALLATION SHALL CONFORM WITH MANUFACTURERS RECOMMENDATION FOR INSTALLATION.
2. MINIMIZE DISTURBANCE TO THE STREAM/DITCH DURING CULVERT INSTALLATION/REMOVAL.

TYPICAL TURBINE ACCESS ROAD STREAM CROSSING — LAST REVISED: 04/08/09 — RD12



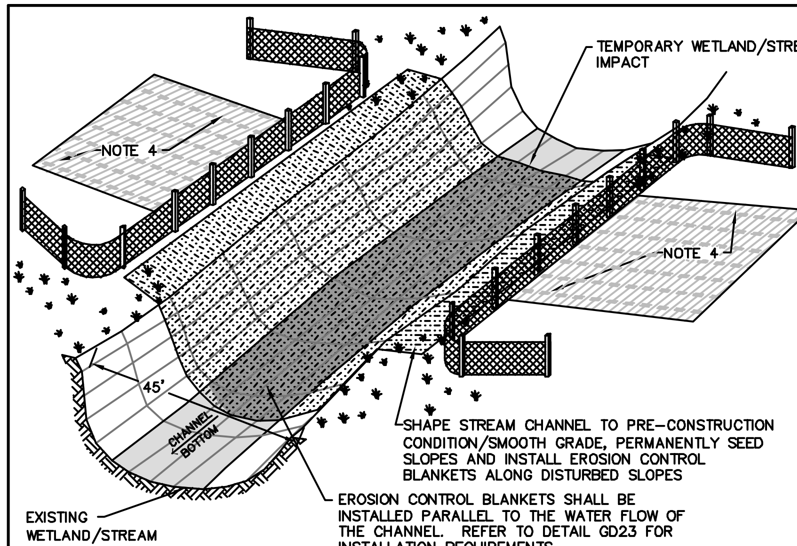
NOTE:
1. CHANNEL SLOPES TO BE MODIFIED TEMPORARILY DURING CONSTRUCTION TO ALLOW FOR ADEQUATE TURBINE COMPONENT DELIVERY AND RESTORE TO FINAL CONDITIONS UPON SITE RESTORATION.
2. CROSSINGS SHALL HAVE THE TOP-MOST SURFACE LAYER A MINIMUM OF 2.5 INCHES BELOW THE STREAM CHANNEL BOTTOM.
3. THE ACCESS ROAD SHALL CROSS THE DITCH AT 90° ANGLE.
4. THE TOP BED OF THE ROCK CHANNEL CROSSING SHALL CONFORM TO THE EXISTING DITCH CROSS SECTIONAL SLOPES.
5. MATERIAL THICKNESSES MAY BE FIELD ADJUSTED TO ACHIEVE SUFFICIENT BEARING CAPACITIES AS ARE NECESSARY FOR ANTICIPATED ROAD USE.

TYPICAL TURBINE ACCESS ROAD LOW WATER CROSSING — LAST REVISED: 04/08/09 — RD16



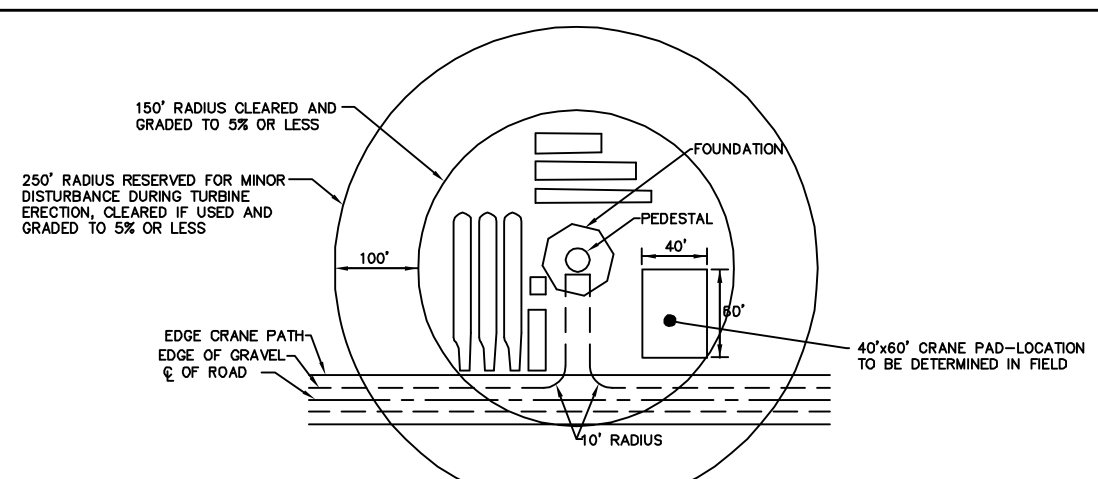
NOTES:
1. CULVERT INSTALLATION SHALL CONFORM WITH MANUFACTURERS RECOMMENDATION FOR INSTALLATION.
2. MINIMIZE DISTURBANCE TO THE STREAM/DITCH DURING CULVERT INSTALLATION/REMOVAL.
3. EROSION CONTROL BLANKETS MAY BE SUBSTITUTED FOR THE RIP RAP WITH GEOTEXTILE FABRIC.
4. UPON REMOVAL OF TEMPORARY STREAM CROSSING, THE DISTURBED AREA SHALL BE RESTORED TO NATIVE CONDITIONS. REFER TO THE PROJECT SWPPP.

TYPICAL TEMPORARY CRANE TRAVEL PATH STREAM CROSSING WITH RIP RAP — LAST REVISED: 03/22/09 — RD14-1



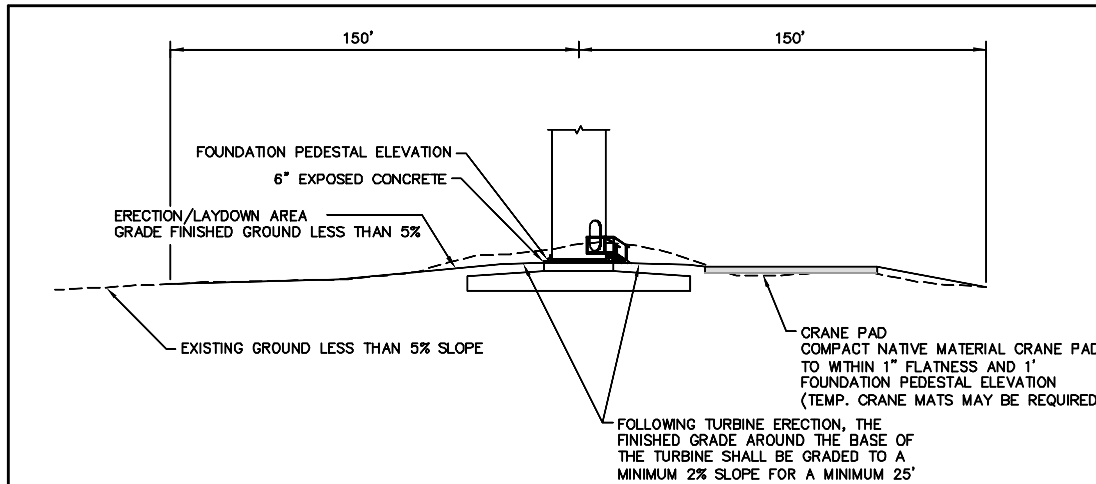
NOTES:
1. DRAWING IS NOT TO SCALE.
2. UPON REMOVAL OF TEMPORARY STREAM CROSSING, THE DISTURBED AREA SHALL BE RESTORED TO PRE-CONSTRUCTION CONDITIONS. REFER TO THE PROJECT SWPPP FOR RESTORATION AND SEEDING SPECIFICATIONS.
3. REMOVE RIP RAP, FILL MATERIAL AND SHAPE CHANNEL TO PRE-CONSTRUCTION CONDITION. PERMANENTLY SEED ALL DISTURBED SLOPES IN CONFORMANCE WITH THE PROJECT SWPPP NARRATIVE. INSTALL EROSION CONTROL BLANKETS, ADEQUATE FOR FLOW CONDITIONS, ON ALL DISTURBED SLOPES GREATER THAN 3:1, WHERE ANY FLOWS ARE CONCENTRATED AND WITHIN THE DITCHES WETTED PERIMETER.
4. DECOMPACT, REAPPLY TOPSOIL AND TILL DISTURBED AREA TO RESTORE TO PRE-CONSTRUCTION AGRICULTURAL CONDITION AND RESTORE ANY VEGETATED BUFFER THAT EXISTED PRE-CONSTRUCTION.
5. REMOVE SILT FENCE ONCE FINAL STABILIZATION HAS OCCURRED WITH A MINIMUM OF 70% VEGETATION UPSTREAM OF SILT FENCE.

