

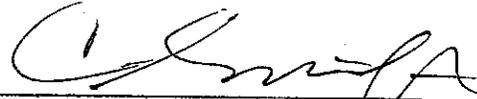
Paper Requirement Title Pages:

**Environmental Fatal Flaw Analysis
For the Flat Hill I Wind Resource Area**

A MURP Professional Paper

In Partial Fulfillment of the Master of Urban and Regional Planning Degree Requirements
The Hubert H. Humphrey Institute of Public Affairs
The University of Minnesota

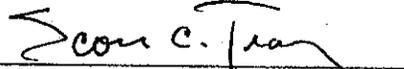
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Note from the author:

The attached report is an environmental fatal flaw analysis that was completed in 2007 and 2008 for the proposed Flat Hill I Wind Resource Area in Clay County, Minnesota. The report was written during my employment as an environmental scientist with Tetra Tech, an environmental consulting firm. I was the primary author for the report with the exception of Section 6 (Wildlife) and Section 7 (Archaeological, Cultural, and Tribal Resources) which were authored by a Tetra Tech Wildlife Biologist and Archaeologist, respectively. For these sections, I served as a technical/peer reviewer and editor. I also served as the Project Manager for the Flat Hill I fatal flaw analysis project.

The overall purpose of a Fatal Flaw Analysis is to conduct an early-stage, due diligence review of available information for a proposed wind energy project to determine if there are any environmental, cultural, land use, or permitting constraints that might pose a 'fatal flaw' to the ultimate development of the project. A developer uses a Fatal Flaw Analysis report to determine the viability of a potential project and lay out a roadmap for developing the project.

The report was completed for the internal use by a confidential wind energy development company. Therefore, much of the information summarized in the report is of a confidential nature (i.e., company name, location of specific resources identified during the analysis, etc.). The attached version of the report has been 'sanitized' to avoid disclosing any confidential client information. The agency consultation letters that would normally be included in Appendix A and the figures illustrating the location of various resources that are discussed throughout the report have been removed.

Environmental Fatal Flaw Analysis

For the
Flat Hill I
Wind Resource Area

January 2008

Prepared For

{Confidential Wind Energy Developer}



Prepared By

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Environmental Scientist



TETRA TECH

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EXECUTIVE SUMMARY

This Fatal Flaw Analysis (FFA) provides a preliminary assessment of the potential biological, cultural resource, and land use issues associated with the Flat Hill I Wind Resource Area (WRA) located in Clay County in Minnesota. The FFA includes a relevant literature and Geographic Information System (GIS) data review, agency consultation, and a limited field reconnaissance.

Based on the data obtained for this analysis, there do not seem to be any issues that would preclude siting of the wind power project or transmission facilities. However, background research and field visits resulted in the identification of vegetation, wildlife, cultural resources, and community development issues that will likely require further investigation prior to construction. In addition, regulatory permits may be required based on the final construction plans. Several recommendations and requirements by state and federal agencies have been identified for the Flat Hill I WRA. Tetra Tech, Inc. (Tetra Tech) has identified several areas where further evaluation would ensure the wind park is sited in a manner that addresses the objectives outlined in the United States Fish and Wildlife Service's (USFWS) Interim Guidelines, and minimizes potential adverse effects to sensitive resources within the project area.

Based on observed native prairie habitats within and adjacent to the Flat Hill I WRA; known occurrences of threatened, endangered, and special concern species within the Flat Hill I WRA; and guidance provided by the Minnesota Department of Natural Resources (MDNR) and the USFWS; Tetra Tech is recommending habitat and wildlife studies be conducted to determine the presence and locations of these natural resources in an attempt to facilitate future project planning and to identify possible activities for avoidance or minimization of adverse effects to resources identified in the WRA. The details of these recommendations are included in this report in Section 5 and Section 6.

In order to provide a summary of the importance of critical issues addressed in this report and recommendations for further evaluation of the resource, if warranted, Tetra Tech has prepared the following matrix (Table E-1) for review. The importance of each issue in the matrix may be adjusted as more information becomes available.

Table E-1. Critical Issues Summary

Issue	Importance Rating			Comment	Recommendation
	High	Med	Low		
Vegetation					
Presence of Threatened and Endangered Species		X		One federally listed plant species and twelve states listed species are known to occur within or in vicinity of the WRA.	A preconstruction survey should be conducted to confirm that special status species will not be impacted.
Native prairies or prairie remnants	X			Several native prairies and prairie remnants were identified in the eastern portion of the Flat Hill I WRA.	The MDNR and USFWS has requested that disturbance to native prairie and prairie remnants be avoided. Vegetation in the WRA should be mapped to determine sensitive areas. The MDNR has requested that a native prairie protection and management plan be completed. The MDNR has recommended that the Nature Conservancy's Northern Tallgrass Prairie Office and the Buffalo State Park be contacted to discuss any concerns that they may have regarding the proposed project.
Impacts to wetlands		X		The results from the NWI indicate that numerous wetland areas were identified within the WRA. Wetlands may be avoided if turbine pads are placed on upland habitat, however, collection lines and access roads will likely intersect wetlands and or waters of the United States.	A high-level desktop assessment should be conducted with layout engineers to micosite turbines, collectors, access roads, and the transmission line, to avoid or minimize impacts to jurisdictional wetlands and Waters of the U.S. and possibly avoid the need to obtain a 404 Permit from the U.S. Army Corps of Engineers (USACE). If proposed locations of turbines and ancillary facilities indicate that a wetland may be impacted, Tetra Tech recommends that a wetland determination and delineation be completed for those areas and avoidance strategies be incorporated into site plans such as horizontal direction drilling techniques.
Wildlife					
Potential for Protected Avian Species to Occur	X			There is a high potential for the occurrence of several state, federal, and other identified rare avian species to occur within the Flat Hill I WRA.	A preconstruction survey should be conducted to confirm that special status species will not be impacted. The MDNR has recommended that wind turbines not be placed within ¼ mile, preferably ½ mile of prairie remnants to avoid impacts to protected species. Tetra Tech recommends conducting point counts in the spring and early summer of 2008 to document avian use throughout the WRA. Tetra Tech recommends conducting a Greater Prairie Chicken survey in the Flat Hill I WRA and prairie grouse species sensitivities should be taken into consideration during construction activities. The MDNR highly recommends that no construction work be conducted in the area from April 1 – May 15 in order to avoid disturbing prairie chickens during the critical booming period.
Potential for Protected Butterfly Species to Occur	X			There is a high potential for the occurrence of several state, federal, and other identified rare butterfly species to occur within the Flat Hill I WRA.	A preconstruction survey should be conducted to confirm that special status species will not be impacted. Several rare butterfly species may occur within the Flat Hill I WRA, the MDNR requests that if project planning within any prairie areas are possible, potential impacts to the rare butterflies identified will need to be addressed through applicable survey protocol as approved by state and federal agencies.
Uniqueness of Habitat in Project Area	X			The eastern portion of the Flat Hill I WRA was identified by the MDNR and the USFWS to have high quality resources for species in relation to the native prairies and prairie remnants located within and in the vicinity of the WRA.	The MDNR and USFWS has requested that disturbance to native prairie and prairie remnants be avoided if possible. Vegetation in the WRA should be mapped to determine sensitive areas. The MDNR has requested that a native prairie protection and management plan be completed.

Table E-1. Critical Issues Summary

Issue	Importance Rating			Comment	Recommendation
	High	Med	Low		
Potential for Raptor Nest Sites		X		Tree nesting habitat was observed within and around the WRA. Local habitat observations indicate the WRA may present ideal hunting grounds for several species.	Tetra Tech recommends conducting a spring survey for raptor nests throughout the WRA to document the intensity of resident raptor use and identify areas where raptor-turbine interactions could be minimized is recommended.
Potential Migration Pathways		X		The WRA and the surrounding vicinity provide migratory stopover habitat (wetlands, grassland, woodlots, etc.) for waterfowl, raptors, and songbirds. There are also large water bodies within the vicinity of the WRA, including tailing ponds to the northeast and a complex of lakes and reservoirs to the south.	Tetra Tech recommends conducting point counts in the spring and early summer of 2008 to document avian use throughout the WRA. This information could then be used to delineate areas or habitats with lower bird use (and therefore, risk), and would identify more favorable sites for wind turbine placement.
Potential Raptor Flight Collisions		X		Use of the WRA by raptors is likely to occur during migration periods in the spring and fall. Some raptors would be expected to reside in the project area during spring and summer.	Tetra Tech recommends conducting point counts in the spring and early summer of 2008 to document avian use throughout the WRA. This information could then be used to delineate areas or habitats with lower bird use (and therefore, risk), and would identify more favorable sites for wind turbine placement.
Potential for Raptor Prey Species			X	No large concentrations of prey species were observed during the site visit however small mammals and other prey are likely present.	No additional studies are recommended.
Potential For Use by Bats		X		Woody vegetation observed within the WRA provides suitable maternity and roosting habitat is present throughout the WRA. Additionally, several mines were observed within the WRA that may be utilized by bats. Wetlands provide high quality foraging habitat as they produce large numbers of insect prey.	Tetra Tech recommends conducting spring acoustic surveys of bat activity to determine passage rates of various bat species that may be present, in various habitats and land form types.
Potential Impact to Mussel Species			X	According to the MDNR, several mussel species of concern have been documented in the Buffalo River in the vicinity of the Flat Hill I WRA.	Erosion and sediment control practices should be implemented and maintained for any work conducted near the river or stream areas.
Cultural Resources					
Archaeological Sites			X	No previously documented sites occur within the project area, though very limited studies have been conducted. The presence of the Buffalo River and other wetlands does increase the potential of encountering archaeological sites within WRA.	Tetra Tech recommends conducting a Phase I cultural resources survey to determine the presence of archaeological sites within the vicinity of the project footprint, avoid resources where possible, and identify mitigation measures where impacts are anticipated.
Architectural History Properties		X		A total of 32 previously documented architectural history properties occur within the WRA. Of these, 7 properties were identified immediately adjacent to the WRA that are listed on the National Register of Historic Places.	Tetra Tech recommends consultation with the Minnesota SHPO be initiated specifically regarding any adverse visual effects the turbines strings and transmission lines may have to NRHP listed architectural properties in the vicinity of the WRA.
Tribal Consultation			X	At least 20 Native American tribes may have interest in activities in west-central Minnesota that may impact areas of cultural or religious significance.	Tetra tech recommends that Native American tribes with an interest in this region be afforded an opportunity to comment on project plans and the potential impacts that project plans may have to areas with cultural or religious significance.
Community Issues and Land Development Constraints					
County zoning and permitting requirements Conditional Use Permit			X	No prohibitive zoning or permitting requirements were identified; basic building permits are required.	Following determination of a preliminary project layout, Tetra Tech recommends meeting with county officials to determine the need for permits or changes in zoning.
Floodplains	X			Mapped floodplains were identified within Clay County, and the WRA appear to intersect floodplains. The Buffalo River as well as several	Floodplains will require further evaluation from a regulatory perspective.

Table E-1. Critical Issues Summary

Issue	Importance Rating			Comment	Recommendation
	High	Med	Low		
				intermittent streams traverse the Flat Hill I WRA.	
Environmental Permitting					
Federal permitting issues		X		USACE, USFWS, and FAA or other federal decision-makers may require permits based on final project layout.	Provide a detailed desktop assessment and coordinate a field inspection with site engineer to microsite turbines, roads, collectors early in the planning phase of the project. The goal of this work would be to avoid wetlands and floodplains as much as possible. During spring conduct a formal delineation if necessary..
State permitting issues	X			Public Utilities Commission site permit will be required, other state permits may be required based on final layout.	Following determination of a preliminary project layout, Tetra Tech recommends consultation with the state to determine the need for permits.

1.0 INTRODUCTION

A Confidential Wind Developer (the “Developer”), is planning to develop a windpark in Clay County in Minnesota. The proposed Flat Hill I Wind Resource Area (WRA) is located approximately 12 miles east of the City of Moorhead. The project is in the initial development stage and many details of the project design have not yet been determined.

The proposed Flat Hill I WRA is located on private land in in west-central Minnesota, east of the City of Moorhead in Clay County (**Figure 1 and Figure 2**). Access to the Flat Hill I WRA is off State Route 9. Numerous farmstead residences occur scattered through the study area. The nearest town to the study area is Glyndon, Minnesota, located approximately five mile southwest of the Flat Hill I WRA. The topography of the study area is level to gently rolling and consists of a large lake plain from Glacial Lake Agassiz. The eastern portion of the Flat Hill I WRA includes Agassiz Beach Ridges topography with noted elevation increases. Elevations range from approximately 910 to 1,117 feet above mean sea level. Much of the study area is undeveloped and consists of agricultural areas. The Flat Hill I WRA borders the Buffalo River State Park, southwest of the intersection of Minnesota Highway 10 and Highway 9 South.

Current plans for the project include the installation of 133, 1.5 MW GE turbines within the WRA. The proposed Flat Hill I windpark will generate a maximum of 200 MW of total power. The Flat Hill I WRA is within an irregularly-shaped area approximately nine miles by six miles, with a two mile by six mile transmission corridor that extends to the south. Infrastructure to be installed in conjunction with proposed turbine arrays includes access roads and underground and overhead electrical lines. Locations for any other structures such as substations, switchyard and an operations and maintenance center have not been identified.

Tetra Tech conducted a desktop study and preliminary field reconnaissance to identify key biological, cultural, and land use issues associated with building and operating the proposed facility. Results of background research and a preliminary field visit are summarized in this report. Additional investigations that may help to address the potential effects of the project are presented for consideration.

2.0 METHODS

Tetra Tech's evaluation of biological and cultural resources within the Flat Hill I WRA is based on searches of relevant databases and reports, geographic information system (GIS) data, and a preliminary site reconnaissance. Both literature and GIS data were compiled through in-house sources and available agency and internet sources. Additionally, other information related to sensitive species distributions, migration flyways, collisions with wind turbines and other structures, cultural resources, zoning regulations, and public planning documents were reviewed for relevance to permitting the proposed project.

