Appendix C

Site Characterization Study

Site Characterization Study of the Elm Creek II Wind Resource Area

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EXECUTIVE SUMMARY

The Elm Creek II Wind Resource Area (ECIIWRA), currently about 30,339 acres (12,278 hectares; ha), is located in east-central Jackson County and northwestern Martin County in southern Minnesota, near the Iowa/Minnesota border. The proposed ECIIWRA is located mainly in the Minnesota River Prairie subsection of the North Central Glaciated Plains section of the Prairie Parkland Province. The landscape of the project area is mostly level to gently rolling, with elevations ranging from 1,245-1,431 feet (379-436 meters). Wetlands were plentiful before settlement but most have been drained. Tallgrass prairie was the predominant vegetation before settlement; almost all prairie was converted for agricultural purposes which is the dominant landuse presently. Ownership within the ECIIWRA is almost all private with one Minnesota Department of Natural Resources lands within the current boundary. The Artz State Wildlife Management Area, which encompasses Hassings Slough, is located in Jackson County. There are no Important Bird Areas with the project area.

Biological resources within the ECIIWRA were evaluated through a search of existing data and a site visit on February 10, 2009. All wildlife species observed during the site visits were recorded. Information about sensitive species presence and locations was requested from Natural Heritage and Nongame Research Program of the Minnesota Department of Natural Resources (MNDNR) and US Fish and Wildlife Service (USFWS) by Iberdrola Renewables. Responses regarding the project have been received from the MNDNR, but not from USFWS.

About 92% of the ECIIWRA is cropland, such as corn and soybeans. The next most common habitat is grassland, which accounts for about 7% of the ECIIWRA. Grasslands observed during the site visit appeared to be dominated by planted species typical of those planted in Conservation Reserve Program lands. There are approximately 301 acres (122 ha) of wetlands, not including streams and rivers, found throughout the ECIIWRA. Less than 1% of the total ECIIWRA is wetlands, excluding rivers and streams.

One federally-protected plant species, the prairie bush-clover, is known to occur in Martin and Jackson Counties. The Minnesota Department of Natural Resources lists several endangered, threatened, and special concern plant species that could be or are found in Martin and Jackson Counties. Many of these plant species have specific and unique habitat requirements; making it unlikely that the plants will occur within a majority of the ECIIWRA. The MNDNR Natural Heritage Information System (NHIS) was queried to determine if any rare species or other significant natural features are known to occur within an approximate one-mile radius of the proposed project. Based on this query, Sullivant's milkweed (*Asclepias sullivantii*), a state-listed threatened plant, has been documented in native prairie remnants in the vicinity of the proposed project.

There are no wildlife species listed as endangered, threatened, or candidate by the USFWS under the Endangered Species Act (ESA 1973) known to occur in the project area. The MNDNR NHIS identified that a Loggerhead Shrike (*Lanius ludovicianus*) was observed in 1992 in the vicinity of the proposed project.

The following raptor species are the most likely to be found in or near the project area: bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, Swainson's hawk, red-tailed hawk, rough-legged hawk, American kestrel, and golden eagle. Other species often grouped with raptors that could be found in the project area include the great-horned owl, eastern screech owl, burrowing owl, barred owl, short-eared owl, and turkey vulture. During the site visit, a red-tailed hawk was observed in the project area. The lack of native habitats reduces the likelihood of high use by any raptor species.

No raptor nests were observed during the site visits but potential nest structures for above ground nesting species were present in the form of living and dead trees. Limited grassland areas could provide nesting habitats for ground-nesting raptors, such as the northern harrier. Prey densities are not expected to be significantly different than areas outside of the proposed ECIIWRA. It is likely that raptors will use the area but not to a greater degree than the surrounding areas with similar habitat. There are no big hills, ridges, or other topographical features that might cause bottlenecks or updrafts where raptors might concentrate.

It is likely that birds migrate through the proposed ECIIWRA, including passerines, raptors, and waterfowl. Agricultural fields, wetlands, and treerows scattered throughout the ECIIWRA may provide stopover habitat for migrants or individuals during post-breeding dispersal. Harvested grain crops, such as the corn that was observed during the site visit, could serve as feeding areas that could attract migrating and wintering waterfowl. These types of habitats are found throughout the region and therefore their presence in the ECIIWRA should not concentrate bird use as compared to adjacent areas.