TYPICAL TEMPORARY STREAM CROSSING RESTORATION — LAST REVISED: 11/16/10 — RD14-2



NOTE:
1. ACTUAL CRANE PAD LOCATION TO BE DETERMINED BY CONTRACTOR.
2. DISTANCE BETWEEN CENTER OF TURBINE AND EGDE OF GRAVEL ROAD VARIES BY TURBINE SITE

TYPICAL WTG SITE – PLAN VIEW — LAST REVISED: 04/08/09 — TS01



TYPICAL WTG SITE – PROFILE VIEW — LAST REVISED: 04/08/09 — TS03

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Checked: CJC
Drawn: SJB
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Revisions:

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Redwood County, Minnesota

Construction Details

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Date: 02/08/12
Sheet: 4 OF 8

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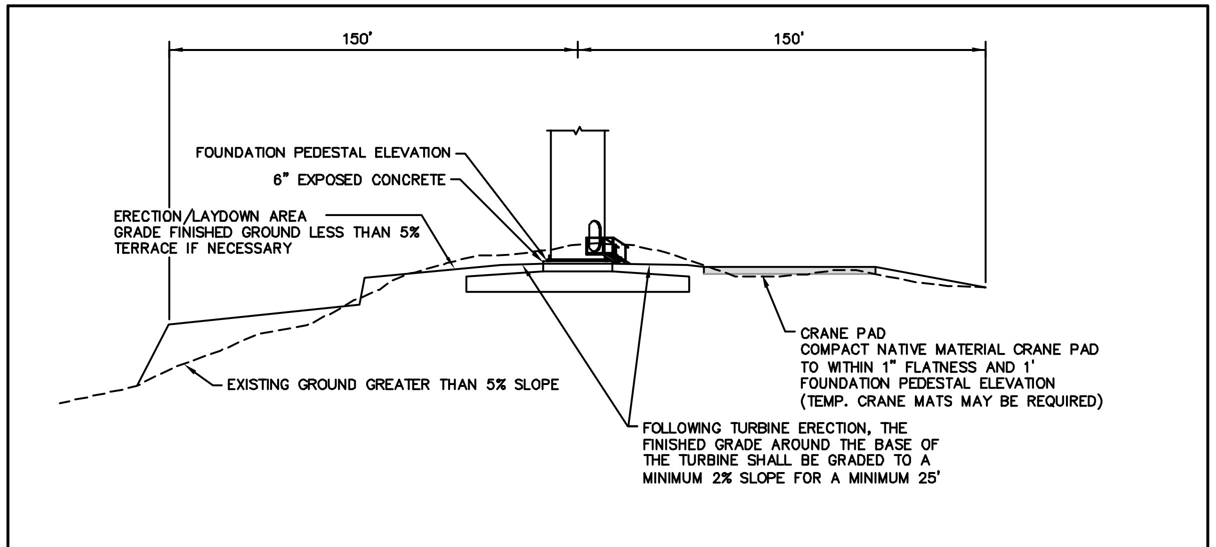
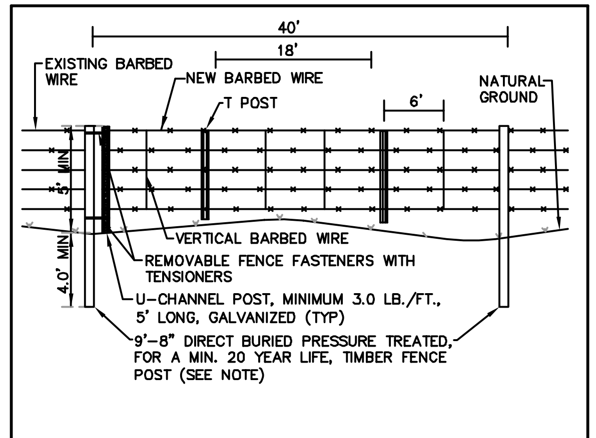


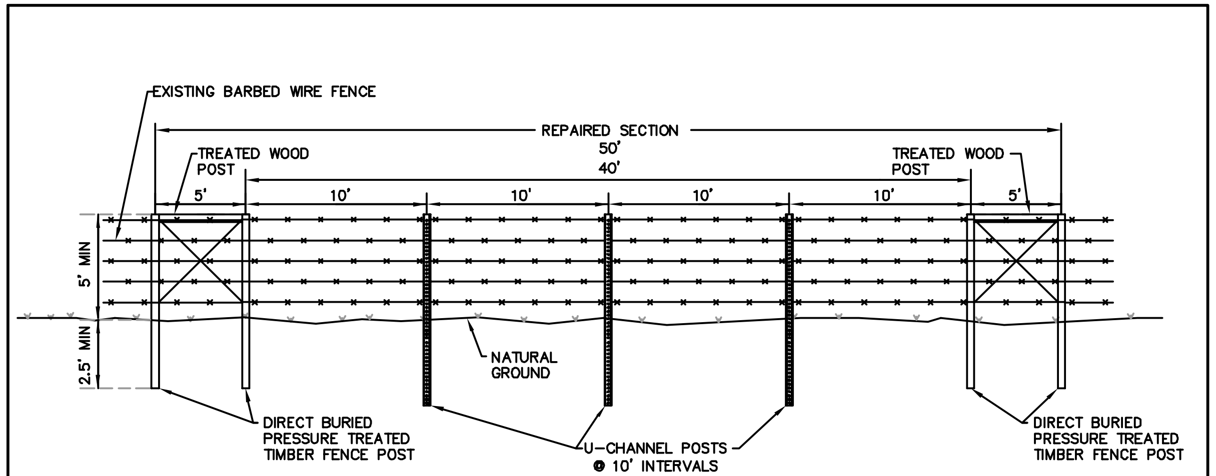
TYPICAL WTG SITE, EXISTING GROUND GREATER THAN 5% – PROFILE VIEW | LAST REVISED: 04/08/09 | TS04



NOTE:

1. TO BE USED AT UNDERGROUND POWER COLLECTION CROSSINGS
2. ALL FITTINGS, HARDWARE AND OTHER APPURTENANCES SHALL BE FABRICATED AND FITTED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS

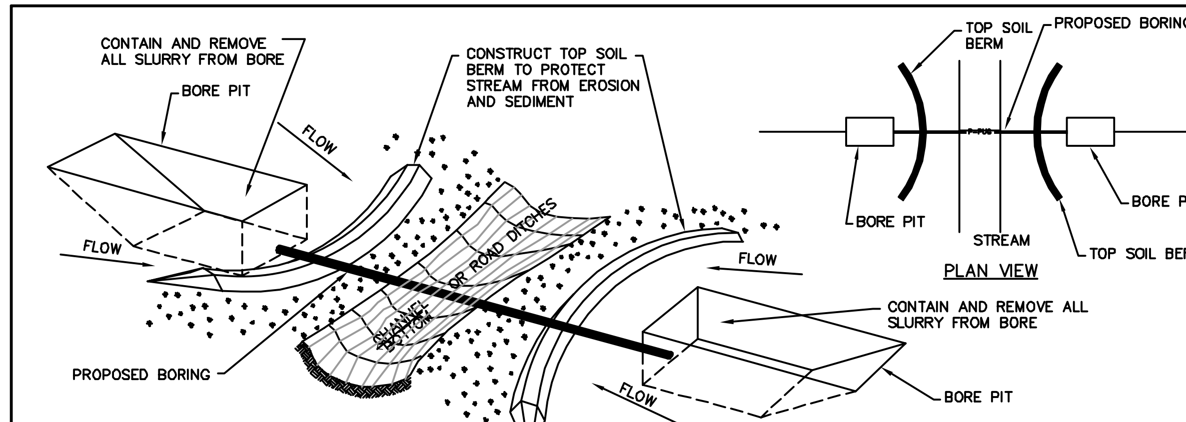
BARBWIRE GATE | LAST REVISED: 01/02/08 | FN02



NOTE:

1. WHEN FENCE IS REMOVED FOR FUTURE REPLACEMENT, H-BRACING SHALL BE CONSTRUCTED ON EACH END OF THE REPAIRED SECTION TO ALLOW REPAIR SECTION TO BE TIGHTENED

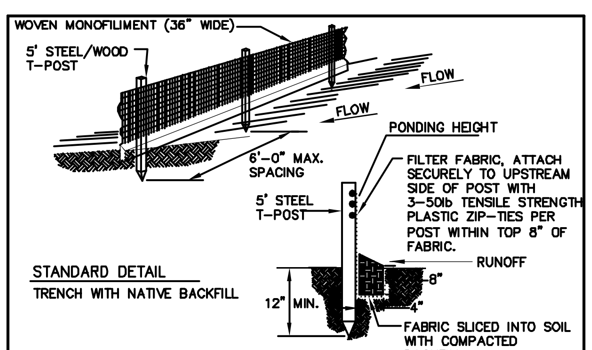
FENCE REPAIR | LAST REVISED: 04/08/09 | FN03



NOTES:

1. CONSTRUCT TOPSOIL BERM TO PROTECT EXISTING CHANNELS WHERE BORING WILL OCCUR FOR UNDERGROUND COLLECTION SYSTEM INSTALLATION.
2. MINIMIZE DISTURBANCE TO THE STREAM DURING CONSTRUCTION.
3. SILT FENCE MAY BE SUBSTITUTED FOR THE TOPSOIL BERM.
4. UPON REMOVAL OF THE BORE PITS, THE DISTURBED AREAS SHALL BE RESTORED TO NATIVE CONDITIONS. REFER TO THE PROJECT SWPPP.

TYPICAL UNDERGROUND COLLECTION SYSTEM STREAM CROSSING | LAST REVISED: 09/23/08 | UT06

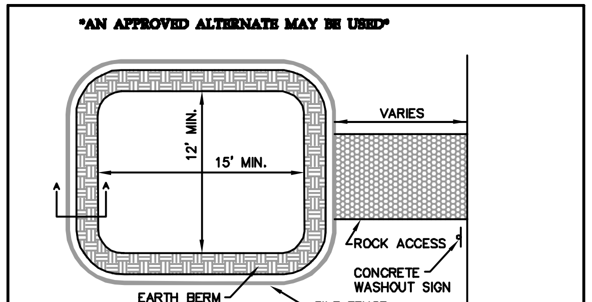


NOTE:

1. INSPECT AND REPAIR FENCE AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED TO 1/3 THE HEIGHT OF THE FABRIC OR MORE.
2. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA THAT WILL NOT CONTRIBUTE SEDIMENT OFF-SITE AND CAN BE PERMANENTLY STABILIZED.
3. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
4. ALL ENDS OF THE SILT FENCE SHALL BE WRAPPED UPSLOPE SO THE ELEVATION OF THE BOTTOM OF FABRIC IS HIGHER THAN "PONDING HEIGHT".