Existing information was collected from a number of public domain sources. Cartographic information and related literature, compiled through agency and internet sources, included the following data:

- US Geologic Survey (USGS) 7.5-minute quadrangle maps
- USFWS National Wetlands Inventory (NWI) data
- USGS Digital Elevation Models
- Environmental Systems Research Institute map sets, including cities, major highways, hydrology, and quadrangle boundaries
- National Hydrologic Dataset, including streams and lakes
- Minnesota Department of Natural Resources (MDNR), including Minnesota physiogeographic provinces and descriptions
- MDNR's Natural Heritage Database, including wildlife species habitat maps and county rare species data
- Minnesota GAP Project, including vegetation cover types and descriptions
- Office of the State Archaeologist and the University of Minnesota I-sites GIS database for archaeological sites
- US Census Bureau
- Federal Emergency Management Agency Floodplain Maps

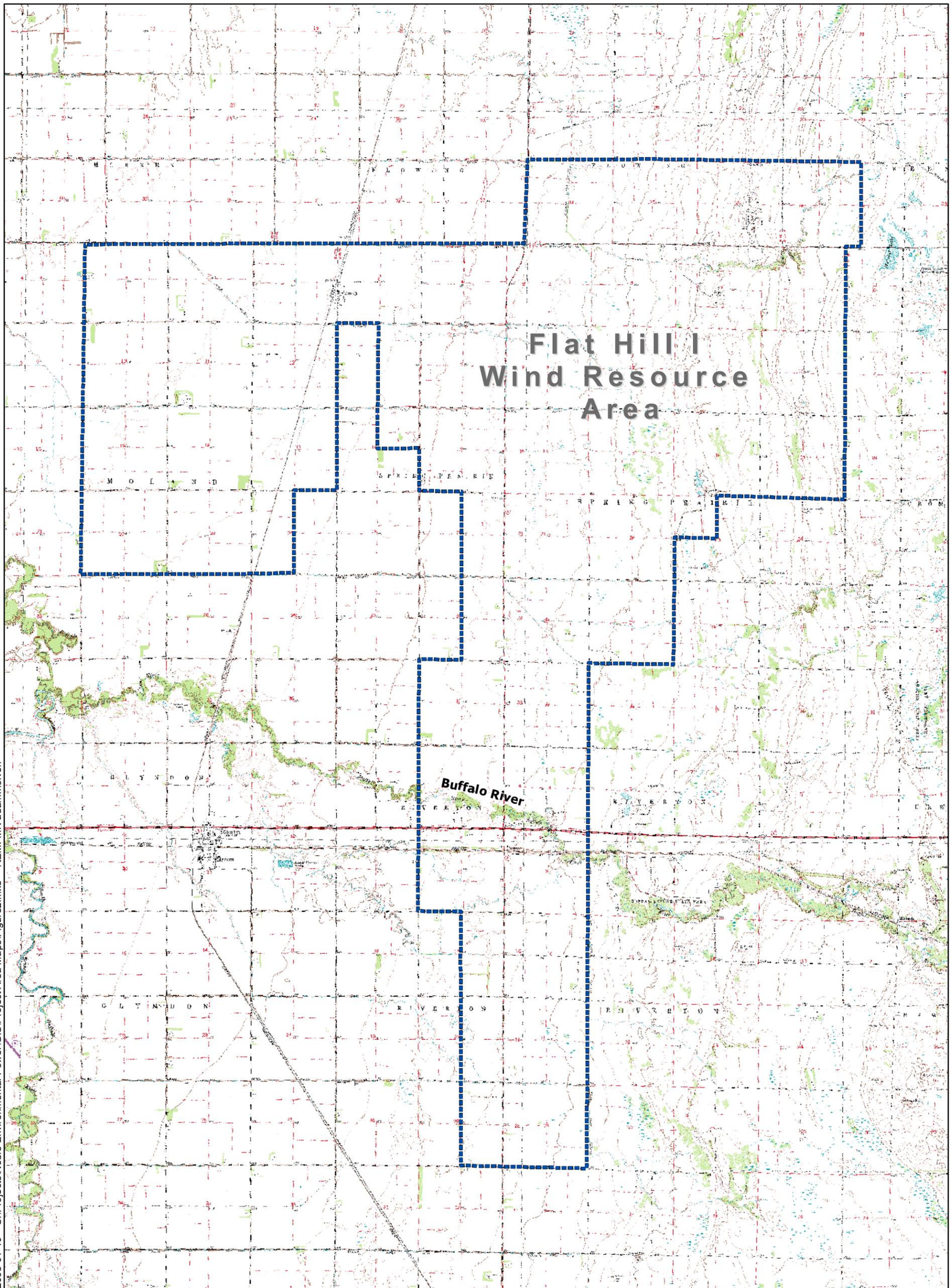
A field reconnaissance of the project area and surrounding areas was conducted by Sean Flannery, an experienced environmental scientist from Tetra Tech on December 18, 2007. During the site reconnaissance, a list of wildlife species observed was developed and notes on wildlife habitat, potential nest structures, wetlands and land use were recorded. Representative photographs depicting various sites and habitats observed are included in Appendix B.

A U.S. Secretary of Interior-certified archaeologist from Tetra Tech conducted a record research and review of existing records contained at the Minnesota State Historic Preservation Office (SHPO) housed at the Minnesota Historical Society (MHS) (see Section 7.0).

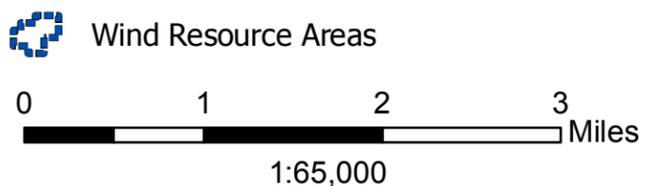
Inquiry letters were sent to the U.S. Fish and Wildlife Service (USFWS) and the Minnesota Department of Natural Resources (MDNR) to obtain a list of threatened and endangered species (see Appendix C).

Figure 1. Flat Hill I Vicinity Map

2008-01-10 S:\Projects\Noble Environmental Power\GIS\Project Area Maps\Figure2.mxd TtEMI-MN adam.holven



Source: Map adapted from LMIC WMS USGS 1:24,000 Topographic Quadrangles: Baker, Downer, Glyndon North, Glyndon South, Hawley NW, Wolverton, Wolverton SE



Environmental Fatal Flaw Analysis
 Flat Hill I and II
 Wind Resource Areas

Figure 2a
 Flat Hill I Topographic Map



3.0 ENVIRONMENTAL SETTING

This section summarizes existing environmental conditions within the Flat Hill I WRA. Information presented describes potentially affected habitats (i.e., wetlands, riparian corridors, general plant communities), fish, wildlife, and plant species (including potentially-occurring threatened, endangered, and rare species), and cultural and historical resources. Environmental resource information presented in this section will be used to identify permits, assist in micro-siting project facilities (e.g., turbines, roads, substation, transmission line), and help determine if additional preconstruction surveys are needed.

3.1 Regional Setting

The Flat Hill I WRA is situated within the Red River Prairie Subsection, which covers 3,985,620 acres (6,173 square miles) in northwestern Minnesota, representing approximately 7 percent of Minnesota. The western boundary of this subsection is formed by the Red River. The eastern boundary follows the eastern limits of continuous tall grass prairie vegetation at the time of Euro-American settlement. Portions of a till plane are included. The southern boundary follows the southern end of the till plain and the Glacial Lake Agassiz basin (MDNR 2007a).

The majority of the Red River Prairie Subsection is a glacial lake plain with silty, sandy, and clayey lacustrine deposits. It is level, uniform, and featureless, broken only by wetlands, meandering waterways, and old beach ridges. Drainage is to the north via the Red River and its tributaries. The major landform is a large lake plain (Glacial Lake Agassiz). Minor landforms include till plain, beach ridges, sand dunes, and water-reworked till. Topography is level to gently rolling. There is some steeper topography along drainages and adjacent to Lake Traverse. The most important land use in this area is agriculture. Due to the extensive agricultural use in the area, the lake plain has been intensively ditched. Some native flora persists in small fragments (in some moderate size) east of the beach ridges and in the interbeach zone. Native flora consists of tallgrass prairie and wet prairie that is dominated by bluestems (*Andropogon scoparius* and *A. gerardii*), Indian grass (*Sorghastrum nutans*), bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), cattails (*Typha spp.*), rushes (*Juncus spp.*), and sedges (*Carex spp.*). Narrow forested areas that consist of cottonwood (*Populus deltoids*), elm (*Ulmus spp.*) and willow (*Salix spp.*) are common along larger streams and rivers. Precipitation averages between 21 to 23 inches, with the lowest amounts at the southwestern edge of the subsection. About half of the precipitation arrives during the growing season. The growing season ranges from 111 to 136 days (MDNR 2007a).

Soils are poorly, somewhat poorly, and moderately well-drained lacustrine clays, silts, and sands. They are primarily Mollisols or Aquolls. Borolls (cold, dry Mollisols) are also common. Saline soils are present in localized areas. Dry, sandy and gravelly soils are characteristic of the beach ridges present throughout the subsection (MDNR 2007a).

4.0 VEGETATION

This section describes plant and wetland communities known to occur within the vicinity of the Flat Hill I WRA. Literature reviews were conducted to determine the types of vegetative communities present and identify potentially sensitive plant species and vegetation communities present within the WRA. A Tetra Tech biologist conducted a limited field reconnaissance of the proposed WRA and associated transmission facility locations on December 18th and 19th, 2007. A determination of plant communities and potential wetland habitats was conducted to the extent feasible given the limitations imposed by the brevity of the site reconnaissance.

4.1 Plant Communities

A plant community is a combination of different plants growing together. Each plant community has a unique structure and appearance, which is determined by the proportions of the species growing in it. The

composition of a plant community type, such as perennial grassland, changes from place to place due to the physical environment. This is because each species has certain limits to where it will grow and survive. Those species that have similar limits often are found growing together; hence, they become a loosely assembled plant community.

The identification of native plant communities within the WRA is essential to identifying wildlife-habitat relationships. Delineating vegetation types will provide an indication as to the types of species that may utilize the WRA. Land cover information was reviewed from the Minnesota Land Management Information Center (1999) that was derived through aerial photographs, the USFWS NWI field maps, and Landsat satellite images. According to the Minnesota Land Management Information Center, the WRA is comprised primarily of cultivated lands. Other land cover types observed within Flat Hill I WRA include native grasslands, deciduous forests, wetlands, rural residential and farmstead properties, gravel pits and open mines. According to the MDNR Natural Heritage Database (MDNR 2007b) there are numerous prairie types that have been identified within the eastern portion of the Flat Hill I WRA that include; Dry Sand – Gravel Prairies, Mesic Prairies, Wet Bush Prairies, Wet Prairies, Wet Saline Prairies, Wet Seepage Prairies, and several undetermined native plant communities. **Figure 3** illustrates the Habitat Types located within the Flat Hill I WRA.

4.2 Special Status Species

The Endangered Species Act (ESA) mandates that actions of federal agencies are not to jeopardize the continued existence of listed species. USFWS and MDNR maintain a list of federal and state threatened and endangered plant species. Species listed by one of these two agencies require protective measures for their perpetuation due to low populations (threatened, endangered, sensitive), sensitivity to habitat alteration, or cultural significance.

Observations made during the December 2007 site reconnaissance indicate that pending wind turbine locations, some clearing of potential native vegetation may be required for construction of wind turbines, access roads and connecting lines. Thus, due to the disturbance of potential native species, Tetra Tech recommends that a preconstruction survey be conducted to confirm that sensitive species are not impacted. This survey would be conducted concurrent with the wetland determination survey.

Tetra Tech staff submitted a request to the USFWS and the MDNR to identify federal and states species of concern that could potentially occur within the WRA (see Appendix A). The USFWS has stated in correspondence to date that there are several high quality resources, including native prairie remnants that are required habitats for several protected and sensitive species that occur within the WRA. As of the date of this report, Tetra Tech is still awaiting a formal response letter from the agency. The MDNR responded in a letter dated January 9, 2007, stating that based on its review, there are 157 known occurrences of rare species or native plant communities in the area searched. Just as stated by the USFWS, the MDNR has stated that the native plant communities are the required habitats for several protected and sensitive species that occur within the WRA. The state threatened and endangered plant species or plant species of concern listed by MDNR and the USFWS potentially occurring in the vicinity of the WRA and potentially affected areas are shown in **Table 4-1**. Specific information about these species and the potential for them to occur within the WRA is described below.

4.2.1 Federal Protected Species

The USFWS lists four threatened and endangered plant species within the state of Minnesota (USFWS 2007a). Of these four species, one species, the western prairie fringed orchid (*Platanthera praeclara*) is known to occur within the Flat Hill I WRA. Specific information about this species and the potential for it to occur within the WRA is described below.

Western prairie fringed orchid (Federal Threatened, State Endangered)

The western prairie fringed orchid is a federal threatened and state endangered species in Minnesota. Historically, the western prairie fringed orchid has been found in Minnesota where mesic to wet tallgrass prairies and sedge meadows occurred west of the Mississippi. These areas may include prairie remnants along roads and railroad rights-of-way and may also include disturbed sites. The orchid blooms from mid-June to late July in Minnesota. Threats to this species include loss of prairie habitats, invasion of non-native plants, haying, over-grazing, and habitat fragmentation. The western prairie fringed orchid may be found in suitable sites with Flat Hill I WRA (USFWS 2007b).

4.2.2 State Protected Species

The MDNR lists over 250 threatened and endangered plant species in the state of Minnesota (MDNR 2007a; Appendix C). According to the MDNR Natural Heritage Database, ten plant species are recorded to have occurred within the Flat Hill I WRA or vicinity (Appendix A). Species occurrence and distribution information is often based on documented occurrences where surveys have taken place, so a lack of records does not necessarily indicate that species are absent from a particular area.

Plains reedgrass (State Species of Concern)

The plains reedgrass (*Calamagrostis montanensis*) is common on dry, open prairies, mostly in native range and associated with clay slopes. The plains reedgrass is a cool season grass beginning growth in mid-April, flowering and setting seed from June through July in Minnesota. The species has been recorded to occur within the east-central portion of the Flat Hill I WRA (MDNR 2007b).

Hall's sedge (State Species of Concern)

Hall's sedge (*Carex hallii*) is known to occur in wet meadows, springs, and seepage areas. Blooming occurs in Minnesota between June and July. The Hall's sedge has been recorded to occur in the northeast-central portion of the Flat Hill I WRA (MDNR 2007b).

Northern singlespike sedge (State Species of Concern)

The northern singlespike sedge (*Carex scirpoidia*) prefers dry soil types and is considered to be widespread throughout its region. This species has been recorded to occur along the southern boundary of the Flat Hill I WRA (MDNR 2007b).

Sterile sedge (State Threatened)

The sterile sedge (*Carex sterilis*) is a characteristic sedge of calcareous fens and other inland fresh meadows supported by stable, calcareous groundwater seepages. The sterile sedge has been recorded to occur in the northeastern and northern portion of the Flat Hill I WRA (MDNR 2007b).

Small white lady's-slipper (State Species of Concern)

The small white lady's-slipper (*Cypripedium candidum*) prefers mesic blacksoil prairie, wet blacksoil prairie, glacial till prairie, sedge meadows, and calcareous fens. The small white lady's slipper blooms from mid-May to early June during hot weather. The small white lady's-slipper has been recorded to occur within the eastern portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Northern gentian (State Species of Concern)

The northern gentian (*Gentiana affinis*) is mostly restricted to the northern half of the state in cool northern prairies. Clumps of northern gentian usually bloom during August. The northern gentians do not tolerate heavy grazing. The northern gentian has been recorded to occur in the eastern portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Nuttall's sunflower (State Species of Concern)

The Nuttall's sunflower (*Helianthus nuttallii ssp.rydbergii*) is found along the banks of streams and ponds, wet meadows, and other wet places. The Nuttall's sunflower blooms in Minnesota from July to September. The Nuttall's sunflower has been recorded to occur within the east-central portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Oat-grass (State Species of Concern)

Oat-grass (*Helictotrichon hookeri*) prefers prairies and plains, often dominating sandhill prairie regions associate with drier upland sites. Oat-grass is a warm season grass that flowers in late July and sets seed through September. Oat-grass has been recorded to occur within the east-central portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Clustered broomrape (State Species of Concern)

The clustered broomrape (*Orobanche fasciculata*) is found to occur in prairies and flowers from May to August in Minnesota. The clustered broomrape has been recorded to occur within the east-central portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Louisiana broomrape (State Species of Concern)

The Louisiana broomrape (*Orobanche ludoviciana*) is considered a dry prairie species that is parasitic on many kinds of plants, especially Artemisia. This species has been recorded to occur within the central northeastern portion of the Flat Hill I WRA (MDNR 2007b).

Prairie Moonwort (State Species of Concern)

The prairie moonwort (*Botrychium campestre*) may be found in dry prairies and sand dunes as well as sandy, dry disturbed sites such as roadsides and old fields. This species is known to breed from May through early June possibly through July in more northern sites. This species has been recorded to occur within the northeastern portion of the Flat Hill I WRA (MDNR 2007b).

Least Moonwort (State Species of Concern)

The least moonwort (*Botrychium simplex*) may be found in terrestrial meadows, barrens, and woods in usually subacid soil. This species has been recorded to occur within the northeastern portion of the Flat Hill I WRA (MDNR 2007b).