The nearest US Geological Survey Breeding Bird Survey (BBS) route is the Fairmont route. In 2008, 742 individuals comprising 39 species were observed on the BBS route. The most abundant bird observed by far was the common grackle. Other abundant birds were the red-winged blackbird, American robin, vesper sparrow, and cliff swallow.

The greatest concern with displacement impacts are for wind-energy facilities that are placed in native grasslands and other native habitats, of which few are found within the ECIIWRA. The ECIIWRA does have some grasslands (native or planted), so it is probable that some grassland-dependent species will be displaced if turbines are placed in these area. If the project does not affect the few grasslands in the ECIIWRA, displacement impacts should be negligible.

There are several species of bats that could be found in the WRA, including the big brown bat, hoary bat, eastern red bat, little brown myotis, northern myotis, and the silver-haired bat. The northern myotis is a species of special concern in Minnesota.

Bat casualties have been reported from most wind-energy facilities where post-construction fatality data are publicly available. At least eleven bat species have been recovered during carcass searches at wind-energy facilities throughout the US. The six species that are likely residents and migrants in the ECIIWRA are all included.

Potential roosting habitat within the ECIIWRA is found in the form of trees and buildings; no caves were observed during the site visits. Bats may forage over the entire ECIIWRA, although

the extent of use is not known. Construction of the proposed ECIIWRA will likely result in the mortality of some bats.

INTRODUCTION

Knowledge of biological resource issues early in the development phase of wind energy facilities helps the industry identify, avoid, and minimize future problems. This report describes biological resources present within a potential wind resource area and evaluates these general characteristics as related to potential or known impacts on the resources from wind energy facilities.

The proposed Elm Creek II wind resource area (ECIIWRA) is located in Martin and Jackson Counties, Minnesota (Figure 1), near the town of Jackson, MN. The purpose of this report is to characterize biological resources in the proposed project area and determine if additional biological resource surveys are warranted.

STUDY AREA

The ECIIWRA, currently about 30,339 acres (12,278 hectares; ha), is located in east central Jackson County and northwestern Martin County in southern Minnesota, near the Iowa/Minnesota border (Table 1 and Figure 2).

Table 1. ECIIWRA Project Area.

County	Township	Range	Sections
Jackson	102 N	34 W	1-5, 8-12
Jackson	103 N	34 W	1, 2, 11-15, 20-29, 32-36
Martin	102 N	33 W	6 and 7
Martin	103 N	33 W	5-8, 17-20, 29-32
Martin	104 N	33 W	17-20, 29-32

The proposed WRA is located mainly in the Minnesota River Prairie subsection of the North Central Glaciated Plains section of the Prairie Parkland Province (USEPA 2009; Figure 3). The Coteau Moraines subsection is located along the western boundary of the project area. The Minnesota River Prairie subsection is composed of large till plains (loamy ground moraine) on either side of the Minnesota River. The glacially formed landscape of the project area is mostly level to gently rolling, with elevations ranging from 1,245-1,431 feet (ft; 379-436 meters [m]) above sea level (Figure 4). The subsection is drained by the Minnesota River and the drainage network is poorly developed due to relatively recent glaciation. Wetlands were plentiful before settlement but most have been drained for agricultural purposes. Tallgrass prairie was the predominant vegetation before settlement; almost all prairie was converted for agricultural purposes which is the dominant land use presently. The ECIIWRA soils are mostly Canisteo-Glencoe complex (about 42%) and Clarion loams (about 13%; SSURGO Soils Data).

Ownership within the ECIIWRA is almost all private with a one Minnesota Department of Natural Resources (MNDNR) property within the current boundary. The Artz State Wildlife Management Area, which encompasses Hassings Slough, is located in Jackson County. There are no federal lands and no Important Bird Areas within the project area. The MNDNR stated

that the project area includes Conservation Reserve Program (CRP) and Reinvest in Minnesota (RIM) easements. The extent and location of conservation program enrollments is unknown at this time.

METHODS

Biological resources within the ECIIWRA were evaluated through a search of existing data and site visit. The site visit entailed an examination of the ECIIWRA from public roads on February 10, 2009, during which biological features and potential wildlife habitat, including plant communities, topography features, and potential raptor nesting habitat and prey populations, were identified. All wildlife species observed during the site visit were recorded and photographs were taken of the ECIIWRA (Appendix A).