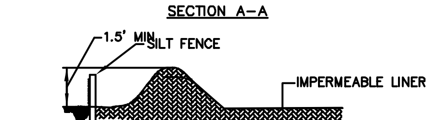
SILT FENCE | LAST REVISED: 11/24/08 | GD03

"AN APPROVED ALTERNATE MAY BE USED"

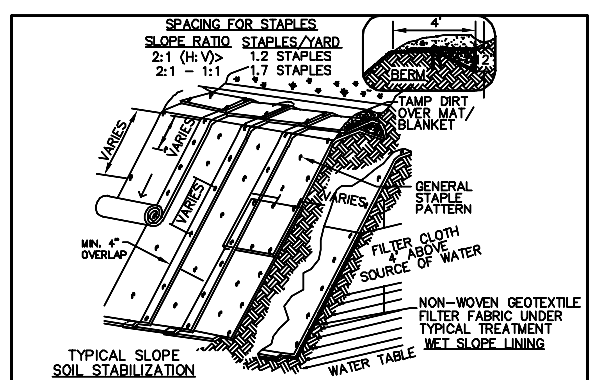


NOTE:
CONCRETE WASHOUT AREAS WILL HAVE AN IMPERMEABLE LINER TO PREVENT CONCRETE WASHOUT WATER FROM INFILTRATING/CONTACTING WITH SOIL. IMPERMEABLE LINER INCLUDES 10 MIL POLYLINER OR COMPACTED CLAY LINER. WASHOUT SYSTEMS CAN BE USED AS ALTERNATE WASHOUT AREAS.

SECTION A–A



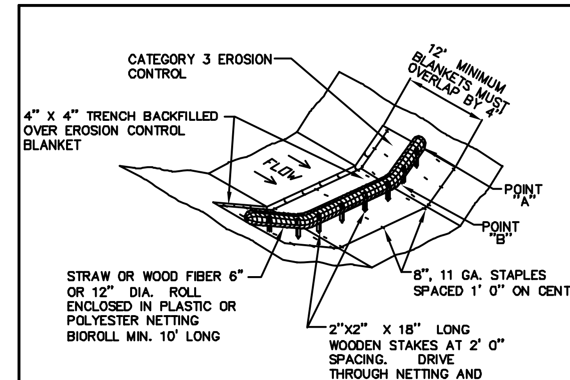
CONCRETE WASHOUT AREA | LAST REVISED: 11/24/08 | GD08



NOTE:

1. REFER TO THE PROJECT SWPPP FOR IMPLEMENTATION REQUIREMENTS.
2. MATS/BLANKETS SHOULD BE INSTALLED VERTICALLY DOWNSLOPE.
3. SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICK AND GRASS.
4. MATS/BLANKETS SHALL HAVE GOOD SOIL CONTACT.
5. LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL.
6. DO NOT STRETCH.
7. BLANKET TYPE AND WEIGHT MUST BE CHOOSEN BASED ON SITE CONDITIONS AND MANUFACTURERS RECOMMENDATIONS.
8. STAPLE LENGTHS SHALL CONFORM TO MANUFACTURERS RECOMMENDATIONS.

TEMPORARY EROSION BLANKETS TURF REINFORCEMENT MATS FOR SLOPES | LAST REVISED: 11/24/08 | GD21



NOTE:

1. REFER TO THE PROJECT SWPPP FOR IMPLEMENTATION REQUIREMENTS.
2. POINT "A" MUST BE HIGHER THAN POINT "B" TO ENSURE THAT WATER FLOWS OVER THE DIKE AND NOT AROUND THE ENDS.
3. TYPE OF MATERIAL FOR EROSION CONTROL BLANKET IS SUBJECT TO FIELD CONDITIONS AND MANUFACTURERS RECOMMENDATION.

TEMPORARY BIOROLL BLANKET SYSTEM (DITCH APPLICATION) | LAST REVISED: 03/03/08 | GD23

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Designed: sjs
Checked: cjc
Drawn: sjs
Record Drawing by/date:
Revisions: # DATE DESCRIPTION

Prepared for:

Lower Sioux Wind Project

Redwood County, Minnesota

Construction Details

30% COMPLETION
NOT FOR CONSTRUCTION

Date: 02/08/12
Sheet: 5 OF 8

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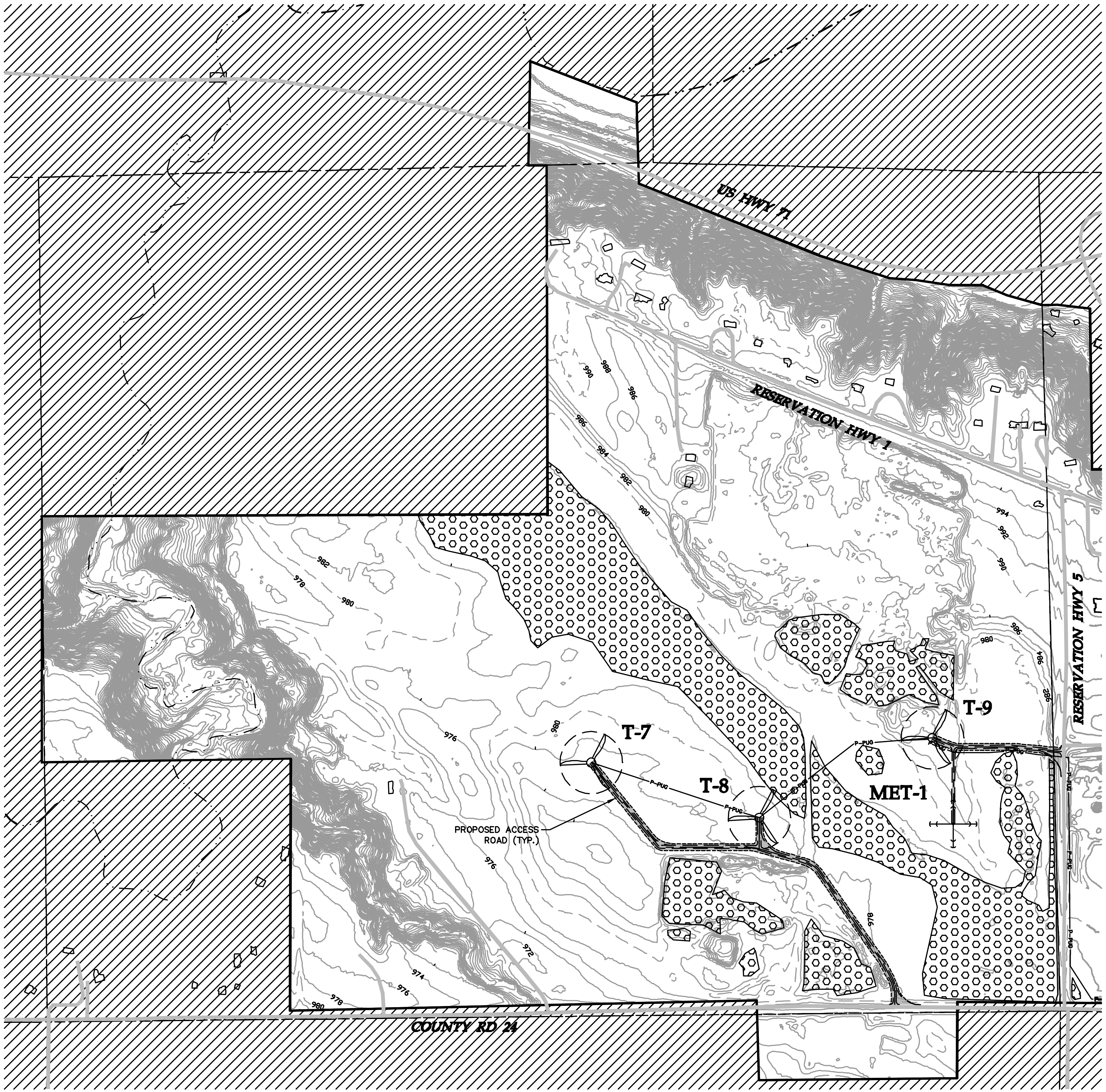
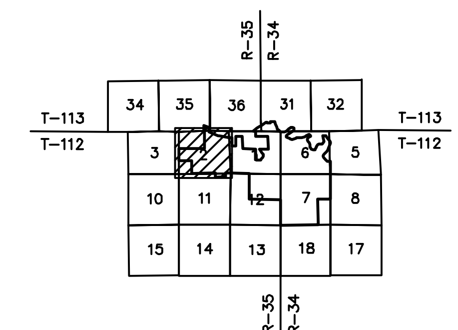


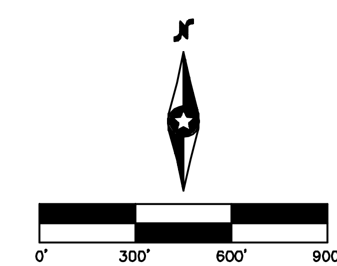
LEGEND:

- PROPOSED TURBINE LOCATION
- XX PROPOSED TURBINE NUMBER
- PROPOSED MET TOWER LOCATION
- PROPOSED ACCESS ROADS
- PROPOSED CRANE PATH
- P-PUG PROPOSED UNDERGROUND ELECTRIC*
- EXISTING ROAD
- X EXISTING FENCE
- POH EXISTING OVERHEAD POWER
- GAS EXISTING GAS PIPELINE
- 980 EXISTING 10' CONTOURS
- EXISTING 2' CONTOURS
- EXISTING WATERWAY
- OUTSIDE OF PROJECT BOUNDARY
- FIELD DELINEATED WETLAND
- CRP LAND

* UNDERGROUND COLLECTION LINE IS CONCEPTUAL ONLY, SEE ELECTRICAL CONSULTANT PLANS FOR FINAL ROUTING AND DETAILS.