Figure 3. Flat Hill I WRA Habitat Type Map

Table 4-1. State Listed Species Potentially Occurring within the WRA

Species	Scientific Name	Status	Likelihood of occurrence in project area*	Habitat Association
VASCULAR PLANTS				
Plains reedgrass	<i>Calamagrostis montanensis</i>	State Species of Concern	Low	Common on dry, open prairies, mostly in native range and associated with clay slopes. The plains reedgrass is a cool season grass beginning growth in mid April, flowering and setting seed from June through July in Minnesota.
Hall' Sedge	<i>Carex hallii</i>	State Threatened	Low	Known to occur in wet meadows, springs, and seepage areas. Blooming occurs in Minnesota between June and July.
Northern Single-spiked Sedge	<i>Carex sciroloidea</i>	State Species of Concern	Low	Prefers dry soil types and is considered to be widespread throughout its region.
Sterile Sedge	<i>Carex sterilis</i>	State Threatened	Low	Is a characteristic sedge of calcareous fens and other inland fresh meadows supported by stable, calcareous groundwater seepages.
Small White Lady's-slipper	<i>Cypripedium candidum</i>	State Species of Concern	Low	Prefers mesic blacksoil prairie, wet blacksoil prairie, glacial till prairie, sedge meadows, and calcareous fens. The small white lady's slipper blooms from mid-May to early June during hot weather.
Northern Gentian	<i>Gentiana affinis</i>	State Species of Concern	Low	Mostly restricted to the northern half of the state in cool northern prairies. Clumps of northern gentian usually bloom during August. The northern gentians do not tolerate heavy grazing.
Nuttall's Sunflower	<i>Helianthus nuttallii</i> ssp. <i>Rydbergii</i>	State Species of Concern	Low	Found along the banks of streams and ponds, wet meadows, and other wet places. The Nuttall's sunflower blooms in Minnesota from July to September.
Oat-grass	<i>Helictotrichon hookeri</i>	State Species of Concern	Low	Prefers prairies and plains, often dominating sandhill prairie regions associated with drier upland sites. Oat-grass is a warm season grass that flowers in late July and sets seed through September.
Clustered Broomrape	<i>Orobanche fasciculata</i>	State Species of Concern	Low	Found to occur in prairies and flowers from May to August in Minnesota.
Louisiana Broomrape	<i>Orobanche ludoviciana</i>	State Species of Concern	Low	Found in dry prairies. This species is parasitic on many kinds of plants, especially Artemisia
Prairie Moonwort	<i>Botrychium campestre</i>	State Species of Concern	Low	Found in dry prairies and sand dunes as well as sandy, dry disturbed sites such as roadsides and old fields. This species is known to senesce from May through early June possibly through July in more northern sites.
Least Moonwort	<i>Botrychium simplex</i>	State Species of Concern	Low	Found in terrestrial meadows, barrens, and woods in usually subacid soil.

*"Likelihood of Occurrence" based on MDNR Natural Heritage Database element occurrences of species within a 1 mile radius of WRA and last observed date reported.

4.3 Impact Assessment and Recommendations

Impacts are anticipated to state and federally listed vascular plant species and wildlife species in the WRA are expected to be variable. This is due to the natural setting and diversity of high quality resources located within and in the vicinity of the WRA, the diversity of wildlife species and subsequent utilization of the WRA, occurrence records, and correspondence with the MDNR and USFWS. Several areas of concern were identified within primarily the eastern portion Flat Hill I WRA.

The construction of turbine pads, access roads, associated buried electrical collection system, overhead transmission line, substation, and operations and management building would result in temporary, construction related, and long-term loss of habitat in the small patches of native grassland habitat, woodlands, and agricultural fields within the WRA. In addition, activities such as road construction and tree clearing can destroy or disrupt habitats and allow for the introduction of unwanted plant species.

Several state listed species are known or considered highly likely to occur in the vicinity of the WRA. Due to potential habitat loss during construction, Tetra Tech recommends habitat mapping and vegetation surveys of the WRA be conducted during the growing season to further define possible native prairie remnants and/or state and federal listed vascular plant species in areas where occurrences are likely.

The MDNR has requested that the Nature Conservancy's Northern Tallgrass Prairie Office and the Buffalo River State Park be contacted to discuss any concerns they may have regarding the project as it relates to their sensitive areas located adjacent to and within the Flat Hill I WRA. In addition, the MDNR has requested that a native prairie protection and management plan be submitted to the MDNR Natural Heritage Database Program that includes measures to avoid impacts to native prairies and measures to mitigate for impacts if deemed unavoidable. The MDNR and USFWS request to be contacted prior to survey work for approved survey protocol and other requirements.

5.0 WETLANDS AND RIPARIAN AREAS

Wetlands and riparian areas are important resources in part because they provide habitat, which is utilized by both resident and migratory wildlife. They are also unique because of their hydrologic conditions and their role as ecotones between terrestrial and aquatic systems (Mitsch and Gosselink 1993). Wetlands have many distinguishing features, the most notable of which are the presence of standing water or saturation within 12 inches of the surface, unique wetland soils, and vegetation adapted to or tolerant of saturated soils. There are many definitions and terms describing wetlands. The legal definition of a wetland, as outlined in the 1987 United States Army Corps of Engineers (USACE) Wetlands Delineation Manual (Wetland Training Institute, Inc 1995), is given as follows:

The term “wetlands” means those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (33CFR328.3(b); 1984)

Numerous federal, state, county, and local regulations currently affect construction and other activities in wetlands. The principal laws in Minnesota affecting wetlands and streams are Sections 404 and 401 of the Federal Clean Water Act (CWA) and the Minnesota Wetlands Conservation Act (WCA). Section 404 (regulation of discharge of dredge/fill materials into wetlands) is implemented by USACE. The Minnesota WCA was first passed in 1991. The local government unit has the primary responsibility for administration of the WCA and for making key determinations. Generally, the local government unit is the County. In many instances both jurisdictions overlap the same wetland feature.

The National Wetland Inventory (NWI) database indicates the general location of wetlands based on changes in vegetation patterns as observed from aerial photography. Tetra Tech reviewed aerial photographs and NWI data to determine the presence of wetland habitat within the WRA; this search indicated that numerous wetland areas are located within the Flat Hill I WRA, primarily within the eastern portion of the WRA. Pending the turbine layout, ancillary facilities such as roads and connection lines, there is a potential for wetland areas to be impacted by the proposed project. NWI wetlands are illustrated in **Figure 4**.

Ecologically, wetlands are recognized by three parameters: wetland hydrology, hydric soils, and wetland vegetation. Hydric soils are soils that are wet frequently enough to periodically produce anaerobic conditions, thereby influencing the species composition or growth, of plants on those soils. Under most circumstances, at least one positive field indicator of each parameter will be apparent at any given wetland. Websoil survey information for the Flat Hill I WRA indicated that hydric soils are located within the proposed project area (NRCS Websoil Survey 2007). Tetra Tech recommends that a high-level desktop assessment be conducted with layout engineers to micosite turbines, collectors, access roads, and the transmission line. If proposed locations of turbines and ancillary facilities indicate that a wetland may be impacted, Tetra Tech recommends that a wetland determination and delineation be completed for those areas and avoidance strategies be incorporated into site plans such as horizontal direction drilling techniques. If wetland resource impacts are unavoidable, the delineated wetland resource areas should be provided to the United States Army Corp of Engineers (USACE) and County to obtain wetlands permits. The wetland delineation should be conducted during the growing season when wetland hydrology is likely present and plant identification is possible. For this region, the growing season occurs approximately from May through September to the beginning of October.

Figure 4. Flat Hill I WRA National Wetlands Inventory Map

6.0 WILDLIFE

This section identifies commonly-found and sensitive wildlife species known to occur or potentially occur within the Flat Hill I WRA. **Table 6-1** identifies those species observed in the WRA during the December 18th and 19th, 2007 site visit.

Based on issues identified at other wind generation facilities throughout the United States, those species of greatest concern are federally or state-protected avian species and bats that may occur in the vicinity of the WRA. Other species of conservation concern are those directly associated with sensitive or unique habitats. Tetra Tech staff submitted a request to the USFWS and the MDNR to identify federal and states species of concern that could potentially occur within the WRA (see Appendix

A). The USFWS has stated in correspondence to date that there are several high quality resources, including native prairie remnants that are required habitats for several protected and sensitive species that occur within the WRA. As of the date of this report, Tetra Tech is still awaiting a formal response letter from the agency. The MDNR responded in a letter dated January 9, 2007, stating that based on its review, there are 157 known occurrences of rare species or native plant communities in the area searched. Just as stated by the USFWS, the MDNR has stated that the native plant communities are the required habitats for several protected and sensitive species that occur within the WRA.

Table 6-1. Wildlife Species Observed in the WRA During the Field Reconnaissance

Common Name	Scientific Name
Birds	
Ring-necked pheasant	<i>Phasianus colchicus</i>
American crow	<i>Corvus brachyrhynchos</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Mammals	
White-tailed deer	<i>Odocoileus virginianus</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Eastern fox squirrel	<i>Sciurus niger</i>

6.1 Special Status Species

The Endangered Species Act (ESA) mandates that actions of federal agencies are not to jeopardize the continued existence of listed species. USFWS and MDNR maintain a list of federal and state threatened and endangered plant species. Species listed by one of these two agencies require protective measures for their perpetuation due to low populations (threatened, endangered, sensitive), sensitivity to habitat alteration, or cultural significance.

Observations made during the December 2007 site reconnaissance indicates that pending turbine locations, some clearing of potential native vegetation may be required for construction of wind turbines, access roads and connecting lines. Thus, due to the disturbance of potential native species, Tetra Tech recommends that a preconstruction survey be conducted to confirm that sensitive species are not impacted. This survey would be conducted concurrent with the wetland determination survey.

6.1.1 Federal Protected Species

The ESA requires protection of species federally listed as threatened or endangered. Significant changes to the habitats of these species and projects that have potential to result in a “take” will require close scrutiny by USFWS and may require special permitting or mitigation measures to lessen or mitigate effects. The Dakota skipper (*Hesperia dacotae*) is the one federally listed candidate species that could potentially occur in the project area (USFWS 2007a). Specific information about this species and the potential for it to occur within the WRA is described below.

Dakota skipper (Federal Candidate Species, State Species of Concern)

The Dakota skipper is found in relatively flat and moist native bluestem prairies and within upland, dry prairies located on ridges or hillsides. The current distribution of this species straddles between tallgrass

and mixed grass prairie regions. Threats to this species include fragmentation, loss of habitat, over grazing, inappropriate fire management, and woody plant invasions. This species has been recorded to occur east of the southern leg of the Flat Hill I WRA (MDNR 2007b).

6.1.2 State Protected and Other Species of Conservation Concern

MDNR has identified 157 animal species in decline at the national, regional or state level, or species whose population status is not well known, but thought to be in decline (Appendix C). These species are listed as “species of concern” or as threatened or endangered based on such factors as known status, funding available for conservation, and presence of breeding habitat. Tetra Tech submitted a request to query the MDNR Natural Heritage Database, which maintains recorded sightings of species of concern within the state of Minnesota. According to the Natural Heritage Database (MDNR 2007b) there are nine records of threatened, endangered, or species of concern found to occur within the Flat Hill I WRA. Of the state threatened and endangered species or species of concern listed by MDNR, those birds, butterflies and moths potentially occurring in the vicinity of the WRA and potentially affected are shown in **Table 6-2**. Specific information about these species and the potential for them to occur within the WRA is described below.

Henslow’s sparrow (State Endangered)

Henslow’s sparrow (*Ammodramus henslowii*) is very uncommon in west-central Minnesota as it is known to mostly occur in southeastern Minnesota during the breeding season. This species prefers large, flat fields with no woody plants and with tall, dense grass and standing dead vegetation. This species has been recorded to occur in the northeastern portion of the Flat Hill I WRA (MDNR 2007b).

Assiniboia skipper (State Endangered)

The assiniboia skipper (*Hesperia comma assiniboia*) is found in native short grass prairie, and open, sandy areas. Peak flight activity occurs in August but ranges from late July to late September. Species loss has been contributed to habitat loss due to agriculture and development. This species has been recorded to occur in the northeast portion of the Flat Hill I WRA (MDNR 2007b).

Loggerhead shrike (State Threatened)

The loggerhead shrike (*Lanius ludovicianus*) is found in Minnesota during the breeding season, from late March to September. This species prefers “edge” habitat, nesting along roadsides and hedgerows in agricultural regions. Causes of decline are unknown but may be related to pesticide use. This species has been recorded to occur in the eastern portion of the Flat Hill I WRA (MDNR 2007b).

Marbled godwit (State Species of Concern)

The marbled godwit (*Limosa fedoa*) is found in Minnesota during the breeding season in marshes and flooded plains nesting in June and July. The declining numbers of this species have attributed to habitat loss. This species has been recorded to occur in the eastern portion of the Flat Hill I WRA (MDNR 2007b).

Powesheik skipper (State Species of Concern)

The Powesheik skipper (*Oarisma powesheik*) requires wet mesic prairie habitat with native grasses, sedges, and a significant component of plants in the sunflower family. This species has declined in numbers due to poor fire management and habitat loss. This species has been recorded to occur within the southeastern portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Uhler’s arctic (State Endangered Species)

The Uhler’s arctic (*Oeneis uhleri varuna*) can be found in slopes in dry, open bunchgrass habitat; tundra; and openings in pine forests. Flight peak for this species occurs from June to early July. Western Minnesota represents the eastern edge of its distribution. This species has been recorded to occur within the eastern portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Wilson's phalarope (State Threatened)

Wilson's phalarope (*Phalaropus tricolor*) can be found breeding in fresh-water marshes and wet meadows and wetlands. In Minnesota, this species can be found from late April to August. This species has been recorded to occur in the northern portion of the southern leg of the Flat Hill I WRA (MDNR 2007b).

Regal fritillary (State Species of Concern)

The regal fritillary (*Speyeria idalia*) has historically been found in Minnesota in the extent of native prairie and savanna. This species can be found in upland prairies and sometimes wetland prairies. Declines in numbers are unclear but may be related to insecticide use. This species has been recorded to occur in the southern leg of the Flat Hill I WRA (MDNR 2007b).

Greater prairie-chicken (State Species of Concern)

The greater prairie-chicken (*Tympanuchus cupido*) prefers undisturbed tallgrass prairies. The prairie chicken was almost extinct in the 1930s due to hunting pressure and habitat loss. Currently, human interactions are the greatest threat to this species. This species has been recorded to occur in numerous areas within the eastern portion of the Flat Hill I WRA (MDNR 2007b).

Table 6-2. State Listed Species Potentially Occurring within the WRA

Species	Scientific Name	Status	Likelihood of occurrence in project area*	Habitat Association
BIRDS				
Henslow's Sparrow	<i>Ammodramus henslowii</i>	State Endangered	Low	Very uncommon in west-central Minnesota as it is known to mostly occur in southeastern Minnesota during the breeding season. This species prefers large, flat fields with no woody plants and with tall, dense grass and standing dead vegetation.
Loggerhead Shrike	<i>Lanius ludovicianus</i>	State Threatened	Moderate	Feeds primarily on large insects, also other invertebrates, small birds, lizards, frogs, and rodents; sometimes scavenges. Nests in open country with scattered trees and shrubs, savanna, and, occasionally, open woodland; often perches on poles, wires or fenceposts.
Marbled Godwit	<i>Limosa fedoa</i>	State Species of Concern	Low	Found in Minnesota during the breeding season in marshes and flooded plains nesting in June and July.
Wilson's phalarope	<i>Phalaropus tricolor</i>	State Threatened	Moderate	Eats insects (larvae and adults), especially mosquitoes and crane flies. Feeds as it walks along muddy shores, wades in shallow water, or swims in whirls. Nests in shallow freshwater and saline ponds, marshes and wet meadows.
Greater Prairie - Chicken	<i>Tympanuchus cupido</i>	State Species of Concern	High	Prefers undisturbed tallgrass prairies.
BUTTERFLIES AND MOTHS				
Assiniboia Skipper	<i>Hesperia comma assiniboia</i>	State Endangered	Low	Found in native short grass prairie, and open, sandy areas. Peak flight activity occurs in August but ranges from late July to late September.
Dakota Skipper	<i>Hesperia dacotae</i>	State Threatened	Low	Occurs in flat and moist native bluestem prairie and dry prairies that often are located on ridges and hillsides. Bluestem grasses and needlegrasses dominate these habitats as well as three wildflowers in the most suitable sites that include; pale purple (<i>Echinacea pallida</i>), upright coneflowers (<i>E. angustifolia</i>) and blanketflower (<i>Gaillardia spp.</i>).
Powesheik Skipper	<i>Oarisma powesheik</i>	State Species of Concern	Low	Requires wet mesic prairie habitat with native grasses, sedges, and a significant component of plants in the sunflower family.
Uhler's Arctic	<i>Oeneis uhleri varuna</i>	State Endangered	Low	Found in slopes in dry, open bunchgrass habitat; tundra; and openings in pine forests. Flight peak for this species occurs from June to early July. Western Minnesota represents the eastern edge of its distribution.
Regal Fritillary	<i>Speyeria idalia</i>	State Species of Concern	Low	Historically been found in Minnesota in the extent of native prairie and savanna. This species can be found in upland prairies and sometimes wetland prairies.