KEY MAP



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Prepared for:

Lower Sioux Wind Project

Redwood County, Minnesota

Civil Plan Set T-7 T-8 T-9 Met-1

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Date: 02/08/12
Sheet: 6 OF 8

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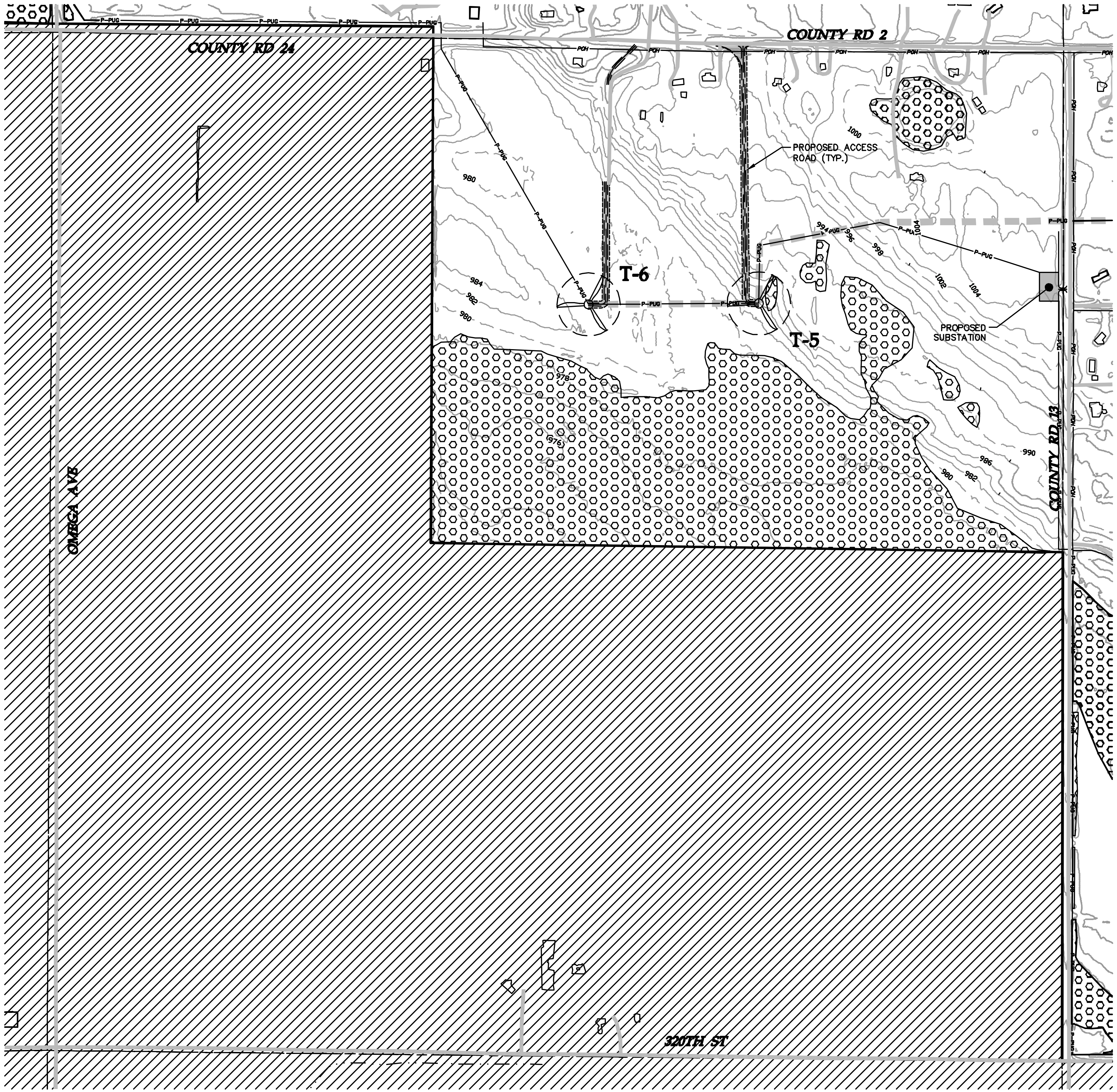

SEE SHEET 8

LEGEND:

- PROPOSED TURBINE LOCATION
- XX — PROPOSED TURBINE NUMBER
- PROPOSED MET TOWER LOCATION
- PROPOSED ACCESS ROADS
- PROPOSED CRANE PATH
- P-PUG — PROPOSED UNDERGROUND ELECTRIC*
- EXISTING ROAD
- X — EXISTING FENCE
- POH — EXISTING OVERHEAD POWER
- GAS — EXISTING GAS PIPELINE
- 980 — EXISTING 10' CONTOURS
- EXISTING 2' CONTOURS
- EXISTING WATERWAY
- OUTSIDE OF PROJECT BOUNDARY
- FIELD DELINEATED WETLAND
- CRP LAND

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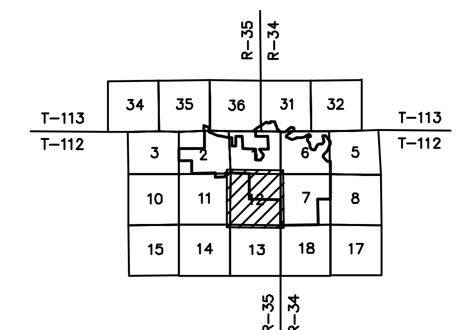

KEY MAP

Westwood

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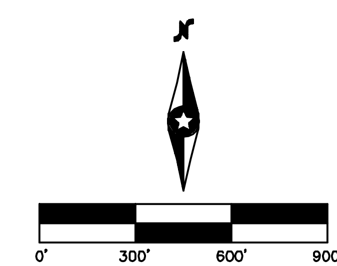

Lower Sioux Wind Project

Redwood County, Minnesota

Civil Plan Set T-5 T-6

30% COMPLETION
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Date: 02/08/12
Sheet: 7 OF 8

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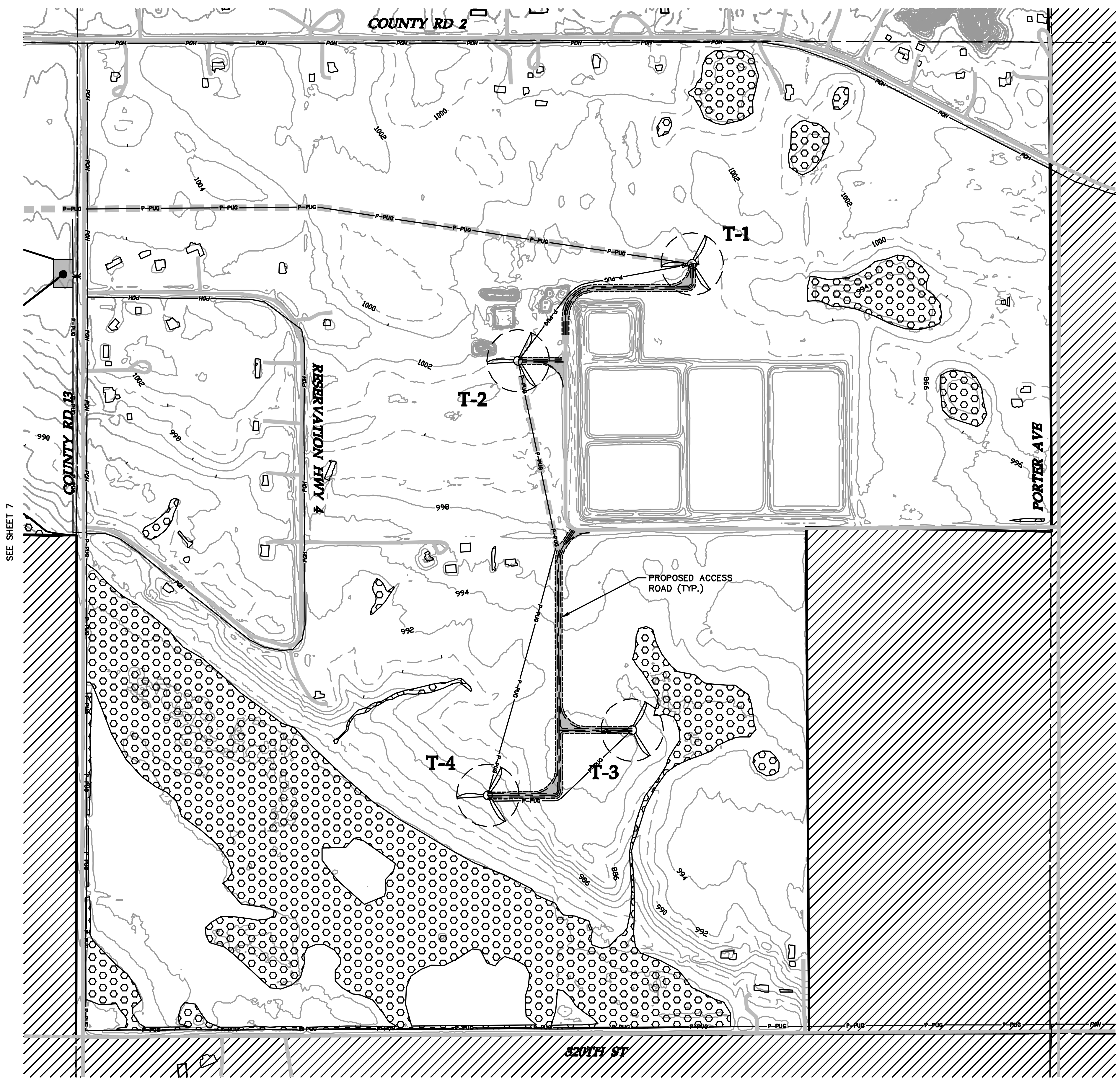

LEGEND:

- PROPOSED TURBINE LOCATION
- XX — PROPOSED TURBINE NUMBER
- PROPOSED MET TOWER LOCATION
- PROPOSED ACCESS ROADS
- PROPOSED CRANE PATH
- P-PUG — PROPOSED UNDERGROUND ELECTRIC*
- EXISTING ROAD
- X — EXISTING FENCE
- POH — EXISTING OVERHEAD POWER
- GAS — EXISTING GAS PIPELINE
- 980 — EXISTING 10' CONTOURS
- EXISTING 2' CONTOURS
- EXISTING WATERWAY
- OUTSIDE OF PROJECT BOUNDARY
- FIELD DELINEATED WETLAND
- CRP LAND