*"Likelihood of Occurrence" based on MDNR Natural Heritage Database element occurrences of species within a 1 mile radius of WRA and last observed date reported.

6.2 Raptors

A variety of raptor species are common spring and fall migrants, winter residents, and residents during the breeding season. Raptor species likely to occur or known to occur within the WRA are the broad-winged hawk (*Buteo platypterus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and great horned owl (*Bubo virginianus*). Some species that are known to occasionally be within the area during spring, fall, and/or winter and take residence during the breeding season include the northern harrier (*Circus cyaneus*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), bald eagle (*Haliaeetus leucocephalus*), merlin (*Falco columbarius*), osprey (*Pandion haliaetus*), northern goshawk (*Accipiter gentilis*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), prairie falcon (*Falco mexicanus*), Eastern screech owl (*Megascops asio*), barred owl (*Strix vari*), and northern saw-whet owl (*Aegolius acadicus*) (Minnesota Ornithological Union [MOU] 2007). Given the topography and natural setting of the WRA, a number of different species may be present within the WRA. Potential wildlife issues within the WRA are summarized on **Table 6-3**.

Raptor mortality at new generation wind projects has been low. For comparison, estimates of raptor mortality at the Foote Creek Rim wind project in Wyoming, which is located in native grassland and shrub steppe habitat, were estimated at 0.03 raptors per turbine per year based on a 3-year study of 69 turbines (Young et al. 2003). No raptor mortality was observed at the Vansycle wind project in Oregon during a 1-year study (Erickson et al. 2000), but an average of 0.060 fatalities per turbine per year were observed during monitoring at the adjacent, much larger Stateline wind project during 2002-2003 (Erickson et al. 2004); and 0.065 raptor fatalities per turbine per year were observed at the Nine Canyon project during 2002-2003 (Erickson et al. 2003).

6.3 Bats

Bat casualties have been reported from most wind power facilities where post-construction fatality monitoring data are available, and operation of the proposed project is expected to result in some bat mortality from collisions with turbines. The majority of recorded fatalities in the west occur during the fall migration period (Johnson 2004).

Due to the lack of data concerning bat/turbine interactions, actual effects to bat populations within the WRA cannot be predicted (Keely 2001). However, estimates of bat mortality range from 0.07 to 10.0 per turbine per year in the United States (Johnson 2004). This level of mortality is minimal in relation to populations of bat species, which are estimated to be very large. However, long-term and cumulative effects are unknown and may become significant over time as more wind projects are constructed. Bats are long-lived and have low reproductive potential, which limits their ability to replace animals lost to turbine collisions, in contrast to most bird species.

To date, we are not aware that any standard agency recommendations have been made for assessing risk to bats in Minnesota. The National Wind Coordinating Committee's Wildlife Working Group has established a Nocturnal Methods subgroup that is in the process of developing a methods and metrics guideline for nocturnal species, which is intended to be a companion document to Anderson et al. (1999), and was expected to be completed in late 2006. Until these methods are developed, mortality estimates at wind projects in similar habitats/landscapes is the primary assessment tool for assessing potential impacts. That said, the relative impact of bat mortality at wind energy projects on overall bat populations is obscured by the fact that there are very few studies of other sources of bat mortality, such as pesticide use, cave destruction, mine entrance closings, removal of trees and buildings, etc.

Due to the timing of the site reconnaissance, no bats were observed within the WRA. However, bats are likely present in the vicinity of the WRA with some habitats in the WRA likely receiving more use than others. Some potentially occurring bat species known to reside or migrate through Clay County include the big brown bat (*Eptesicus fuscus*), the silver-haired bat (*Lasionycteris noctivagans*), the hoary bat

(*Lasiurus cinereus*), the eastern red bat (*Lasiurus borealis*), eastern pipistrelle (*Pipistrellus subflavus*), little brown myotis (*Myotis lucifugus*), and northern myotis (*Myotis septentrionalis*) (MDNR 2007a). Little is known about the migration corridors used by these species. It is possible that portions of the WRA could provide a migratory pathway for any of the species above. Hoary, silver-haired, and red bats were commonly recorded as fatalities at wind projects where standardized fatality searches have been conducted (Johnson 2004, Arnett et al. 2005).

Bats typically utilize farm buildings and dead and dying trees with cavities and loose bark as roosting and maternity habitat. Bats typically use forests, riparian corridors and wetlands as feeding habitats due to higher nocturnal insect densities in these areas. In the WRA, these habitats are present. Due to the lack of data concerning bat/turbine interactions, actual effects to bat populations with the WRA cannot be predicted (Keely 2001).

6.4 Avian Migration and Potential Occurrence in the Project Area

The Flat Hill I WRA lies within the Mississippi Flyway, which is heavily utilized by numerous species of birds during the spring and fall migrations. These include many species of waterfowl (i.e., ducks, geese and swans), shorebirds, songbirds, and raptors. Waterfowl, raptors, shorebirds, and grassland bird species are likely to migrate through the area in the vicinity of the project on a seasonal basis. Bird/turbine interactions are determined by a number of factors including visibility and weather, with increased bird and turbine interactions occurring at night and in inclement weather. Inclement weather and low cloud ceilings force migrating birds to fly at reduced altitudes, thereby putting them at greater risk for adverse interactions with turbines, turbine towers and support infrastructure (National Wind Coordinating Committee [NWCC] 2004).

Based on the number and types of wetlands present in the vicinity of the WRA, particularly the eastern portion of the Flat Hill I WRA, these habitats are likely to provide nesting and migration stopover habitat for large numbers of breeding waterfowl or shorebirds. Most migrating waterfowl fly several thousand feet above ground level (e.g., 2,000 feet for Canada geese), which is well above the rotor swept area of the turbines. The greatest risk would be for those birds that stop over in the vicinity of the project area, since they would be flying at lower altitudes while ascending and descending. However, there is no literature that indicates that waterfowl are particularly vulnerable to collisions with tall, manmade structures. For example, of the avian kills documented at the Buffalo Ridge Wind Resource Area in southern Minnesota, only one was a duck (Osborn et al. 1998).

Observed areas of shrub/woodland habitats within the WRA serve as important habitat for resident and migratory bird species. The diversity of raptor species possibly occurring within the vicinity of the project area coupled with known migration routes suggests there is the potential for raptors to migrate through the WRA.

There have been no large fatality events of nocturnal migrant passerines (defined as over 50 individuals in one night), recorded at existing wind projects (Erickson et al. 2002, NWCC 2004). Erickson et al. (2002) summarized information on fatalities recorded at wind power projects where standardized fatality monitoring was conducted and estimated that nocturnal migrants comprised approximately 50 percent (estimated range of 34 to 59 percent) of the fatalities at new wind projects. Only two small fatality events have been documented, one with 14 nocturnal migrants at Buffalo Ridge in Minnesota, and one with 33 migrants at the Mountaineer Wind Energy Center in West Virginia near a well-lit substation (Erickson et al. 2002, Kerns and Kerlinger 2004). In West Virginia, the substation lights were subsequently turned off, and no further events were recorded. In both cases, weather conditions may have also been a factor.

Although passage rates of migrating birds have been estimated by numerous radar studies (for example, Mabee and Cooper 2001, 2004; ABR 2004), only a few studies have attempted to relate estimated passage rates to estimated collision rates (McCrary et al 1986, Mabee and Cooper 2001, Erickson et al. 2003, 2004). These studies indicated that the number of fatalities compared to the number of birds passing over

the turbines was extremely low. McCrary et al. (1986) estimated that 75 million migrants passed over the San Geronio wind project and that 0.009 percent (6,800) of those resulted in fatalities. Erickson et al. (2004) estimated that of the approximately 3.5 million migrants that passed over the Buffalo Ridge, Minnesota wind power project, only a few hundred migrants were killed by turbines. Similarly, only a small number of the several hundred thousand to 1 million migrants passing over the Stateline Wind Project's 454 turbines resulted in fatalities (Erickson et al. 2004). Radar studies of nocturnal migration at the Stateline and Vansycle Ridge WRA in Oregon during the spring and fall of 2001 recorded 85 percent (spring) to 94 percent (fall) of targets (birds) observed flew at altitudes above proposed turbine heights (Mabee 2004).

6.5 Impact Assessment and Recommendations

Impacts are anticipated to be variable (low to high) for state and federally listed wildlife species and other wildlife species in the WRA. This is due to the natural setting and diversity of high quality resources located within and in the vicinity of the WRA, the diversity of wildlife species and subsequent utilization of the WRA, occurrence records, and correspondence with the MDNR and USFWS. The impacts are dependent on turbine, access road, and transmission line locations.

Several state listed species and several other rare birds are known or considered highly likely to occur in the vicinity of the WRA. Due to potential habitat loss and human disturbance during construction, Tetra Tech recommends habitat mapping of the WRA. The MDNR has recommended that wind turbines not be placed within at least $\frac{1}{4}$ mile, and preferably, $\frac{1}{2}$ mile, of prairie remnants if avoidable.

Due to the known presence of several Greater prairie chicken booming grounds within the Flat Hill I WRA (see **Figure 5**), the MDNR highly recommends that no construction work be conducted in the area from April 1 – May 15 in order to avoid disturbing prairie chickens during the critical booming period. Greater prairie chicken surveys may be necessary in order to obtain project approvals through the MDNR, USFWS, and Public Utilities Commission. In addition, other species of prairie grouse with sensitivities to disturbed sites should be taken into consideration during site planning.

Several rare butterflies have been documented within the native prairies within and in the vicinity of the Flat Hill I WRA. If project planning within any prairie areas are possible, potential impacts to the rare butterflies identified will need to be addressed through applicable survey protocol as approved by state and federal agencies.

Because of the natural setting and diversity of wildlife habitats in the WRA, and due to the lack of knowledge of bird interactions with turbines in northwestern Minnesota, Tetra Tech recommends conducting point counts in the late spring and summer of 2008. This information could then be extrapolated to future expansion areas delineating areas or habitats with lower bird use (and therefore, risk), and identify more favorable sites for wind turbine placement.

Raptor nest surveys and monitoring of avian use and occurrence in appropriate seasons prior to project construction are generally recommended by USFWS. A spring survey for active raptor nests throughout the WRA to document the intensity of resident raptor use is also recommended to identify sites where effects could be further minimized as practicable. Such surveys are best conducted prior to project development if the results are to be used to either make decisions regarding development or document changes in use resulting from the facility's construction.

Because bat use is unknown, and potentially suitable habitat for bats is present in the shrubby areas and near draws, lakes and wetlands, Tetra Tech recommends that a May and June acoustic survey be conducted to gather information on bat passage rates in the various habitats of the WRA. If the results clearly indicate that use is higher in some types of habitat and/or landforms, this information can be used to site turbines in areas with lower bat use. The lakes and wetlands are likely to produce large numbers of insect prey for bats.

Figure 5. Flat Hill I WRA Greater Prairie Chicken Booming Ground Map

According to the MDNR, several mussel species of concern have been documented in the Buffalo River in the vicinity of the Flat Hill I WRA (MDNR 2007b). Erosion and sediment control practices should be implemented and maintained for any work conducted near the river or stream areas.

To reduce the potential for adverse effects to raptors using the WRA, collection and transmission lines should be buried to the extent practicable. Where overhead lines are constructed, the USFWS recommends that potential for bird electrocutions and bird strikes be reduced through implementation of measures outlined in “Suggested Practices for Raptor Protection on Power Lines” (Edison Electric Institute 1996) and “Mitigating Bird Collisions with Power Lines: The State of the Art in 1994” (Edison Electric Institute 1994), or more recent versions if available.

The construction of turbine pads, access roads, associated buried electrical collection system, overhead transmission line, substation, and operations and management building would result in temporary, construction related, and long-term loss of habitat that would result in wildlife to be temporarily displaced from the WRA during construction. Displaced wildlife would likely temporarily or permanently relocate to nearby unaffected areas. Potential wildlife issues, other than state or federally listed species, within the WRA are summarized on **Table 6-3**.

Table 6-3. Summary of Potential Wildlife Issues

Issue	Potential ¹			Comments
	H	M	L	
Potential for Raptor Nest Sites		X		Tree nesting habitat was observed within both WRA as well as adjacent lands. Marsh and grassland habitat in the vicinity of the WRA could also provide habitat for ground-nesting species.
Potential for Protected Species to Occur	X			Several federal and state listed species have been reported to occur within the Flat Hill I WRA. It is highly possible that other listed species not reported may occur within the WRA.
Potential Migration Pathways		X		The WRA provides some migratory stopover habitat (wetlands, grassland, forest, etc.) for waterfowl, raptors, and songbirds, primarily along the eastern portion and eastern adjacent lands to the Flat Hill I WRA. Larger water bodies including several tailings ponds and other wetland areas according to the NWI maps reviewed are located within both the Flat Hill I WRA. Since the site visit was conducted in a single day and no point counts have been conducted, use by migrants during the spring and fall migration periods is unknown but may be large at times.
Potential Raptor Flight Collisions		X		Use of the WRA by raptors is likely to occur during migration periods in the spring and fall. Some raptors would be expected to reside in project area during spring and summer.
Potential for Raptor Prey Species		X		No large concentrations of prey species were observed during the site visit however small mammals and other prey are likely present in wetlands, marshes and forest areas.
Uniqueness of Habitat in Project Area		X		Habitat in the project area is not unique to the surrounding landscape or region. However, the Flat Hill I WRA is adjacent to several native state protected prairie natural areas.
Potential For Use by Bats		X		Woody vegetation that would provide suitable maternity and roosting habitat is present throughout the WRA. Tailings ponds and wetlands provide high quality foraging habitat as they produce large numbers of insect prey.
Potential for Federal and State Game Issues			X	White-tailed deer, and ruffed grouse, are common game species within the WRA. Habitat loss will marginally impact these species.

¹ Potential Ratings: H = High; M = Medium; and L = Low

7.0 ARCHAEOLOGICAL, CULTURAL, AND TRIBAL RESOURCES

The heritage of the WRA is manifested in its archaeological record, architectural history, and in its Native American and European-American communities. These resources represent aspects of the physical environment that relate to culture, society, and institutions that bond communities together and link them to their environmental and social surroundings. In this context, cultural resources can include but are not limited to prehistoric and historic archaeological sites, buildings, structures, objects, districts, natural features, and biota; all of which can be deemed significant to a culture or community for scientific, social, traditional, religious, or other reasons.

Tetra Tech conducted a record search and review of existing records contained at the Minnesota State Historic Preservation Office (SHPO) in the Minnesota Archaeology Inventory database and in the Standing Structures Inventory database. The records search was conducted to determine if significant archeological, architectural history, or tribal resources have been documented within the vicinity of the proposed project and, if present, identifies the likelihood of impacts to these resources from project development. Search parameters for the cultural resources records search are listed in **Table 7-1**.

Table 7-1. Search Parameters for Cultural Resources Records Inventory

Inventoried Records	Search Parameters
Archaeological Sites	1 mile from the Flat Hill I WRA and associated proposed transmission line corridor
Architectural History Properties	2 miles from the Flat Hill I WRA and associated proposed transmission line corridor
Previous Surveys	Within the Flat Hill I WRA

7.1 Cultural History

Minnesota's prehistory has been divided into three broad cultural periods: Pre-Contact (9,500 B.C. to A.D. 1650), Contact (A.D. 1650 to 1837), and Post-Contact (1837 to 1945). The Pre-Contact Period includes several traditions such as Paleoindian (9,500-7,000 B.C.), Archaic (7,000-500 B.C.), Woodland (500 B.C.-A.D.1650), Plains Village (A.D.900-1300), Mississippian (A.D.1300 to 1650), and Oneota (A.D.1300-1650 B.P.). By A.D. 1650, the first French explorers had reached Minnesota, ending Minnesota's prehistory and initiating the Contact Period. This period is further broken down based on Euro-American influences in the state including: French (1650-1803); British (1763-1816); and the Initial United States Presence (1803-1837). At that time, the Native American tribes present in the state included the Chiwere Siouan language groups, Eastern Dakota, Western Dakota, and Ojibwe Indians, all of which were in constant interaction with Euro-Americans in search of animal furs. The Contact Period lasted until around 1837 when Native Americans were forcibly divided into communities and put onto reservations while Euro-American settlement expanded and new ways of life (i.e., lumbering and intensive agriculture) overtook the region.