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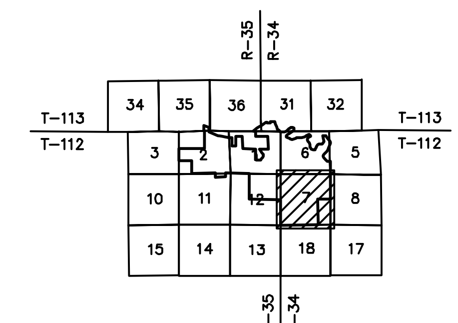

KEY MAP

0' 300' 600' 900'

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Lower Sioux Wind Project

Redwood County, Minnesota

Civil Plan Set T-1 T-2 T-3 T-4

30% COMPLETION
NOT FOR CONSTRUCTION

Date: 02/08/12
Sheet: 8 OF 8

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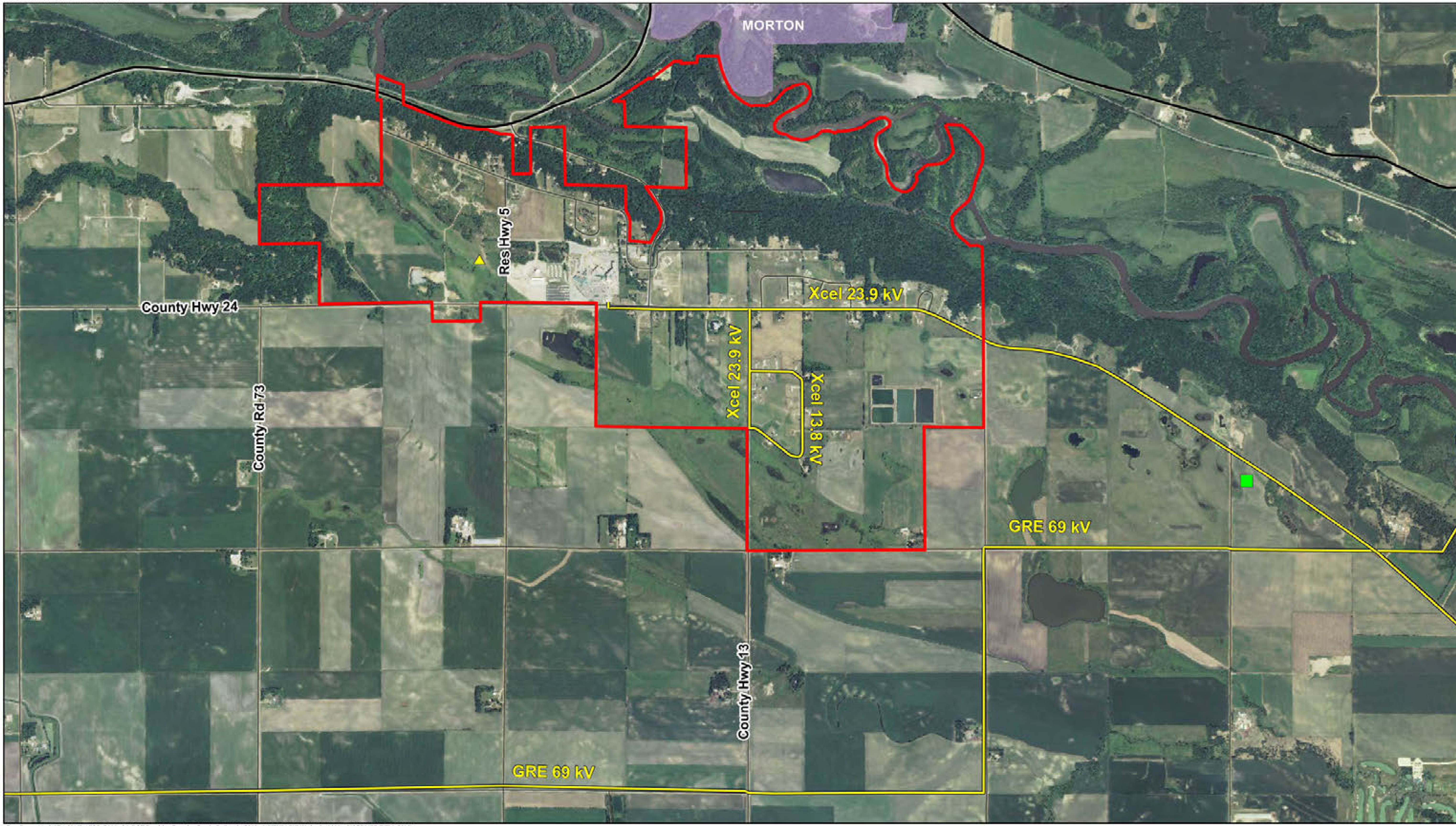

Data Source(s): USDA NAIP AFPO (2008); MnDOT BaseMap Counties, Roads, Railroads (2008); USFWS NWI Wetlands (1991); USGS NED DEM (2010); FEMA Q3 Floodways (1996); USGS/EPA NHD Rivers and Waterbodies (2010); MN DNR PWI (2008); and Westwood (2009).

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N

0 2,000 Feet

Legend

- Lower Sioux Boundary
- Existing Meteorological Tower
- Municipality
- Major Road
- Transmission Line
- Capacitor Bank

Dakota Futures and the Lower Sioux Indian Community

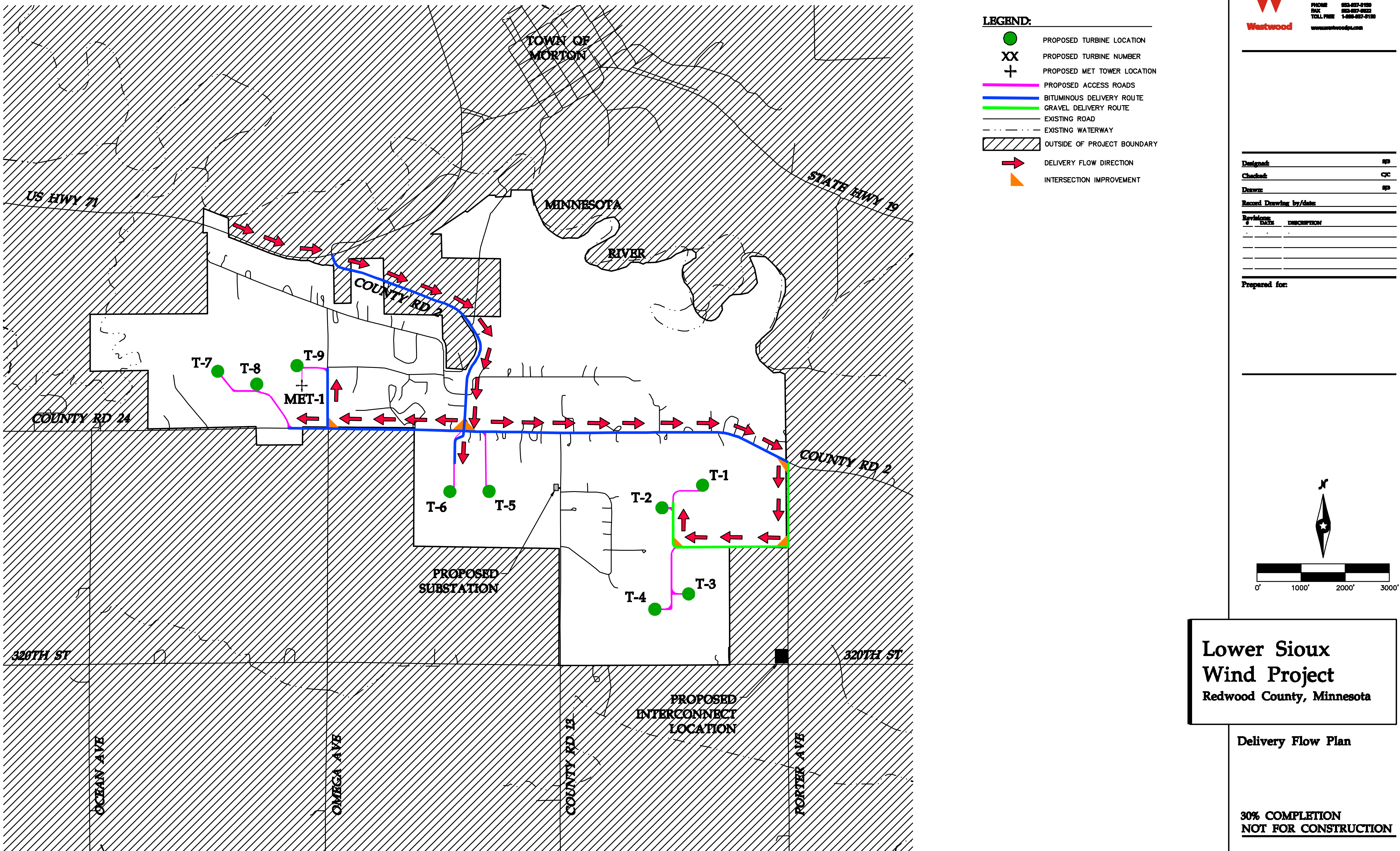
Redwood County, Minnesota

Surrounding Infrastructure

EXHIBIT 1 (Transmission Only)