The Post-Contact Period began with the intensive settlement of Minnesota by Euro-Americans and the resettlement of Native Americans to reservations. The waterways in the state initially served as the primary means for commerce, travel, and sustenance for the first Euro-Americans to permanently settle the state and played a major role in the development of the state by providing a means to transport raw materials from Minnesota on barge traffic down the Mississippi River from the port at Duluth to industries in the eastern United States. Three of Minnesota's earliest Post-Contact traditions directly related to the early use of waterways for transportation and include the Early Agriculture and River

Settlement (1830s-1870), St. Croix Triangle Lumbering (1837-1920), and Settlement and Fishing on Minnesota's North Shore (1854-1930). As railroad transportation grew and expanded throughout Minnesota, so did the settlement of these previously unpopulated areas and with it came more intensive agriculture (Railroads and Agricultural Development [1870-1940]), lumbering (Northern Minnesota Lumbering [1870-1930]), tourism and recreation (North Shore Tourism and Recreation [1870-1945]), development of large urban centers (Urban Centers [1870-1945]) and the mining (Iron Ore Industry [1880s-1945]). These cultural resources represent some of the state's most interesting and complex cultural resources.

7.2 Environmental Background

According to Cummins and Grogal (1981), the Flat Hill I WRA lies on the Glacial Lake Agassiz landform region, which is characterized by a level, uniform, and featureless landscape; broken only by wetlands, meandering waterways, and old beach ridges.

The Original Public Land Surveyor Maps from 1870 and 1872 indicated that the Flat Hill I WRA was mostly prairie with some wet prairie at the time of initial development. The only timber in the area was located along the Buffalo River. The WRA is currently agricultural cropland and pasture with some timber along drainages and at farmsteads.

7.3 Documented Cultural Resources

Cultural Resources Surveys

At least four cultural resources surveys have been conducted within the search area described in **Table 7-1**. All of these surveys involved background or historical research and field surveying. Two of these surveys were conducted in the late 1970s and included improvements along Trunk Highways 9 and 10 which transect the Flat Hill I WRA. Additional surveys performed in the Flat Hill I WRA included a bridge replacement on Trunk Highway 10 over the Buffalo River. Overall, the Flat Hill I WRA has not been intensively surveyed for cultural resources. Cultural resources previously documented within the WRA are summarized on **Table 7-2**.

Archaeological Sites

A total of 20 archaeological sites have been documented within the search area discussed in **Table 7-1**; **Figure 6**. None of these sites are currently located within the Flat Hill I WRA. Of the 20 sites located, 17 are Pre-Contact lithic or artifact scatters, 1 is Pre-Contact/Post-Contact artifact scatter, and 2 are Post-Contact artifact scatters, with one containing a structural ruin. None of the 20 archaeological sites have been evaluated for listing on the National Register of Historic Places (NRHP). The majority of these sites are clustered to the east and west of the Flat Hill I WRA. A preliminary inventory of the unevaluated sites in the WRA resulted in the identification of two major site types: lithic scatters and artifact scatters.

At this time, these sites are not within the Flat Hill I WRA and no additional work appears to be necessary for these sites. However, if project plans do change and these archaeological sites are included in the WRA, then a more intensive review of these unevaluated sites will be needed to determine significance and the potential for impacts from project development. Once final locations for turbine footings and transmission facilities have been chosen, a more intensive look at site records will help determine if impacts are likely; ground-truthing of sites may be necessary if adequate site location information is absent from the records. If impacts to sites can be avoided, no further evaluation is needed.

Architectural History Properties

A total of 32 architectural history properties have been identified within the Flat Hill I WRA and in the search area discussed in **Table 7-2**; **Figure 6**. Of these properties, 25 have not been evaluated for listing on the NRHP and 7 are listed on the NRHP. The properties listed in the search area of the Flat Hill I WRA are located in the Buffalo River State Park, which is located 0.5 miles from the southeastern edge of the WRA. The park was a WPA (Works Progress Administration) project likely constructed between 1935 and 1940 and is listed on the NRHP with additional contributing properties in the park including the

parking lot, swimming beach, latrine, well house, bath house, and residence with a garage. These listed properties may require further evaluation efforts if they are found to be within the area of potential effects for visual effects.

National Register Eligible Properties

According to SHPO file search of archaeological sites and architectural history properties performed on November 30, 2007, no National Register Eligible Properties have been identified within the Flat Hill I WRA.

Table 7-2. Cultural Traditions Previously Documented in Study Area.

Cultural Tradition	Time Span	Characteristics
Archaic	7,000-500 B.C.	Transitional period between mobile hunter-gatherers and semi-permanent settlements. Subsistence and movement patterns tied to seasonal availability of resources
Woodland	500 B.C.-A.D.1650	Introduction of ceramic technology and cultivated plants. Subsistence and movement patterns tied to seasonal availability of resources. Mound construction and elaborate mortuary practices. Extensive trade networks
Post-Contact	A.D. 1837-1945	The Post-Contact cultural resources observed in the study area are likely associated with the Railroads and Agricultural Development (1870-1940) tradition. Such resources in this area were likely attributed to farmsteads.

Figure 6. Flat Hill I WRA Cultural Resources Map

7.4 Impact Assessment and Recommendations

Given the moderate number of previously documented archaeological sites and architectural history properties in the project area, it is likely that undocumented cultural resources exist within the project area. Tetra Tech recommends conducting a Phase I pedestrian survey with subsurface testing in areas with low surface visibility or an increased potential for buried archaeological sites along the proposed turbine strings, associated access roads, and transmission line corridors. In addition, a more detailed look at the previously documented cultural resources, which have not been evaluated in terms of NRHP eligibility, is recommended to determine significance and potential impacts from project development. Avoidance of archaeological sites and architectural history properties is always the preferred mitigation method; however, if sites cannot be avoided, further investigations may be needed to evaluate significance and recover data.

It is also strongly recommended that consultation with the Minnesota SHPO be initiated specifically regarding any adverse visual effects the turbines strings and transmission lines may have to NRHP listed architectural properties in the vicinity of the Flat Hill I WRA. Current project plans revealing the approximate location of the turbines and transmission lines and the estimated height of these structures should be presented to the SHPO in an attempt to mitigate potential adverse visual effects to these historic properties.

It is also recommended that Native American tribes with an interest in this region be afforded an opportunity to comment on project plans and the potential impacts that project plans may have to areas with cultural or religious significance. Native American tribes known to have an interest in west-central Minnesota include, but are not limited to: Cheyenne-Arapaho Tribes of Oklahoma, Chippewa Creek Tribe of the Rocky Boy's Reservation, Fort Peck Tribes, Leech Lake Band of Ojibwe, Lower Brule Sioux Tribe, Lower Sioux Indian Community of Minnesota, Menominee Indian Tribe of Wisconsin, Mille Lacs Band of Ojibwe Indians, Minnesota Indian Affairs Council, Omaha Tribe of Nebraska, Northern Cheyenne Tribe, Ottawa Tribe of Oklahoma, Prairie Band Potawatomi Nation, Prairie Island Indian Community, Shakopee Mdewakanton Sioux Community of Minnesota, Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, Spirit Lake Nation, Turtle Mountain Band of Chippewa, Upper Sioux Community of Minnesota, and the White Earth Tribal Council.

8.0 COMMUNITY ISSUES AND LAND DEVELOPMENT CONSTRAINTS

This section presents an analysis of community issues and land development constraints as they relate to the development of the Flat Hill I WRA in Clay County, Minnesota.

8.1 Land Use and Zoning

Based on 2000 US Census Bureau (2006a) data, Clay County encompasses 1,053 square miles, averaging 48.7 persons per square mile. The statewide average population density was 61.8 persons per square mile, covering 87,014 square miles. Clay County is located in west-central Minnesota, and land use in the WRA is predominately agricultural land. Clay County is located adjacent to Wilkin County, which is to the south. North Dakota is located to the west of Clay County, with Becker and Otter Tail counties on the east, and Norman County on the north.

The Flat Hill I WRA is located in a rural setting with scattered residences northeast of the town of Glyndon, and northwest of the town of Hawley. The area is bisected by Minnesota Highway 10, running east-west, and Highway 9 South, running north-south. The WRA includes 11.5 square miles of Moland Township, 24 square miles of Spring Prairie Township, 8.5 square miles of Riverton Township, 3 square miles of Lowing Township, and 1 square mile of Keene Township.

The majority of the Flat Hill I WRA is zoned as "Agricultural Preservation District" (AgP-1), (Clay, 2005). Portions of the central Flat Hill I study are identified as "Flood Hazard Zones", including the floodway and flood fringe associated with the Buffalo River.

Clay County does not have specific development rules for wind projects; however, in the past they have been handled with conditional use permits. In addition, Spring Prairie Township and Riverton Township have adopted their own zoning ordinances in addition to the Clay County Planning and Zoning ordinances for zoning requests (Conditional Use Permits, variances, etc.). All zoning requests must be granted by both Clay County and the Township for these areas (Clay County 2007). Table 8-1 identifies and explains the permit requirements for Clay County (Clay County 2007).

8.2 Floodplains

Federal Emergency Management Agency (FEMA) maps were reviewed to determine whether 100-year or 500-year floodplains are present in the WRA. Mapped floodplains were identified within Clay County, and the WRA appears to intersect floodplains (FEMA 2007). The Buffalo River as well as several intermittent streams traverse the Flat Hill I WRA. Several prairie wetlands appear to be within or near the WRA. Floodplain maps depicted the FEMA 100-year floodplain for the Flat Hill I WRA are depicted in **Figure 7**.

Floodplains will require further evaluation from a regulatory perspective. During periods of intense rainfall and during spring runoff, many of the upland drainage bottoms may exhibit temporary flooding. Design of permanent structures (e.g., turbine array, access roads, and transmission lines) placed in these drainage bottoms should consider flooding possibilities and these structures should be engineered and constructed to withstand temporary inundation and forceful currents without significantly obstructing stream flow.

Figure 7. Flat Hill I WRA Floodplain Map

8.3 Noise

Noise is generally defined as unwanted or excessive sound. Some land uses are considered more sensitive to intrusive noise than others due to the type of activities typically involved at the sensitive human noise receptors. Specifically, sensitive human noise receptors normally include residences, schools, libraries, religious institutions, hospitals and nursing homes, daycare centers, and other businesses within the vicinity of the WRA. Potential noise receptors in the WRA include scattered rural residences, some located within a few feet of the WRA boundaries.

Managing noise is complicated by the varied character and amount of sources in a particular area. The ambient sound pressure level in a particular region is comprised of a variety of natural and manmade sources. Sound levels are determined by small variations in air pressure, and these pressures are referenced to a logarithmic scale in the units of decibels. Human response to sound is a function of the magnitude of pressure variations and the frequency distribution of the sound energy (MPCA 2007).

Community noise levels are measured in terms of the A-weighted decibel (dBA) scale, which was developed to approximate the human ear's sensitivity to certain frequencies by emphasizing the middle frequencies and de-emphasizing lower and higher frequencies (MPCA 2007). This scale, expressed as dBA, best correlates the human response to sound and is commonly used as a descriptor for ambient sound levels. The threshold of human hearing is about 10 dBA, while noise above 140 dBA can cause damage to hearing after just one exposure (MPCA 2007). **Table 8-1** presents typical sound levels for common conditions or activities referenced to the dBA scale.

Table 8-1. Typical Sound Levels for Common Conditions and Activities

Type of Noise	Sound Level (dBA)
Rifle	163 dBA
Chainsaw; Hammer on Nail	120 dBA
Tractor	90 dBA
Construction of Wind power project	85 to 88 dBA (distance of 50 feet)
Freeway Traffic	70 dBA
Refrigerator	50 dBA
Operation of Wind power project	45 to 50 dBA (distance of 1,000 feet)
Quiet Residential Area	40 dBA
Quiet Bedroom at Night	30 dBA

Source: League for the Hard of Hearing 2006; Tipler 1991

Presently, noise in the WRA is dominated by traffic on local roads, and agricultural and equipment operations. The heaviest traveled roadways near the WRA include US Highway 10 and MN Highway 9 South. Secondary noise in the area persists from general low-density, rural neighborhoods, and farming-related activities. Ambient noise levels in the WRA are typical of noise levels experienced within a predominantly rural area.

Based on information presented in **Table 8-1**, noise levels at the WRA would be expected to be in the 45 to 88 dBA range, or moderate. The wide variation is primarily a result of wind speed and direction; the lowest levels typically occur late at night under calm conditions, while the higher levels typically occur during the daytime coinciding with construction or operation activity within the WRA. No federal noise standards directly regulate environmental noise related to construction or operation of the WRA. With regard to noise exposure and workers, Occupational Safety and Health Administration regulations safeguard the hearing of workers exposed to occupational noise, which may be applicable for construction, operation, and maintenance of the facility. The National Safety Council recommends no

more than 85 dBA for eight hours of exposure as the safe limit for farm operations (National Safety Council 2007). No local noise regulations were identified during the investigation.

The Minnesota Pollution Control Agency has a statewide noise regulation (Minn. Rule 7030) which specifies daytime and nighttime noise levels that can not be exceeded by any source (MPCA 2007). These standards are consistent with speech, sleep, annoyance, and hearing conservation requirements for receivers within areas grouped according to land activities by the noise area classification (NAC). For NAC for household units (including farm houses) is identified as NAC 1. The daytime standards state that a sound level of 60 dBA may not be exceeded for more than 50 percent of the time for a one hour survey, and a sound level of 65 dBA may not be exceeded for more than 10 percent of the time for a one hour survey. The nighttime standards state that 50 dBA may not be exceeded for more than 50 percent of a one hour survey, and 55 dBA may not be exceeded for more than 10 percent of a one hour survey (MPCA 2007). **Table 8-2** presents the regulated noise levels from the State of Minnesota statutes. The L50 is the noise level exceeded for 50 percent of the time during any measurement duration, and represents the median sound level. The L10 is the sound level exceeded for 10 percent of the time during any measurement duration.

Table 8-2. State of Minnesota Noise Standards [db(A)]*

Noise Area Classification (as Identified in Minn. Rule 7030.0050)	Daytime	Daytime	Nighttime	Nighttime
	L50	L10	L50	L10
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

* A-weighted decibels

Source: Minnesota Rule 7030.0040

Noise issues associated with wind energy facilities typically include both construction and operation noise. Construction noise is temporary (short-term) and consists of increased noise levels associated with construction activities. Generally, noise generated from construction of wind energy facilities yield maximum noise levels of 85 to 88 dBA at a distance of 50 feet. Increased traffic on area roadways would generate additional noise. Operational noise (long-term) includes mechanical noise from the gearbox and aerodynamic noise from the rotor blades. Generally, an operating wind energy project at a distance of 750 to 1,000 feet emits sounds at a level comparable to a kitchen refrigerator or a moderately quiet room (45 to 50 dBA). Aerodynamic noise results from turbine blades moving through the air. Blade tips and back edges are currently designed to minimize aerodynamic noise. Noise from moving blades is low frequency, and is therefore less obvious to the human ear.

8.4 Aesthetics

The visual setting of the WRA is low-density, predominantly rural, consisting of an altered landscape with views ranging from scattered residences in an agricultural setting to roadways. The characteristic natural landscape of the WRA varies from flat topography to the marked elevation increases associated with the Glacial Agassiz beach ridges in the eastern portion of the Flat Hill I WRA. Intermittent drainages enter the WRA, and some scattered wetlands are present throughout the WRA. The color of the landscape generally contains brownish-yellow fields of croplands throughout the WRA with some wooded areas present in the northeastern portions of the Flat Hill I WRA and surrounding the Buffalo River in the Flat Hill I WRA.

Visual sensitivity is dependent on viewer attitudes, the types of activities in which people are engaged when viewing the site, and the distance from which the site will be seen. Overall, higher degrees of visual sensitivity are correlated with areas where people live, are engaged in recreational outdoor pursuits, or participate in scenic or pleasure driving. Conversely, visual sensitivity is considered low to moderate in

industrial or commercial areas where the scenic quality of the environment does not affect the value of the activity.