5/25/2011 11:08:26 AM

DELIVERY ROUTING PLAN



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Lower Sioux Wind Project

Redwood County, Minnesota

Delivery Flow Plan

30% COMPLETION
NOT FOR CONSTRUCTION

Date: 2/8/12
Sheet: 1 OF 1

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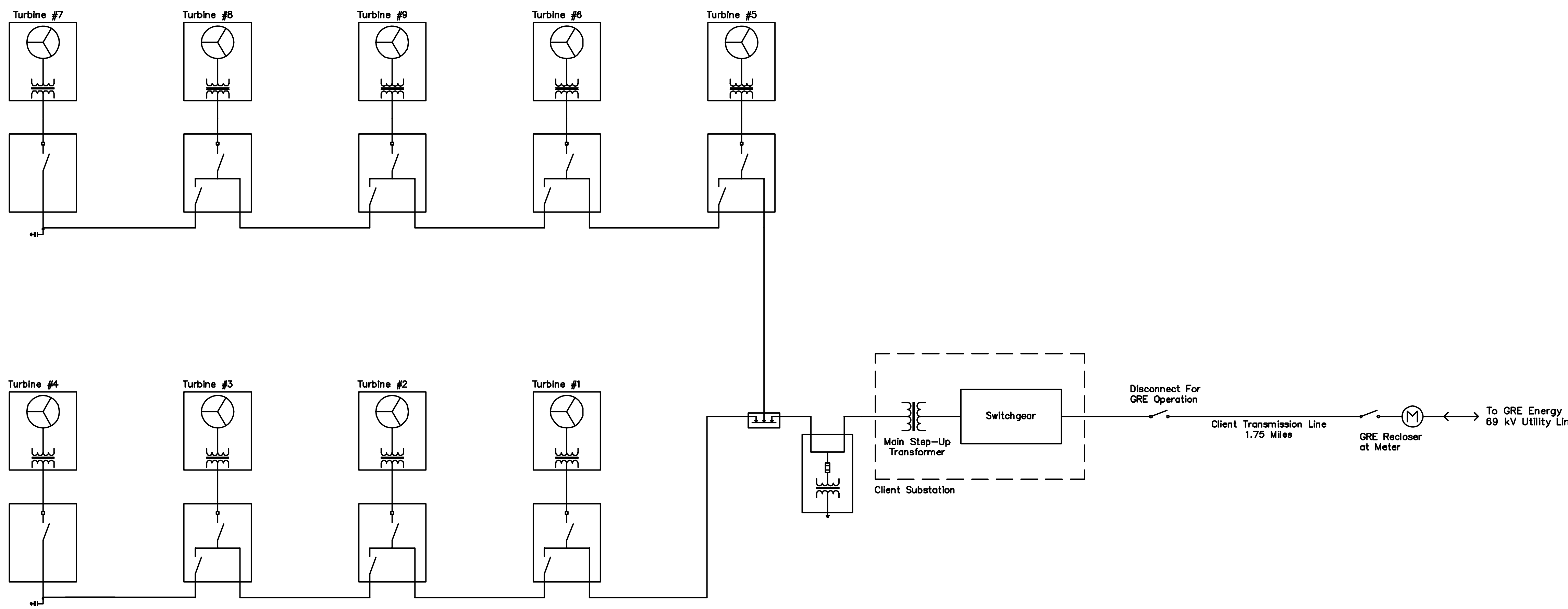
ELECTRICAL ONE-LINE DIAGRAM

OVERALL ONE-LINE DIAGRAM



NOTES

1. (9) GE 1.6 kW SERIES WIND TURBINE
2. TOTAL SYSTEM CAPACITY: 14.4 kW
3. ALL ELECTRICAL WORK SHALL BE IN ACCORDANCE WITH CURRENT EDITION OF NATIONAL ELECTRIC CODE APPROVED BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ) ALL APPLICABLE LOCAL, STATE, AND NATIONAL CODES AND REGULATIONS.
4. THE NATIONAL ELECTRIC CODE SHALL BE THE GOVERNING DOCUMENT ON THE CUSTOMER'S SIDE OF THE UTILITY METER.
5. ALL EQUIPMENT WHERE APPLICABLE SHALL BE LISTED AND LABELED PER RECOGNIZED ELECTRICAL TESTING LABORATORY AND INSTALLED PER THE LISTING REQUIREMENTS AND THE MANUFACTURER'S INSTRUCTIONS.
6. WIND TURBINES SHALL BE INTERCONNECTED WITH GRE SUBSTATION, PER GRE SPECIFICATIONS.

LEGEND

- WIND TURBINE GENERATOR
- EXTERNAL END OF CIRCUIT SWITCHGEAR
- EXTERNAL INLINE CIRCUIT SWITCHGEAR
- GROUNDING TRANSFORMER
- JUNCTION BOX, 3 WAY
- SURGE ARRESTOR

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Lower Sioux Wind Project

Redwood County, Minnesota

One-Line Diagram

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Date: 02/08/12
Sheet: 1 OF 1

20101210LINE01.dwg

BILL OF ESTIMATED QUANTITIES

BILL OF ESTIMATED QUANTITIES

BASE BID FORM

Below is the base bid form to be used for guidance in preparation of the complete BOP Construction Cost Estimate. It is the intent of this RFQ to encompass all costs associated with the BOP construction of the project. If discrepancies or omissions are identified, contractor shall notify in writing to the owner and request clarifications. Contractor is required to submit their proposal on this form to provide the final estimate. It is the contractors' responsibility to examine the RFQ document, plans, reports, and specifications provided, verify the quantities, familiarize themselves with the site, and use their previous project experience and knowledge to ensure a complete and accurate estimate.

Task, Item, and Description		Unit	Estimated Qty	Unit Price	Total Price
Task 1.0 Pre-Construction					
Item 1.1	Geotechnical Investigation Determine scope details, design, conduct investigation(s), assess and perform associated QA/QC activities as necessary to properly construct the project in accordance with the contact documents.	LS	1		
Item 1.2	Structural Engineering Determine scope details, provide foundation design based on final geotechnical investigation, submit to owner for 3rd party review, complete design as necessary to properly construct the project in accordance with the contact documents.	LS	1		
Item 1.3	Electrical Engineering Determine scope details, provide full design and construction documents including but not limited to the underground electrical collection system, substation, overhead transmission, and interconnection/switchyard design. Submit to owner for 3rd party review, complete design as necessary to properly construct the project in accordance with the contact documents.	LS	1		
Item 1.4	Civil Engineering Determine scope details, provide full design and construction documents including but not limited to access roads, crane paths, temporary intersections, and stormwater design. Submit to owner for 3rd party review, complete design as necessary to properly construct the project in accordance with the contract documents.	LS	1		
Item 1.5	Project Management Provide and lead a project management team. Present on-site at all times during the construction of the project. The Project Manager and the project management team will be responsible for the following: • Execution Plan • Quality Assurance / Quality Control Project Plan • Environmental Management Plan • Health and Safety Plan • Traffic Management Plan • Security Plan • Document Control Register	LS	1		
	Task 1.0 Total:				
Task 2.0 Site Access and Preparation					
Item 2.1	Construction Staking/Surveying Determine scope details and provide construction staking and survey(s) necessary to properly construct the project including but not limited to all civil, foundations, and electrical infrastructure improvements, in accordance with the contact documents.	LS	1		

Task, Item, and Description		Unit	Qty	Price	Price
Item 2.2	Temporary Erosion & Sediment Transport Control Procure, install, and maintain for the duration of the Work in accordance with the contract documents	LS	1		
Item 2.3	Temporary Fencing & Gates Procure, install, and maintain temporary fencing, gates, and signage associated with temporary facilities, environmentally /culturally sensitive areas, or construction area security operations for the duration of Work in accordance with the contract documents.	LS	1		
Item 2.4	Trimming, Clearing & Grubbing Trim, Clear, and grub only those areas necessary to support the Work in accordance with the contract documents. This item also includes proper disposal of all wastes (vegetative / debris) generated during this activity in accordance with all applicable rules and regulations.	LS	1		
Item 2.5	Temporary Operation and Logistics Facilities Stripping and stockpiling of topsoil for future restoration activities, provide, install, and maintain all temporary facilities (field offices, lavatories, equipment/material staging areas, construction parking, garbage service, etc...) and associated temporary utilities (electric, water, sanitary, data, telephone, etc.) necessary to complete the Work in accordance with the contract documents.	LS	1		
Item 2.6	Permanent Fencing & Gates Procure, install, and maintain permanent fencing and gates associated with landowner agreements and permanent site structures security for the duration of Work in accordance with the contract documents.	LS	1		
Item 2.7	On-site Quarry Operation/Temporary Concrete Batchplant Stripping and stockpiling of topsoil for future restoration activities, plan, design, obtain all federal, state and local permits, construct and operate a quarry and temporary concrete batch plant.	LS	1		
Item 2.8	Bridge, Culvert, and Utility Protection Procure materials, reinforce per design, pour concrete and finish. Item scope includes any necessary gravel ramping on the leading and trailing roadway approach.	LS	1		
Item 2.9	Public Road Surfacing and Widening Improvements Alteration of existing public roads as necessary, manage soils, provide associated QA/QC, and maintain throughout the duration of Work all public roads used for project vehicular traffic and associated drainage systems in accordance with the contract documents and public road agreements.	LS	1		
Item 2.10	Public Road Intersection Widening and Bypasses Stripping and stockpiling of topsoil for future restoration activities, construct, manage soils, provide associated QA/QC, and maintain throughout the duration of Work all temporary county road intersections used for project vehicular traffic and associated drainage systems in accordance with the contract documents. Item scope includes relocation of fencing in addition to procurement and installation of temporary culverts.	EA	6		
Item 2.11	Existing Road Inventory Pre-construction and post-construction analysis of all roads utilized as part of the project, may include: roadway surface condition inventory and video, thickness testing, and subgrade stability testing.	LS	1		
Item 2.12	Traffic Control Coordinate bi-directional trucking of Delivery vehicles along county and interior roads between site and highways as shown in the Delivery Flow Plan.	LS	1		