The proposed project will consist of approximately 133 wind turbines arranged within the Flat Hill I WRA. The turbines will be visible for many miles given their location on the generally flat topography, and their presence will change the visual character of the area from cropland to partially industrial land. The turbines may introduce a strong vertical element to the viewshed, creating strong contrast. The perceived dominance of the turbines on the landscape depends on the angle of the sun, times of day and year, and weather conditions (i.e., turbines would reflect the sun at different times of the day, depending on time of year and weather conditions). During times of the day and year when the angle of the sun is lower, sunlight striking at a lower angle on the side of the turbines would tend to make them more visible and prominent than when the sun is more directly overhead. Furthermore, if some or all of the turbines require lights on top of the nacelle for aircraft safety, it would cause a change in views from nearby residences and roadways.

Visual impacts would be greatest for those residences located nearest to the WRA, especially residences and visitors to Buffalo River State Park, and the natural areas present to the east of the WRA. Visual impacts would be greatly reduced with significant distance from the wind facility. Residences and visitors to Buffalo River State Park and other nearby natural areas may have strong views about the presence of wind turbines in their viewshed.

8.5 Population and Local Economy

In 2000, Clay County had a population of 51,229; an increase of 1.6 percent from the 1990 census; and in 2006, the estimated population was 54,476, an increase of 6.3 percent from the 2000 census. Statewide, Minnesota's population in 2000 was over 4.9 million, an increase of 12.4 percent from the 1990 census; and in 2006, the estimated population was more than 5.1 million, an increase of 5 percent from the 2000 census.

The economic base of Clay County consists primarily of management, professional, and related occupations (31.9 percent); sales and office occupations (27.9 percent); and educational, health, and social services (27.4 percent). In comparison, the economic base of Minnesota consists primarily of management, professional, and related occupations (35.8 percent); sales and office occupations (26.5 percent); and 20.9 percent in educational, health, and social services (US Census Bureau 2007a).

8.6 Environmental Justice

The proposed project would be located in Clay County in west-central Minnesota. Minority populations and low-income populations are discussed below.

US Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (59 CFR 7629, 16 February 1994) directs federal agencies to "make...achieving environmental justice part of its mission" and to identify and address "...disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations." This section identifies any minority and low-income populations that may be affected by the proposed project.

Minority populations are persons of Hispanic or Latino origin, Blacks or African Americans, American Indians or Alaska Natives, Asians, and Native Hawaiian and other Pacific Islanders. Minority populations for 2000 are identified in **Table 8-3**. The Council on Environmental Quality (CEQ) identifies these groups as minority populations when either (1) the minority population of the affected area exceeds 50 percent or (2) the minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis (CEQ 1997). As shown in **Table 8-3**, the proposed project is not expected to create disproportionately high or adverse human health or environmental effects on the minority population.

The two largest minority groups reported in Clay County in 2005 were persons of Hispanic or Latino origin (3.3 percent) and American Indian and Alaska Native persons (1.6 percent), followed by Asian persons (1.1 percent), persons reporting two or more races (1.1 percent), and black persons (0.7 percent).

Compared to the state, Clay County has a minority population totaling 6.8 percent, whereas Minnesota's minority population totals 12.6 percent (US Census Bureau 2007a).

Table 8-3. Minority Populations 2005

Minority Group	Clay County	State of Minnesota
Total Population	54,476	5,167,101
Percent: White persons	95.4%	89.9%
Percent: Minority, composed of*	6.8%	12.6%
Persons of Hispanic or Latino origin	3.3%	3.6%
American Indian and Alaska Native persons	1.6%	1.2%
Black or African American persons	0.7%	4.3%
Asian persons	1.1%	3.4%
Native Hawaiian and other Pacific Islander persons	0.1%	0.1%

Source: US Census Bureau 2007a

*Totals may not add to Percent Minority because of reporting classifications and/or the value is greater than zero but less than one-half unit of measurement

According to the Department of Housing and Urban Development, low-income neighborhoods are those where more than 50 percent of the population has an income less than 50 percent of the median per capita income for the whole community. Low-income populations for 2004 are illustrated in **Table 8-4**.

Low-income populations are defined by environmental justice guidance by using the statistical poverty threshold of the US Census Bureau. In 2004, the poverty-weighted average threshold for a family of four was \$19,307 and \$9,645 for an unrelated individual (US Census Bureau 2007b). The national poverty level was over 12 percent. To be classified meaningfully greater, CEQ recommends a formula describing the environmental justice low-income threshold as being 10 percent above the national rate (or 22.7 percent) as applied to local poverty rates (CEQ 1997). As shown in **Table 8-4**, the proposed project is not expected to create disproportionately high or adverse human health or environmental effects on low-income population.

Table 8-4. Low-Income Populations 2004

Jurisdiction	Percent Below Poverty Level
United States	12.7%
State of Minnesota	8.1%
Clay County	9.7%

Source: US Census Bureau 2007b

8.7 Traffic and Aviation

Major highways near the WRA include US Highway 10 and MN Highway 9 South that generally traverse Moorhead, Glyndon, Barnsville, and other nearby towns. US Highway 10 and MN Highway 9 South bisect the Flat Hill I WRA. Access to the Flat Hill I WRA is best off MN Highway 9.

Construction of the proposed project would increase traffic on local roads to the site; possibly causing temporary impacts while transporting equipment to the site. Construction contractors may need to obtain permits for oversize or overweight vehicles from the Minnesota Department of Transportation. Operation of the proposed project is not expected to result in any significant traffic issues on area highways or state roads. Operation of the proposed project is not expected to result in any significant traffic issues on the area highways or local roads. A Size and Weight Permit from the Minnesota Department of Transportation may be needed if equipment hauled to the site exceeds a maximum capacity (**Table 9-1**).

There are no major airports near the WRA. Smaller airports in the surrounding area include Moorhead Municipal Airport, approximately 6 miles west of the WRA; Fargo International Airport, approximately 16 miles west-northwest of the WRA; and Hawley Municipal Airport, approximately 8 miles east of the WRA. The closest known airport to the WRA is in Moorhead, Minnesota. Given the distance between the project area and the airport, Federal Aviation Administration (FAA) construction regulations or compliance issues may be needed (**Table 9-1**).

9.0 ENVIRONMENTAL PERMITTING

The mix of permits that would apply to the Project depends on several factors, such as final location and layout, generating and transmission capacity, presence of threatened or endangered species, and impacts to water resources. **Table 9-1** identifies federal, state, and local permits that may to be required in conjunction with project development based on the desktop analysis performed for this report. A summary of permitting requirements is presented in this section.

Since the project is not located on federal land and federal funding has not been proposed as a funding source, federal review of the Project will be limited to the issuance of individual permits for impacts to natural resources. Review under the National Environmental Policy Act (NEPA) and interagency consultation (e.g., Section 106 of NHPA, Section 7 of Endangered Species Act) would only be required if project impacts require extensive review, such as for individual permits from USACE or an Incidental Take Permit from the USFWS. Coordination between federal and state regulatory authorities may also reduce the amount of federal review of the project. For example, Minnesota has developed one joint application to be submitted to USACE as well as the state and counties for impacts to rivers, lakes, streams, and wetlands.

State permitting of the Project will be driven by the Public Utilities Commission (PUC) Site Permit, which is developed with substantial input from the Minnesota Department of Commerce (DOC). Under current regulations, wind projects with a nameplate capacity greater than 5 MW are considered Large Wind Energy Conversion Systems (LWECS), and must apply for a Site Permit pursuant to Minnesota Statutes Chapter 216F and Minnesota Rules Chapter 7836. The Site Permit requires a comprehensive

assessment of impacts on environmental resources and satisfies the Minnesota Environmental Policy Act review process (Minnesota Rules Chapter 7836.0500, Subpart 7).

Although the PUC has the ultimate authority to issue the Site Permit, recommendations on each stage of the process from the DOC weigh heavily in the approval decision. The DOC issues a written statement about the completeness of the application, develops the draft Site Permit, and accepts public comments throughout the process. The PUC oversees the process and posts project documents on its online docket system. The PUC also reviews applications for Certificates of Need in conjunction with the Site Permit review for projects that require a Certificate of Need (i.e., projects over 50 MW).

Conditional Use Permits from the counties are not required in addition to the state Site Permit for projects under state jurisdiction (i.e., projects over 5 MW). Input from the county and standards set forth in county regulations are considered by the DOC and PUC during the development of the Site Permit. The PUC and DOC are currently developing new rules to delegate approval of projects with a nameplate generating capacity of 25 MW or less to counties under a General Site Permit. The public comment period closed on October 31, 2007, and a comprehensive review of comments and standards, including for setbacks and noise limits, is expected to be released in December 2007. The standards established during this process would likely be used in Site Permits for projects over 25 MW, as well. Additional information is available from the PUC online docket for the project at <http://energyfacilities.puc.state.mn.us/Docket.html?Id=19302>.

Regulations require that the PUC issue its decision on Site Permits within 180 days of accepting a complete application. The PUC is currently considering a number of other applications for wind energy projects and may have limited staff resources for reviewing new applications. Personal communication with the PUC indicates that the PUC staff is currently still able to process Site Permits and associated Certificates of Needs within the regulated timeframes. However, the burden on the PUC staff is expected to increase as the influx of wind development into the state continues.

Coordination and consultation with other state agencies is required as part of the Site Permit process, similar to the coordinated reviews mandated for federal review processes. Consultation with the Minnesota Historical Society SHPO and archaeologist, for example, is required to determine potential impacts to historical, archaeological, and cultural resources. Other state agencies will also be responsible for issuing permits of their own for individual aspects of the Project. These include water-related permits from the MDNR and MCPA and transportation permits from MnDOT. Similarly, although Project siting may be under state jurisdiction, various county approval would also be needed for water-related (e.g., Wetland Conservation Act permits), transportation, and building permits.

Transmission facilities are permitted under separate permits. Transmission lines greater than 200 kV are always under the jurisdiction of the PUC and require a Route Permit. Proponents of transmission lines between 100 kV and 200 kV have the option of applying for the state Route Permit or for county siting and zoning permits. Transmission lines less than 100 kV are always under county jurisdiction.

9.1 Recommendations

Tetra Tech recommends engaging the DOC, PUC, MDNR, and other relevant state agencies as soon as possible to discuss permitting requirements and to begin requesting input from county planning and zoning boards. Based on Tetra Tech's experience with permitting wind projects in Minnesota, coordination with the DOC is especially important for the development of an acceptable, complete Site Permit application and to determine the conditions of the Site Permit.

The Project plan for obtaining the necessary permits should take into account the various combinations possible for siting jurisdiction, the 6-month Site Permit approval timeframe, time required to develop required studies, and possible delays due to insufficient DOC or PUC staffing capacity. For example, approval of a transmission line can occur in conjunction with the PUC Site Permit application or may be

conducted as a separate process. The Project layout, generating capacity, and transmission plans can be developed to create the optimum approach for obtaining necessary approvals by desired construction and operation dates.

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
FEDERAL							
Lead agency TBD if necessary	National Environmental Policy Act (NEPA) Review	Federal permit required, disturbance of land managed by a federal agency, interconnection with federal transmission entity	Low	Cost for preparation of studies and documentation based on level of analysis	9 to 18 months to complete an EIS; 5 to 9 months to complete an EA	Scoping period; public comment period; formal public review	NEPA requires federal agencies to integrate environmental values into decision-making by considering the environmental impacts of proposed actions and reasonable alternatives to those actions through the NEPA process. NEPA review is most commonly triggered by the need for federal review of a project (with the exception of categorically exempt actions such as nationwide permits from the USACE), disturbance of federally-managed lands, and interconnection with federal transmission entities. Additional information is available at: http://www.nepa.gov/nepa/nepanet.htm
Federal agency responsible for project review and issuing permit	Section 7 Consultation under the Endangered Species Act	Federal review of project	Low	No fee	Depends if informal or formal consultation is necessary	Public comment period prior to issuance of Biological Opinion	USFWS is required to assist other federal agencies to ensure that any action they authorize, implement, or fund, including wind energy developments, will not jeopardize the continued existence of any federally endangered or threatened species. <u>Section 7</u> requires a consultation letter with USFWS regarding the proposed project. The Environmental Protection Agency (EPA) and FAA could trigger the Endangered Species Act, but because these processes are ministerial, it is unlikely Section 7 will be required. The Section 7 Consultation Handbook is available online at http://www.fws.gov/endangered/consultations/s7hndbk/s7hndbk.htm .

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
U.S. Fish and Wildlife Service	Incidental Take Permit under Sections 9 and 10 of the Endangered Species Act	Potential impacts to federally listed species	Low	ITP Application fee of \$100; additional cost to develop HCP if needed	Dependent on unknown factors (i.e., types and numbers of listed species in the area; length of any required field studies of listed species; preparation of any required Habitat Conservation Plans)	Public comment period prior to issuance of Biological Opinion	<p><u>Section 9</u> makes it unlawful for a person to “take” a listed species. However, permits for “incidental take” can be obtained from USFWS for take which would occur because of an otherwise legal activity, such as construction of wind turbines, and which would not jeopardize the species.</p> <p><u>Section 10</u> allows for the development of “Habitat Conservation Plans” for endangered species on private lands. This provision is designed to assist private landowners in incorporating conservation measures for listed species with their land and/or water development plans. Private landowners who develop and implement an approved habitat conservation plan can receive an incidental take permit that allows their development to go forward.</p> <p>Additional Information is available online at http://www.fws.gov/endangered/hcp/index.html</p>
U.S. Fish and Wildlife Service	Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act Incidental Take Permit	Impacts to protected migratory bird species	Low	\$50-\$100 depending on permit	See USFWS process above	See USFWS process above	<p>Review and permitting process may occur simultaneously with review under the ESA. The USFWS may issue a consolidated permit for all activities related to wildlife statutes provided that the single application contains all the information required by the separate applications for each permitted activity.</p> <p>Additional information is available at: http://www.fws.gov/migratorybirds/</p>

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Federal Aviation Administration	Form 7640-1 Determination of No Hazard on Notice of Proposed Construction	Structures standing higher than 200 feet above ground level or within distances of airports and heliports specified by federal regulation (14 CFR 77.13)	High	No Fee	Submit notice at least 30 days prior to applying for construction permits	FAA application sent to multiple agencies, including DOD that will review turbine locations to determine whether or not they will affect airspace	<p>A Notice of Proposed Construction or Alteration application (FAA Form 7460-1) is filed with the FAA to assess potential impacts to airspace safety and navigation. Depending on the wind turbine layout in relation to local air traffic patterns and airport proximities, a determination of the potential hazard of constructing and operating the wind energy project is made by FAA. This includes a recommended wind turbine lighting scheme necessary to acquire a determination of no hazard. The FAA may also conduct a review of the potential impacts to military radar as part of its aviation hazard review, following the conclusion reported in the Department of Defense 2006 report on the effects of wind farms on military readiness. It is also recommended to consult individually with local airfields and military bases as part of this effort.</p> <p>Form 7460-1 and additional information regarding FAA rules and requirements is available at: https://oeaaa.faa.gov/oeaaa/external/portal.jsp</p>

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
U.S. Army Corps of Engineers	Clean Water Act (CWA) Section 404 (Joint application with MDNR)	Discharges of dredged or fill material into waters of the United States, including their adjacent wetlands	Moderate	Fees vary depending on specific impacts and specific permit needed	Depends on type of permit. Allow 1 month for fieldwork and report and application preparation; allow 60 to 120 days for application review	Public comment period if individual permit required; mitigation of unavoidable impacts is negotiated with USACE to its satisfaction in order to obtain the permit.	Section 404 of the CWA requires a permit before dredged or fill material may be discharged into waters of the United States. The permit may be a programmatic nationwide permit or may require an individual permit. Project proponent must conduct a wetlands delineation to identify and locate any wetland areas that could be impacted by the project. USACE Section 404 permitting would occur in conjunction with the NRPA Permit for the Maine DEP. See additional discussion under state permits for more information. Additional information is available at: http://www.usace.army.mil/cw/cecwo/reg/oceover.htm
U.S. Army Corps of Engineers	Rivers and Harbors Act Section 10 Permit	Impact to navigable waters of the United States	Low	None	30-60 days depending on type of permit	None noted	Section 10 of the Rivers and Harbors Act gives USACE jurisdiction over construction, excavation, or deposition of materials in, over, or under such waters, or any work which could affect the course, location, condition, or capacity of those waters. Dredging or disposal of dredged materials is covered by a Section 404 permit. Other activities or placement of structures that may obstruct navigation with the waters of the United States would require a Section 10 permit. Additional information is available at: http://www.usace.army.mil/cw/cecwo/reg/oceover.htm

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Head of federal agency engaged in a qualifying undertaking, in consultation with the Minnesota State Historic Preservation Office (SHPO)	Section 106 Consultation under the National Historic Preservation Act (NHPA)	Issuance of permit or license by federal agency or expenditure of federal funds. Potential to affect historically-significant properties listed on or eligible for National Register of Historic Places	Low	No fee; but Project proponent pays for and conducts the necessary information, evaluation, and related studies	Consultation process must be completed before federal undertaking begins; SHPO responds in 30 days to formal requests for comment; total amount of time required for consultation process depends upon scope and complexity of Project; 3 to 12 months is typical	Extent of formal public involvement depends upon scope, complexity, and number of historic resources affected by the federal undertaking	NHPA seeks to minimize adverse effects of federal undertakings on significant historic properties. Under Section 106, federal agencies must take into account the effects of their undertakings (including the issuance of licenses and permits) upon historically-significant districts, sites, buildings, structures, and objects. A historically-significant property is one that is listed in or eligible for listing in the NRHP. Section 106 is a consultative process between the federal agency and the SHPO or Tribal Historic Preservation Officer (THPO), who act on behalf of the federal Advisory Council for Historic Preservation (ACHP). Section 106 consultation may be conducted in conjunction with other federal reviews, such as those conducted under NEPA. Consultation begins during the planning phase of a project. Survey and reporting of archeological and historic architectural resources will be required during consultations. Consultation parties include the federal agency, SHPO and/or THPO (if on tribal lands as defined in §101(d)(2) of NHPA), Native American tribes who attach religious and cultural significance to potentially-affected historic properties, local government representatives, and the public. The ACHP is only directly involved in consultations for complex projects, or in situations in which the consulting parties are unable to agree on a course of action. The federal agency must provide all consulting parties a reasonable opportunity to comment on resource identification studies and recommendations.