Task, Item, and Description		Unit	Qty	Price	Price
Item 2.13	Security Provide project security on a 24/7 basis throughout the duration of the project to include 1 roving security guard with vehicle.	LS	1		
	Task 2.0 Total:				
Task 3.0 Access Road and Crane Path Construction					
Item 3.1	Access Road Construction Stripping and stockpiling of topsoil for future restoration activities, manage soils, construct access roads per contract documents, construct temporary crane shoulders, provide associated QA/QC, survey as-built location, and maintain throughout the duration of Work access roads between wind turbine locations and onsite supporting facility locations, access road entrances, turn radius improvements, and associated drainage systems in accordance with the contract documents.	LF	9,500		
Item 3.4	Existing Utility Crossings Coordinate with Owner, procure materials, construct, provide associated QA/QC, and provide as-built drawings and location data in accordance with the contract documents.	LS	1		
Item 3.5	Culvert Installation Procure materials, design, construct, provide associated QA/QC, and provide as-built drawings and location data in accordance with the contract documents.	LS	1		
	Task 3.0 Total:				
Task 4.0 WTG Foundations					
Item 4.1	Foundation Excavation Excavation/removal of native (undisturbed) soils. Item scope includes excavating, loading, hauling, and depositing/respreading of material and compaction as required. Stockpiling is not permitted without prior consent of Owner.	EA	9		
Item 4.2	Reinforced Concrete Foundations Procure, place, and finish.	EA	9		
Item 4.3	Anchor Bolts & Template Rings Procure and install. Quantity based on a per-turbine basis	EA	9		
Item 4.4	Earthen Crane Pads Manage soils and construct pads as required to complete the Work in accordance with the contract documents.	EA	9		
Item 4.5	Temporary Component Erection Areas Manage soils and construct all erection areas as required to complete the Work in accordance with the contract documents.	EA	9		
Item 4.6	QA/QC Include QA/QC pricing associated with Work Task 4 items only (i.e. concrete strength testing, compaction testing, curing tests, field tests, laboratory tests and certification, submittals, etc.) in accordance with the contract documents.	LS	1		
	Task 4.0 Total:				

Task, Item, and Description	Unit	Qty	Price	Price
Task 5.0 Power Collection System (Underground)				
Item 5.1 Underground Power Collection System	LS	1		
a) Pad-mount Transformer Procure and install 69 kV-34.5 kV step-up transformer at each turbine location. Includes pad preparation and connections.				
b) 1/0 AWG Aluminum 1/C conductor 35 Kv, TRXLPE, 100% Insulated, 1/3 Concentric Neutral Cable Procure and Install. Item scope includes any necessary surge arrestors, connectors, splice and/or termination kits, and junction boxes.				
c) 4/0 AWG Aluminum 1/C conductor 35 kV, TRXLPE, 100% Insulated, 1/3 Concentric Neutral Cable Procure and Install. Item scope includes any necessary surge arrestors, connectors, splice and/or termination kits, and junction boxes.				
d) 350 MCM Aluminum 1/C conductor 35 kV, TRXLPE, 100% Insulated, 1/6 Concentric Neutral Cable Procure and Install. Item scope includes any necessary surge arrestors, connectors, splice and/or termination kits, and junction boxes.				
e) Fiber Optic cable, 12 fiber, single mode, loose tube, jacketed, suitable for direct burial. Procure. Item scope includes splicing materials, termination kits, junction panels and signage.				
f) 1000 MCM Aluminum 1/C conductor 35 kV, TRXLPE, 100% Insulated, 1/6 Concentric Neutral Cable Procure and Install. Item scope includes any necessary surge arrestors, connectors, splice and/or termination kits, and junction boxes.				
g) 4/0 Bare 1/C copper Ground Wire Procure and Install. Item scope includes any necessary surge arrestors, connectors, splice and/or termination kits, and junction boxes.				
h) 35 kV 600A Rated Junction Box and 35 kV Terminations Procure and Install. Item scope includes any necessary surge arrestors, connectors, splice and/or termination kits, and junction boxes.				
i) Wetland / Intermittent Stream Crossings Coordinate with Owner, procure materials, construct, provide associated QA/QC, and provide as-built drawings and location data in accordance with the contract documents.				
Task 5.0 Total:				
Task 6.0 SCADA				
Item 6.1 SCADA Install, integrate, test and commission all fiber optic material and associated components of the SCADA system in accordance with the contract documents.	LS	1		
Task 6.0 Total:				
Task 7.0 Wind Turbine Generator Erection The Owner may choose to utilize the manufacturer to provide WTG erection and completion and eliminate this scope of work from the Contractor's bid.				
Item 7.1 Receiving Coordinate delivery, inspect, accept, unload, and cleaning / touch up paint in accordance with the contract documents.	LS	1		

Task, Item, and Description		Unit	Qty	Price	Price
Item 7.2	Erection	EA	9		
	Erect, wire, and commission in accordance with the contract documents. Note wiring includes low voltage wiring up to and including connection with pad mount transformers. Item scope includes up to and including mechanical completion in addition to punch list item completion.				
Item 7.3	Climb-assist	EA	9		
	Procure, install, and maintain for the duration of Work, "Climb-Assist" (www.tower-logistics.com) or equivalent Owner approved product for each Wind Turbine in accordance with the contract documents.				
Item 7.4	Conduit & Grounding	EA	9		
	Procure and install conduit and grounding associated with each WTG foundation in accordance with the contract documents.				
	Task 7.0 Total:				

Task 8.0 Collection Substation

Contractor to provide pricing to include supply and install step-up power transformers and equipment at the collector substation for connection to Xcel Energy's system for the project. The Owner may choose to supply these items and eliminate these items from the Contractor's scope of work.

		Unit	Qty	Price	Price
Item 8.1	Substation Site	LS	1		
	Preparation of subgrade, aggregate base, procure materials, Construction, and finish. Installation shall include any associated foundations, trenching, and fencing in addition to electrical testing and commissioning.				
Item 8.2	Control Building	LS	1		
	Supply and construction of control building including battery room, WTG SCADA room, P&C room, cable entrance from switchyard, cable tray system, HVAC system, lighting, fire and security systems.				

Task, Item, and Description	Unit	Qty	Price	Price
Item 8.3 Structures, Equipment, SCADA, Communication and Protection Control	LS	1		
a) Structures Supply and construction of structures and buswork including 69 kV bus and structures, 34.5 kV bus and structures including future considerations, takeoff structures for 1-69 kV line, lightning protection, lighting, 34.5 kV pothead structures for incoming feeders.				
b) Equipment Supply, Install and connect (but not limited to): 34.5 kV-69 kV, 75/100/125 MVA power transformer 69 kV Circuit Breaker 69 kV CCVT 144 kV Surge Arrestor 69 kV 3-phase group operated switch with motor operator 34.5 kV Circuit Breaker 34.5 kV Potential Transformer 34.5 kV 3 phase group operated disconnect switch 34.5 kV Ring Pull Disconnect Switch 19.9kV - 120/240 V 1 phase, 50 KVA Station Service Transformer Fused cutouts for PTS and SSTs 22kv Surge Arrestor				
c) SCADA, Communication and Protection and Control Supply, Install and connect (but not limited to): Line Protection Backup Line Protection Power Transformer Protection Bus Protection Transformer Overcurrent Protection Transformer Lockout Feeder Protection Transient Fault Recorder Metering and Annunciation Panel Boards (Quality TBD) Inter Panel Wiring and Equipment Cabling Collection Substation SCADA, Controller, HMI Fiber Optic Termination Panels Other				
Item 8.4 Testing and commissioning all Collector Substation equipment Miscellaneous allowance for connections and testing with Transmission Owner network	LS	1		
Task 8.0 Total:				
Task 9.0 Restoration & Project Closeout				
Item 9.1 Restoration Restoration activities and materials necessary to restore all disturbed areas on- and off-site. Item scope also includes decompacting of crane shoulders and crane paths in addition to respread of any topsoil stockpiles.	LS	1		
Item 9.2 Close-out Documentation Preparation, submittal to Owner for review and comment, revise as required, and final submittal to Owner.	LS	1		
Task 9.0 Total:				

PROJECT TOTAL (Tasks 1-10 Inclusive): ____________________

INTERCONNECT STUDY

the power to help you succeed.

A Professional Study for
Westwood Professional Services

Redwood County, MN Screening Study Near Morton, MN

October 4, 2011

Contact: Jeffrey Norman, P.E.
10710 Town Square Drive NE, Suite 201
Blaine, MN 55449
Direct: 763-783-5352
Fax: 763-755-7028
Email: PorterR@powersystem.org
Web Site: www.powersystem.org

Power System Engineering, Inc.

Madison, WI · Minneapolis, MN · Marietta, OH · Indianapolis, IN · Sioux Falls, SD

Table of Contents

1.0 Certification

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the Laws of the State of Minnesota.

Jeffrey Richard Norman
Registration Number 44951

2.0 Background

The technical analysis summarized in this Report was performed at the request of Westwood Professional Services to identify the potential Point(s) of Interconnection ("POI's"), determine the outlet capacity, and identify the local transmission system limiters which would be likely be encountered for a proposed 14 MW wind generation project in Redwood County near Morton, MN.

This Report summarizes the results of the outlet capacity screening "TLTG" analysis performed to identify the thermal (line or transformer loading) limiters sequentially encountered as the generation at the site of interest was incremented from 0 to 100 MW. No voltage adequacy, voltage stability, or dynamic stability simulation was included within the scope of this study. The analysis was performed starting with the 2016 Summer Off-Peak (70% of peak) MRO model. Up to 100 MW of power was injected at the site of interest in 5 MW increments, and the limiting facilities encountered were noted for each level of generation. In this analysis, the incremental generation output was simulated as displacing existing generation.

The study is an "out of queue order" study which includes only existing or "under construction" generation projects; it does not include any other prior-queued generation or any associated Network Upgrades. Study assumptions have been based on PSE's knowledge of the electric power system and Client's study specifications. The accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to other generation additions and transmission improvements being contemplated by other entities. A change in the assumptions of the timing of other generation additions or transmission improvements will affect the accuracy of this study's conclusions. Thus a future MISO System Impact Study ("SIS") may yield different results if it utilizes different assumptions.

The final phase of the analysis was to identify the projects in the MISO queue that could impact the facilities this project would utilize for generation outlet.

3.0 Analysis Method

The Siemens Power Technologies, Inc. "PSS/E" digital computer powerflow simulation program was used to identify the MW levels at which the limiting facilities were sequentially encountered as the power injection (generation output) was incrementally increased at the interconnection site of interest.. This program is the standard transmission system modeling software utilized in MISO studies.

PSE used the most recent MRO summer off-peak model, the 2016 Summer Off-Peak (70% of peak) model, for this study. The "Summer Off-Peak" scenario is the "worst case" scenario, resulting in a highly stressed transmission system due to low local loads to utilize the excess local generation and the lower (than winter) summer line ratings.

In preparation for this analysis, the North Dakota Export (NDEX), Manitoba Hydro Export (MHEX) and Minnesota Wisconsin Export (MWEX) levels in the model were increased to their limits in order to stress the system to its design limits, thus maximizing the number of limiters that would show up as the level of power being injected was ramped from 0 to 100 MW and dispatched to the Twin Cities area.

Under the MISO study process, new generators are not responsible for mitigating a limiter if the distribution factor ("DF") for their generation on the limiter is less than 5% under system intact conditions and has a post-contingent DF of less than 20%. The distribution factor is calculated as follows:

$$\boldsymbol{DF = \frac{Branch\ FLow\ Post\ New\ Generation - Branch\ Flow\ Pre\ New\ Generation}{New\ Generation\ Power\ Output\ Level}}$$

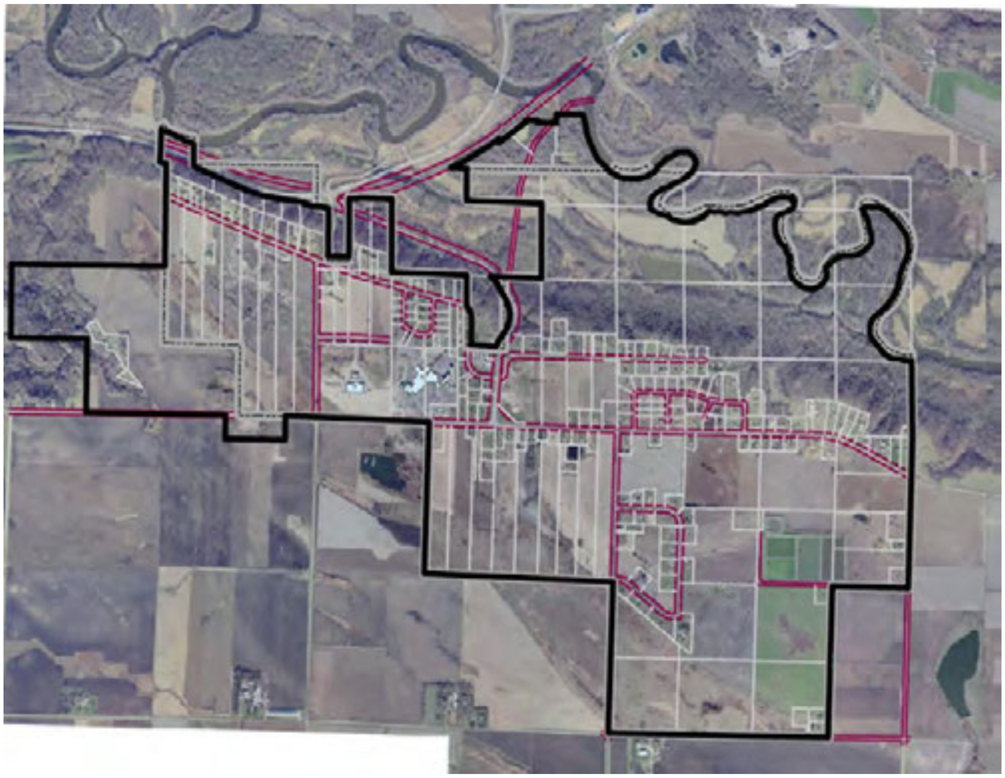
The analysis described in this report is based on the "generation to generation" method of modeling new generation resources; consistent with MISO evaluation practice, existing remote generation was scaled back rather than scaling-up local load to utilize this new generation.

After running this analysis, the results were filtered using the above distribution factor criteria. No limiters were identified until the generation at the point of interconnection reached 35 MW, at which point the Franklin-Morton Tap 69 kV line overloads for outage of the Sheridan Tap-Wabasso 69 kV line. At 35 MW of generation the Redwood-Sheridan Tap 69 kV line also overloads for outage of the Morton-Franklin 69 kV line.

Based on this analysis, the Redwood Falls Tap-Franklin 69 kV line can support the interconnection of 14 MW of proposed new generation at this location.

4.0 Point of Interconnection

The map provided by Westwood Professional Services below shows the project footprint.



The point of interconnection was chosen through research and process of elimination.

The Minnesota River runs to the north and east of the proposed project site. The lack of transmission lines less than 100 kV north of the river and the cost and permitting issues that a river crossing poses eliminated facilities in these directions as cost effective interconnection options. To the west and south, the closest interconnection option is approximately 1.5 miles south of the proposed site of the project's collection system substation on the Franklin-Redwood Falls Tap 69 kV line.

The optimal Point of Interconnection identified during this screening study was on the Redwood Falls Tap-Franklin 69 kV line, approximately 5.5 miles west of the Franklin substation. This would place the point of interconnection approximately 1.5 miles south of the proposed wind farm collection system substation. The DC linear analysis performed during this screening study indicated that the Redwood Falls Tap-Franklin 69 kV line can support the 14 MW of proposed new generation at this location.

5.0 Steady State (Thermal) Analysis

The following table shows the generation levels (MW) at which various facilities become subject to overloads when project generation is gradually increased from 0 to 100 MW. Table 1 identifies the limiting facilities when the proposed generation is dispatched to the Twin Cities.

Table 1: Thermal Limiters for Morton 69 kV Interconnection

MW	Limiting Facility	Outage	DF
35	Morton-Franklin 69 kV at 100 % of 34.8 MVA	Sheridan Tap-Wabasso 69 kV	81.9%
35	Redwood-Sheridan Tap at 100% of 31.6	Morton-Franklin 69 kV	100.0%
55	Morton-Franklin 69 kV at 100% of 34.8	System Intact	76.9%
100	(no additional limiters at this level)		

The thermal analysis indicates the transmission system can support the 14 MW of generation at the proposed point of interconnection.

6.0 MISO Queue Analysis

PSE reviewed the MISO queue for prior queued projects that could impact the outlet capacity of the proposed wind farm. Table 2 provides a list of all active MISO projects in Brown, Cottonwood, and Redwood Counties, MN.

Table 2: MISO Queue

MISO Project Num	Project Transmission Owner (TO)	County	Point of Interconnection	MW
G341	ITC Midwest	Cottonwood		2
G375	ITC Midwest	Cottonwood	Bat Lake - Mt. Lake 69kV	20
G442	**ITC Midwest**	**Cottonwood**	**Storden 69 KV**	**50**
G517	ITC Midwest	Cottonwood	Storden Junction Substation 161 kV	130
G532	ITC Midwest	Cottonwood	Odin 69 kV	20
G626	XEL (NSP)	Brown	Morgan to Sleepy Eye line #0719 69 kV	32
G628	ITC Midwest	Brown	Comfrey - Mountain Lake 69 kV line	32
G759	ITC Midwest	Cottonwood	Dotson 161kV Substation	101
G769	ITC Midwest	Cottonwood	Storden to Heron Lake 161kV	50
H017	XEL (NSP)	Cottonwood	South connected to the 345 kV line running from Lakefield Junction Substation	100
H018	XEL (NSP)	Cottonwood	Storden - Heron Lake 161kV	150
H045	ITC Midwest	Cottonwood	Alliant Mountain Lake, MN 69 kV Switching Station	50
H052	**GRE**	**Brown**	**Dotson, MN 69 kV substation**	**50**
H055	**XEL (NSP)**	**Redwood**	**Right next to GRE's Sheridan 69 kV sub**	**40**
J033	ALTW	Cottonwood	1 pole north of sub, Alliant 69 kV line	4.95
J058	ITC Midwest	Cottonwood	Section 21, Midway Township	4.95

The interconnections in **bold** indicate that if these projects move forward, the Morton Tap-Franklin 69 kV line will overload. Prior-queued projects should be responsible for upgrading the line. However, under the current MISO tariff, the proposed Morton wind project would be responsible for cost sharing based on the 14 MW of impact the project has on the line. Assuming the limiter could be mitigated by a reconductor of the line, the cost would be approximately $1,100,000. The proposed Morton project would likely have to contribute approximately a third of the cost of the network upgrades back to their builders if all the bold projects move forward.

Future changes to the area transmission configuration are possible and would change the results of this analysis. If system changes occur further analysis to determine the impacts of the changes is advised.

7.0 Conclusions & Recommendations

PSE performed an engineering analysis of the transmission system in the vicinity of the proposed wind farm and identified tapping Franklin-Redwood Falls Tap 69 kV approximately 1.5 miles south of the project collection substation and 5.5 miles west of the Franklin substation as the optimal point of interconnection. This preferred point of interconnection has approximately 35 MW of outlet capacity using the study assumptions identified above. This analysis shows that under these assumptions, the proposed point of interconnection has adequate outlet capacity to accommodate the proposed 14 MW project without requiring local network upgrades.

As noted, the accuracy of the conclusions contained within this study is sensitive to the assumptions made with respect to other generation additions and transmission improvements being contemplated by other entities. Changes in the assumptions of the timing of other generation additions or transmission improvements will affect the accuracy of this study's conclusions; thus, a future MISO System Impact Study ("SIS") may yield different results if it utilizes different assumptions. Also, a MISO SIS goes beyond the scope of this screening study, and thus may allocate additional interconnection costs to mitigate regional transmission system issues or problems due to Dynamic Stability, Voltage Stability, or Voltage Adequacy issues.