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Head of federal agency engaged in a qualifying undertaking	Native American Graves and Repatriation Act 25 USC §3001	Discovery of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony on federal land	Low	None noted	If a discovery is made, must stop working in the affected area and contact the appropriate authorities	Indefinite	The Native American Graves and Repatriation Act (NAGPRA) describes the rights of Native American lineal descendants, Indian tribes, and Native Hawaiian organizations with respect to the treatment, repatriation, and disposition of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony, referred to collectively in the statute as cultural items, with which they can show a relationship of lineal descent or cultural affiliation. One major purpose of this statute (Section 3) is to provide greater protection for Native American burial sites and more careful control over the removal of Native American human remains, funerary objects, sacred objects, and items of cultural patrimony on federal and tribal lands. NAGPRA requires that Indian tribes or Native Hawaiian organizations be consulted whenever archeological investigations encounter, or are expected to encounter, Native American cultural items or when such items are unexpectedly discovered on federal or tribal lands. Excavation or removal of any such items also must be done under procedures required by the Archaeological Resources Protection Act (ARPA).

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Head of federal agency engaged in a qualifying undertaking	Archaeological Resources Protection Act of 1979 (16 USC §470aa-mm)	Archeological investigation on federal land	Low	None noted	Permit typically issued 30 days after application is submitted	None noted	The ARPA protects archaeological resources and sites that are located on federal property and Native American tribal lands. ARPA requires that archeological investigations on such lands be authorized by a permit issued by the pertinent federal land manager if excavations or removal of archeological materials will take place. The permit specifies information concerning the time, scope, and location and specific purpose of the proposed work and the qualifications of the developer. Requirements vary on the need for an ARPA permit, depending on the agency, type of work, and location.
Federal Energy Regulatory Commission	Market-based Rate Authorization	Interconnection with federal transmission line	Low	\$9,660; annual charge based on quantity of power sold	60 days after completed filing; unless supplemental material is required, then allow an additional 60 days	None noted	Prior to commissioning of the facility, rates must be reviewed and authorized by FERC. Power marketers get market-based rate approval through an order issued by FERC accepting the power marketer's rates. Rates are permitted to go into effect after 60 days notice to FERC and to the public (i.e., 61 days after the filing date). The developer can ask for a tariff effective date one day after filing. Then, if the application is approved before the 60 days are up, the developer is authorized to work within the approved rates.
STATE OF MINNESOTA							

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
<p>Minnesota PUC (in coordination with the DOC)</p> <p>121 7th Place E., Suite 350 Saint Paul, MN 55101-2147</p> <p>Bob Cupit 651-201-2255 Bret Eknes 651-201-2236 David Jacobson 651-201-2238</p> <p>Questions re General Site Permit Standards may be directed to Adam Sokolski (651-296-2096) at the DOC</p>	Site Permit	Wind energy facility \geq 5 MW	High	Fee to cover agency costs. Agency budget is estimated upon receipt of application.	Up to 180 days after acceptance of complete application. The permit is valid for 30 years and may be renewed upon request.	Process includes public meeting and comment period	<p>A Site Permit from the Minnesota PUC is required to construct a Large Wind Energy Conversion System (LWECS) (i.e. 5 MW or greater). This requirement became law in 1995 (Minnesota Statutes Chapter 216F). The rules to implement the permitting requirements for LWECS are found at Minnesota Rules Chapter 7836. Although the PUC has the ultimate authority to issue the Site Permit, recommendations on each stage of the process from the DOC weigh heavily in the approval decision. The DOC issues a written statement about the completeness of the application, develops the draft Site Permit, and accepts public comments throughout the process. The PUC oversees the process and posts project documents on its online docket system. The application and permit conditions require a comprehensive environmental assessment, energy projections, and decommissioning and restoration plans. The PUC will not issue a Site Permit until the applicant has obtained a power purchase agreement or other enforceable mechanism or may issue a date by which such an agreement must be obtained or the Site Permit will become null and void. The PUC will also not issue a Site Permit for which a Certificate of Need is required from PUC until the applicant obtains the Certificate, although the PUC may process the Site Permit application while the Certificate of Need request is pending before the PUC.</p> <p>Additional information is available at http://energyfacilities.puc.state.mn.us/wind.html.</p>

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Minnesota PUC	Certificate of Need	50 MW (exceptions apply to wind projects)	Moderate	Fee to cover agency costs	Review in conjunction with Site Permit	Public process in conjunction with Site Permit process	Under Minnesota Statutes 216B.243, a Certificate of Need is required for projects over 50 MW. Subdivision 8, Subpart 7 states that a large energy facility that generates electricity from wind energy conversion systems may be exempt if certain conditions are met.
Minnesota PUC	Route Permit	Transmission line \geq 100 kV (for transmission lines 100 kV to 200 kV, the project proponent has the option of deferring to county permitting)	Depends on transmission plans	Costs of reports and review	Up to one year after acceptance of application for full review and up to 6 months for alternative review	Public hearing	Under the Power Plant Siting Act (Minnesota Statutes §§ 116C.51 to 116C.69) a route permit from the Public Utilities Commission is required to build a high voltage transmission line (HVTL). A HVTL is a transmission line and associated facilities capable of operation at 100 kilovolts or more. Minnesota Rules, Chapter 4400 establish the regulations for the administration of transmission line Route Permits. The PUC conducts either a full review or an alternative review. The full review requires the preparation of an Environmental Impact Statement. The alternative review is for smaller projects as defined in Minnesota Statutes 216E.04. Additional information is available at http://energyfacilities.puc.state.mn.us/TransmissionLines.html .

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Minnesota Department of Natural Resources (MDNR)	Public Waters Work Permit (Joint application for federal, state, and local water permits)	Impact to river, lake, stream, or wetland (includes culvert installation)	High	\$150 min fee, \$1,000 max fee. Fee calculation based on project cost, length of shoreline affected, and volume of material filled or excavated.	Submit joint "Minnesota Local/State/Federal Application Forms for Water/Wetland Projects" to local government agency, area MDNR office and regional USACE office. These agencies inform the applicant of jurisdiction determination and need for permit.	None noted.	Agencies representing three levels of government (federal, state, and local) in Minnesota regulate certain activities that affect the course, current and cross-section of lakes, wetlands, rivers and streams. Minnesota has developed one joint application process for notifying all three levels of government of projects that may impact rivers, lakes, streams, or wetlands. The MDNR Public Waters Work Permit Program applies to those lakes, wetlands, rivers, and streams identified on MDNR Public Water Inventory (PWI) maps. The Wetland Conservation Act is administered at the county level and applies to nearly all wetlands not shown on the MDNR Public Water Inventory maps. USACE regulatory authority generally covers all water and wetland areas, including those that are regulated by the MDNR or subject to the Wetland Conservation Act. Additional information, including the joint application form, is available at http://www.dnr.state.mn.us/permits/water/index.html

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
MDNR	Utility Crossing License	Passage of utility over, under, or across any state land or public waters	Dependant on final project layout and transmission plan	\$500 application fee. Additional licensing fees apply and are calculated by the MDNR. Additional fees for field inspection (\$25) and monitoring may also apply.	Complete form entitled "Application for License to Cross Public Lands and Waters." Application will be sent to appropriate MDNR office to review.	None noted	Minnesota Statute 84.415 requires that a license be obtained from the Department of Natural Resources for the passage of any utility over, under or across any state land or public waters. Public waters are any water bodies (lakes, rivers and some wetlands) identified as such on the Public Waters and Wetlands Maps. These maps were produced on a county-by-county basis and are available for download from the Public Waters Inventory Maps portion of this web site, or from Minnesota's Bookstore. Additional information is available at http://www.dnr.state.mn.us/permits/utility_crossing/index.html .

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
MDNR Richard Baker 651-259-5073 Attn. Endangered Species Permits 500 Lafayette Rd., Box 25 St. Paul, MN 55155	Endangered Species Permit	Impacts to state- listed species	Low	None noted	Letter request must be submitted. Permits expire by December 31 st of the year of issuance unless otherwise specified in the permit and may be renewed.	None noted	Minnesota's endangered species law (MS 84.0895) and associated rules (Chapter 6212.1800 , 6212.2300 and 6134) impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as endangered or threatened. When taking is proposed in connection with a development project, the request can be in the form of a letter that outlines the nature of the project, location and species and number of individuals that would be taken. Before a permit can be issued, the project proponent is asked to explore project alternatives, including other locations or designs, which would avoid or minimize taking. If it is determined that there are no feasible alternatives to taking in connection with a development project, the applicant must propose compensatory mitigation to reduce the impact of the taking to an acceptable level. The magnitude of the compensation required is related to the degree of impact on the species, (for example, will the whole population at a site be destroyed, or just a few individuals'), and also to the statewide significance of the population on the site. Additional information is available at http://www.dnr.state.mn.us/eco/nhnrp/endangered_permits.html .

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
MDNR	Water Appropriation Permit	Withdrawal of more than 10,000 gallons of water per day from surface or groundwater or 1 million gallons per year	Low	\$150	Submit application form to regional MDNR office. Local governments allowed 30 days to review permit app and submit comments to MDNR.	None noted.	There are several exemptions to water appropriation permit requirements: <ul style="list-style-type: none"> • domestic uses serving less than 25 persons for general residential purposes, • test pumping of a ground water source, • reuse of water already authorized by a permit (e.g., water purchased from a municipal water system), or • certain agricultural drainage systems (check with your area hydrologist for applicability). Additional information is available at http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/permits.html .

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
MDNR	General Permit 1997-2005 for Temporary Water Appropriations	Temporary water appropriations for construction dewatering, landscaping, dust control, and hydrostatic testing of pipelines, tanks, and wastewater ponds	Moderate	\$101 water use fee if project estimated to exceed 15 million gallons	The current general permit is valid from January 1, 2007 to December 31, 2011	None noted.	<p>To be included under General Permit 1997-0005 the project must meet the following criteria:</p> <ul style="list-style-type: none"> • Projects must have a minimal potential for causing adverse environmental impacts, • Water appropriations cannot exceed 50 million gallons per year, • Water appropriations must be completed within one year from the start of pumping, • The Area Hydrologist for the county in which the project is located must be notified at least five days prior to the start of pumping. The information packet below has a form that can be used to satisfy notification requirements, • Water volumes must be measured and reported upon completion of the project. A \$101 water use report processing fee is required for projects that expect to exceed 15 million gallons. <p>An information packet and general permit application is available at http://files.dnr.state.mn.us/waters/forms/tempprojectsgp.pdf.</p>

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Minnesota Pollution Control Agency (MCPA) Beckie Olson, Permit Document Coordinator, 520 Lafayette Road N., St. Paul, Minnesota 55155-4194	General NPDES Permit for Storm Water Discharges Associated with Construction Activities (MN R100001)	Disturbance of land greater than 1 acre or MPCA determination that permit is required	High	\$400	Permits/reviews required from other state and federal agencies and local units of government must be obtained first. The current permit expires on August 1, 2008.	None noted	<p>A permit is required for any construction activity disturbing:</p> <ul style="list-style-type: none"> • One acre or more of soil. • Less than one acre of soil if that activity is part of a "larger common plan of development or sale" that is greater than one acre. • Less than one acre of soil, but the MPCA determines that the activity poses a risk to water resources. <p>The permit requires the development of a Storm Water Pollution Prevention Plan (SWPPP). Additional information is available at http://www.pca.state.mn.us/water/stormwater/storm-water-c.html. A detailed explanation of the application process is available at http://www.pca.state.mn.us/water/stormwater/storm-water-c-steps.html.</p>

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
MCPA	Industrial Stormwater General Permit	Industrial facility included in one of 11 categories of industrial activity	Low	None noted	None noted	None noted	Public (municipal) and private operators of industrial facilities included in one of the 11 categories of industrial activity defined in the federal regulations by an industry's Standard Industrial Classification (SIC) code or a narrative description of the activity found at the industrial site are required to apply for a permit. A complete list of SIC codes covered under this program is available at http://www.pca.state.mn.us/water/stormwater/sw-sic.pdf . The federal regulations can be found at 40 CFR 122.26 (b)(14)(i)-(xi). The general permit is currently under revision and is scheduled to be reissued in the Spring of 2009. Additional information is available at http://www.pca.state.mn.us/water/stormwater/stormwater-i.html .
MCPA	Water Quality Certification (WQC) under Section 401 of the Clean Water Act	Need for USACE Section 404 Permit (dredging or discharge into waters of the U.S.)	Moderate, depending on impacts to USACE jurisdictional waters	None noted	USACE forwards the joint "Minnesota Local/State/Federal Application for Water/Wetland Projects" to the MPCA if the WQC is required	None noted	During 2001-2006, the MPCA predominantly waived its Section 401 determination on projects required to obtain a Section 404 Corps permit, due to budget constraints. In late 2006, however, the MPCA determined it would no longer systematically waive its Section 401 authority on all Section 404 applications, and criteria were established to itemize the type of projects the MPCA would review in the future. Additional information on Minnesota's WQC is available at http://www.pca.state.mn.us/water/permits/index.html#401 .

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Minnesota State Historic Preservation Office (SHPO)	Section 106 Consultation	Site listed on or eligible for listing on NRHP; federal approval required.	Low	None noted	Part of environmental review during approval process	None noted	Under the National Historic Preservation Act (NHPA), consultation with the Minnesota SHPO is required if the project requires federal approval or will impact a site listed on or eligible for listing on the National Register of Historic Places (NRHP). Additional information is available at http://www.mnhs.org/shpo/ .
Minnesota State Historic Preservation Office (SHPO)	Minnesota Historic Sites Act	State agency review	High	None noted	Part of environmental review during approval process	None noted	Similar to the federal NHPA, the Minnesota Historic Sites Act establishes the State Historic Sites Network and the State Register of Historic Places and requires that state agencies consult with the Minnesota Historical Society before undertaking or licensing projects that may affect properties on the Network on the State or National Registers of Historic Places. Additional information is available at http://www.mnhs.org/shpo/ .
Minnesota Office of the State Archaeologist (OSA)	Archaeological Field Work License	Field archaeology on state lands and waters	Moderate, depending on need for archaeological investigation	None noted	Must apply prior to starting field work	None noted	Under the Minnesota Field Archaeology Act, a license from the Minnesota OSA is required for field archaeology undertaken on state lands and waters. Proposed projects are reviewed to assess the appropriateness of research methodology and to assist in identifying strategies for mitigating potential adverse effects to known cultural resources. Only professional archaeologists meeting the Secretary of the Interior's Standards for Archaeology (36 CFR Part 61) may be licensed to conduct such investigations in the state of Minnesota. A copy of the application form, including terms and conditions for licensure, can be obtained by contacting the OSA. Any human remains or burial sites found during field work are subject to Minnesota's Private Cemeteries Act. Additional information is available at http://www.osa.admin.state.mn.us/

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
MnDOT	Oversize and Overweight Permit	Travel of oversize and/or overweight vehicles on state roads	High		Processing takes 1 to 5 business days, depending on complexity	None noted	A permit is required from the MnDOT Office of Freight and Commercial Vehicle Operations for vehicles that exceed legal dimensions and weight limits. The maximum height is 13'6", the maximum width is 8'6", and the maximum length and weight varies by type of vehicle. Types of permits that are available include Single Trip and Annual Construction Machinery and Supplies. The application and permit fees can be filed online. Additional information is available at http://www.dot.state.mn.us/cvo/oversize/ .
MnDOT	Utility Access Permit	Utility construction on state roads	Depends on project transmission plans	Security deposit required	After construction is completed, the applicant must return the certificate of completion form for final inspection	None noted	An application must be submitted to MnDOT for placing, construction, and reconstructing utilities within trunk highway rights-of-way. The Long Form TP-2525 is used for the vast majority of utility placements and relocations. The Short Form TP-1723 is used for minor work, such as the installation of utility service connections, that do not cross or parallel the roadway within the trunk highway right of way. This form is also used for installing miscellaneous guy wires and anchors, to place temporary obstructions on the right of way, and to accommodate a construction project. Additional information is available at http://www.dot.state.mn.us/utility/index.html
MnDOT	Highway Access Permit	Access roads connecting to state roads	Depends on project access road and transportation plan	Security deposit required	MnDOT review time depends on complexity of request. Notification upon construction completion required.	None noted	Upon receipt of application, MnDOT researches access options, location conditions, regulatory compliance and conducts a field review. Additional information is available at http://www.dot.state.mn.us/utility/index.html

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
CLAY COUNTY							
Clay County Soil and Water Conservation District (SWCD) 1615 30 th St. Moorhead, MN 56560 (218) 287-255	Wetland Conservation Act Permit	Impact to wetlands not under state or federal jurisdiction. Jurisdiction established at Mean High Water and above (fringe wetlands)	Moderate	Contact LGU to determine if fee is required	Minnesota joint application for wetlands. Decision must be made within 60 days of receiving application.	None noted	Local government units (LGU's) implement the program established by Minnesota's Wetland Conservation Act (WCA). The LGU may be the county or the SWCD. The WCA requires anyone proposing to drain, fill, or excavate a wetland first to try to avoid disturbing the wetland; second, to try to minimize any impact on the wetland; and, finally, to replace any lost wetland acres, functions, and values. Clay County technical staff review wetlands delineations. Additional information is available at http://www.bwsr.state.mn.us/wetlands/wcaforms/index.html .
Clay County Planning and Zoning Administration 807 11 th St. N Moorhead, MN 56560 (218) 299-5002	Building Permit	Development of wind energy facility in Clay County	High	\$25 application fee and \$1/\$1000 of the cost of the turbine structure	Permit valid for period specified in the permit. Permit expires after 1 year if construction has not begun.	Public hearing required.	The Clay County Zoning Ordinance, as amended December 2005, allows wind energy generation facilities in all zones except floodway and general floodplain as are outlined in 8-6-23 of the zoning ordinance. Although, the PUC will have jurisdiction for the Project, a transmission line may require a county permit. There are minimum size requirements a maximum turbine height of 250', a maximum of 4 turbines per four quarters per quarter section of land, no closer than 300' to a property line, and no closer than 500' to a commercial or residential property. Apply MPCA noise standards. The Zoning Ordinance and Map are available at http://www.co.clay.mn.us/planning/ordinance.php .
Clay County Planning and Zoning Administration	Flood Plain District Permit	Construction or work in flood plain	Moderate, unless facilities sited to avoid all flood plains	None noted	None noted	None noted	Permits are processed through MDNR and the County reviews to ensure the structures are not located in floodways or general floodplain overlay districts. Contact: Tim Magnusson, Planning Director (218) 299-5002

Table 9-1. Permits Potentially Required for Flat Hill I WRA in Clay County, Minnesota

Permitting Agency	Permit	Trigger	Probability of Being Required	Fee	Application Timeline	Public Process	Comments
Clay County Highway Department	Utility Permit on County Highway Right-of-Way	Utility construction on county highway right-of-way	Depends on project transmission plans	Minimal fee	None noted	None noted	A permit is required for placing utilities along county highway rights-of-way. The permit sets conditions for soil disturbances, tree removal, construction methods, and safety precautions. The application must include a sketch that shows the location of the proposed utility with reference to county highway centerline. Application and permit conditions are available at http://www.co.clay.mn.us/uploadedcontent/forms/utility_permit.pdf .
Clay County Motor Vehicle and Licenses 218 299-5080	Transportation Permit (Overweight/Oversize)	Travel of oversize or overweight vehicles on county roads	High	Depends on weight	None noted	None noted	This permit is required for vehicles that exceed legal dimension limits. The permit prohibits travel along bridges and roads from December to March 7 th . The application, permit conditions, and legal dimensions are available at http://www.co.clay.mn.us/uploadedcontent/forms/transport_permit.pdf .
Clay County Highway Department	Driveway Permit	Access for a driveway to any county road	Depends on plans for access roads and road improvements	Minimal fee	Permit is valid for 1 year	None noted	The location of direct access for a driveway to any county road must be approved by the Rice County Highway Engineer and Planning Director. Access to township roads shall be regulated by Town Boards. Permit application and conditions are available at http://www.co.clay.mn.us/uploadedcontent/forms/driveway_permit.pdf .
Clay County Highway Department	Permit for Construction Work in Right-of-Way	Construction in county right-of-way	Depends on project layout	Certificate or Insurance and/or Bond may be needed	Final inspection before final project approval	None noted	Upon notification that the project is complete, the Clay County Highway Department makes a final inspection. Any necessary changes must be completed by the applicant before final project approval is granted. Application and permit conditions are available at http://www.co.clay.mn.us/uploadedcontent/forms/construction_work_permit.pdf .

10.0 REFERENCES

- ABR, Inc. 2004.** A radar study of nocturnal bird migration at the proposed Cotterel Mountain wind-energy facility, Idaho, Fall 2003. Prepared for Windland, Inc.
- Anderson, R.L., M. Morrison, K. Sinclair, and D. Strickland. 1999.** Studying wind energy/bird interactions: A guidance document. National Wind Coordinating Committee/RESOLVE, Washington, D.C. 87pp.
- Arnett, E., W.P. Erickson, J. Kerns, and J. Horn. 2005.** Relationships between bats and wind turbines in Pennsylvania and West Virginia: An assessment of fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report prepared for the Bat and Wind Energy Cooperative. 187 p.
- Association for Biodiversity Information. 2007.** NatureServe. <http://www.natureserve.org/>.
- CEQ (Council on Environmental Quality). 1997.** Environmental Justice: Guidance Under the National Environmental Policy Act. Accessed on December 20, 2007. Available online at http://www.lm.doe.gov/env_justice/pdf/justice.pdf.
- Clay County. 2002.** *Comprehensive Plan*. Prepared by Dahlgren, Shardlow & Uban, Inc. Adopted July 2, 2002. Available at <http://www.co.clay.mn.us/Depts/PlanEnvi/CompPlan>.
- Clay County. 2005.** *Zoning Code*. Adopted July 19, 2005. Available at <http://www.co.clay.mn.us/AboutUs/CoCode.htm>
- Clay County. 2007.** Communication between Planning Department/Public Works Department and Tetra Tech, Inc. Clay County, Moorhead, Minnesota. December 13, 2007.
- Cummins, J.F., and D.F. Grigal. 1981.** *Legend to Map: Soils and Land Surfaces of Minnesota, 1980*. Miscellaneous Publication 11, Soil Series No. 110. Department of Soil Science, University of Minnesota, St. Paul.
- Edison Electric Institute. 1994.** Mitigating Bird Collisions with Power Lines: The State of the Art in 1994. Waldorf, Maryland. Available online at www.eei.org.
- Edison Electric Institute. 1996.** Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996. Waldorf, Maryland. Available online at www.eei.org
- Environmental Laboratory. 1987.** Corps of Engineers Wetland Delineation Manual. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS. Technical Report Y-87-1.
- Erickson, W.P., J. Jeffrey, K. Bay and K. Kronner. 2004.** Stateline Wind Project Wildlife Monitoring Final Report, July 2001 – December 2003. Technical report prepared for FPL Energy, Stateline Technical Advisory Committee and the Oregon Department of Energy.
- Erickson, W.P., K. Kronner, and B. Gritski. 2003.** Nine Canyon Wind Power Project Avian and Bat Monitoring Report, September 2002 – August 2003. Technical report submitted to Energy Northwest and the Nine Canyon Technical Advisory Committee.
- Erickson, W., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002.** Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Power Developments. Prepared for Bonneville Power Administration, Portland, OR. 129 p.

- Erickson, W.P., G.D. Johnson, M.D. Strickland, and K. Kronner. 2000.** Avian and bat mortality associated with the Vansycle Wind Plant, Umatilla County Oregon. 1999 study year. Technical report submitted to Umatilla County Department of Resource Services and Development, Pendleton, Oregon.
- FEMA (Federal Emergency Management Agency). 2007.** FEMA Issued Flood Maps: Clay County, Minnesota. Accessed on December 12, 2007. Available online at <http://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay?catalogId=10001&storeId=10001&categoryId=12001&langId=-1&userType=G&type=1&dfirmCatId=12009>.
- Hobbs, Howard C. and Joesph Goebel. 1982.** *Geologic Map of Minnesota Quaternary Geology*. University of Minnesota Press, Minneapolis.
- Johnson, G. 2004.** Overview of Available Bat Mortality Studies at Wind Energy Projects. Presentation at National Wind Coordinating Committee, Onshore Wildlife Interactions with Wind Developments: Research Meeting V, November 3-4, 2004, Lansdowne, VA. Available at www.nationalwind.org website
- Kaufmann, Kira E. 1999.** Guidelines for Archaeological Investigations in Minnesota. Jointly sponsored by the Association of Minnesota Archaeologists, Office of the State Archaeologist, and the State Historic Preservation Office. Available at the Minnesota State Historic Preservation Office, St. Paul.
- Keely B. 2001.** "Bat Ecology and Wind Turbine Considerations. Bat Interactions with Utility Structure," in Proceedings of NWCC National Avian-Wind Power Planning Meeting IV, Carmel California, May 16-17, 2000. Available online at <http://www.nationalwind.org/pubs/avian00/default.htm>
- Kerns, J. and P. Kerlinger. 2004.** A study of bird and bat collision fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003 (14 February 2004). Unpublished report, Curry and Kerlinger LLC., Cape May Point, New Jersey.
- League for the Hard of Hearing. 2007.** Noise Center: Noise Levels in Our Environment Fact Sheet. Accessed on December 12, 2007. Available online at <http://www.lhh.org/noise/decibel.htm>.
- Mabee, T.J. and B.A. Cooper. 2001.** Nocturnal bird migration at the Nine Canyon Wind Energy Project, Spring 2001. Technical report prepared for WEST, Inc. and Energy Northwest by ABR, Inc., Forest Grove, Oregon.
- Mabee, T.J., B.A. Cooper. 2004.** Nocturnal bird migration at the Stateline and Vansycle wind-energy projects in Oregon. *Northwestern Naturalist*: Vol. 85, No. 2, pp. 39–47.
- McCrary, M.D., R.L. McKernan, and R.W. Schreiber. 1986.** San Gorgonio wind resource area: Impacts of commercial wind turbine generators on birds, 1985 data report. Prepared for Southern California Edison Company. 33 p.
- Minnesota Department of Natural Resources (MDNR). 2007a.** Ecological Classification System. <http://www.dnr.state.mn.us/ecs/251Aa/index.html>
- Minnesota DNR Natural Heritage and Nongame Research Program. 2007b.** Short and Long Report of Element Occurrences within 1 mile radius of: Flat Hill I Windpark, Multiple TRS, Clay County.
- Minnesota Ornithological Union. 2007.** <http://moumn.org/index.html>.
- Minnesota Pollution Control Agency (MPCA) 2007.** Noise Program, A Guide to Noise Control in Minnesota. Available at <http://www.pca.state.mn.us/programs/noise.html>.

- Minnesota Rules, Revisor of Statutes.** Chapter 7030. *Minnesota Pollution Control Agency, Noise Pollution Control*. Accessed on December 14, 2007. Available at <http://www.revisor.leg.state.mn.us/arule/7030/0040.html>.
- Mitsch, W., and J. Gosselink. 1993.** Wetlands; Second Edition. Van Nostrand Reinhold, New York.
- National Resource Conservation Service (NRCS). 2007.** <http://www.nrcs.usda.gov/>
- National Safety Council, 2007.** Workplace Safety Compliance. Available at <http://www.nsc.org/>.
- National Wind Coordinating Committee (NWCC). 2004.** Wind Turbine Interactions with Birds and Bats. A summary of Research Results and Remaining Questions. November 2004.
- Osborn, R. G., C. D. Dieter, K. F. Higgins, and R. E. Usgaard. 1998.** Bird flight characteristics near wind turbines in Minnesota. *American Midland Naturalist* 139:29-38.
- Tipler P. 1991.** "Physics for Scientists and Engineers", 3rd Edition, Worth Publishers, pp. 464-468.
- US Census Bureau. 2007a.** Clay County, Minnesota Quick Facts. Accessed on December 12, 2007. Available online at <http://quickfacts.census.gov/qfd/>.
- US Census Bureau. 2007b.** Small Area Income and Poverty Estimates: Clay County, Minnesota. Accessed on December 12, 2007. Available online at <http://www.census.gov/hhes/www/saipe/saipe.html>.
- USDA NRCS.** Web Soil Survey. On-line address: <http://websoilsurvey.nrcs.usda.gov/app/> Accessed: December 2007.
- US Fish and Wildlife Service (USFWS). 2007a.** Threatened, Endangered, Candidate and Proposed Species. Twin Cities Field Office, Minnesota Ecological Services Field Office. Accessed on December 11, 2007. Available online at <http://www.fws.gov/midwest/endangered/lists/minnesotspp.html>.
- USFWS. 2007b and 2008.** Communication from Ms. Laurie Fairchild of the USFWS via electronic mail. December 2007 – January 2008.
- Wetland Training Institute, Inc.** 1995. Field Guide for Wetland Delineation; 1987 Corps of Engineers Manual, Glenwood, NM. WTI 02-1 143pp.
- Young, D. P. Jr., W. P. Erickson, R. E. Good, M. D. Strickland, and G.D. Johnson. 2003.** Avian and bat mortality associated with the initial phase of the Foote Creek Rim Windpower Project, Carbon County, Wyoming: November 1998 - June 2002. Technical Report prepared by WEST, Inc. for PacifiCorp, Inc., SeaWest Windpower, Inc. and Bureau of Land Management. 35 pp.

Appendix A

Agency Letters of Consultation

Appendix B

Site Photographs



Photo 1. View looking east at existing transmission line inside the southern boundary of the Flat Hill I WRA.



Photo 2. View looking northwest at agricultural land of the proposed Flat Hill I WRA.



Photo 3. View looking east toward existing wind turbine array immediately north of the Flat Hill I WRA. The topographic increases visible to the east in the photograph are indicative of the Glacial Lake Agassiz beach ridges land form.



Photo 4. View looking southwest at the Buffalo River corridor and floodplain which bisects the proposed transmission line area, south of the Flat Hill I WRA.



Photo 5. View looking southeast at the Bluestem Prairie habitat to the east of the proposed transmission line area, south of the Flat Hill I WRA

Appendix C

MDNR List of State Threatened and Endangered Species