Several sources of available data were used to identify biological resources within the ECIIWRA including published literature, field guides, and public data sets. Information about sensitive species presence and locations was requested from the Natural Heritage and Nongame Research Program of the Minnesota Department of Natural Resources (MNDNR) and US Fish and Wildlife Service (USFWS) by Iberdrola Renewables. Responses regarding the project have been received from the MNDNR, but not from USFWS (Appendix B). WEST has also consulted the federal and state responses regarding Elm Creek I, an adjacent wind-energy facility.

LAND USE

About 92% of the ECIIWRA is cropland (Table 2; Figure 5). Crop types observed during the site visit were corn and soybeans. The next most common habitat is grassland, which accounts for about 7% of the ECIIWRA. Grasslands observed during the site visit appeared to be dominated by planted species typical of those planted in Conservation Reserve Program lands. All other land use categories accounted for less that 1% of total land use (Table 2; USGS NLCD 2001).

Table 2. Land use types present within the ECIIWRA.

Land use	Acres	% Composition
Cropland	27,874	92
Grassland	2,175	7
Oak	115	0.38
Lowland Deciduous	98	0.33
Marsh	45	0.15
Water	29	0.10
Maple/Basswood	3	0.01

Sensitive and Special Status Plant Species

A reply from the US Fish and Wildlife Service (FWS) regarding a project review has not yet been received; it is possible that issues regarding sensitive plant species and habitats may arise

once this information is received. In the federal response regarding the Elm Creek I facility, they report no known occurrences of rare plant species. One federally-protected plant species, prairie bush-clover *(Lespedeza leptostachya*), is known to occur in Martin and Jackson Counties (Table 3; USFWS 2009). Prairie bush-clover *(Lespedeza leptostachya*) is a prairie legume found in tallgrass prairie regions of the Midwest. Most of this type of habitat has been converted to cropland; this is true for ECIIWRA as well. Other threats to its survival are habitat conversion, overgrazing, and loss of its remaining habitat to rock quarries or right-of-way maintenance (USFWS 2008). Based on the plant's habitat requirements and the scarcity of that habitat within the project area, it is unlikely to occur there.

The MNDNR Natural Heritage Information System (NHIS) listed Sullivant's milkweed (*Asclepias sullivant*), a threatened plant species, in the project vicinity (Appendix B). This plant and mesic prairie community are within the railroad right-of-way south of the project area.

Sensitive Habitats

In the state response, native prairie remnants were identified along the railroad corridor south of Interstate Highway 90. The land classification that WEST obtained from MN GAP Analysis grouped native grass, pasture, planted cover, and hayland into one category called "grassland" so it wasn't possible to quantify native habitats. During the site visit, very few if any areas were observed that were obviously native grasslands although some may exist along the steeper terrain found near waterways and along the railroad right-of-way. The ECIIWRA does have some planted grasslands that probably provide habitat to grassland-dependent species.

The eastern part of the project area in Sections 5 and 8 in T 103 N, R 33W, includes Watkins Lake (Appendix A, Photo 6) and associated wetland, grassland, and forested habitats. This area also includes several parcels that are conservation easements.

Wetlands and Riparian Areas

Based on National Wetland Inventory (NWI) polygon data (USFWS NWI 2007), there are approximately 301 acres (122 ha) of wetlands, not including streams and rivers, found throughout the ECIIWRA (Table 3). Less than 1% of the total ECIIWRA is wetlands, excluding rivers and streams. The highest percentage (59.4%) of wetlands are seasonally flooded; semipermanently flooded wetlands account for another 28.9%. There are very few lacustrine (lake) wetlands or temporary wetlands.

Table 3. Wetland types present within the ECIIWRA (NWI wetland polygons; USFWS NWI 2007).

Wetland type/modifier	Acres	% Composition
lacustrine	17	5.6
semipermanent	87	28.9
seasonal	179	59.4
temporary	18	6.0
artificially flooded	0.1	0.03

The East Fork of the Des Moines River drains to the southeast in the southern part of the WRA (Figure 6). The South Fork of Elm Creek drains to the northeast through the western and northeastern portion of the project area. There are also several unnamed ditches and streams in the ECIIWRA. Constructing access roads to the turbines and other facilities may require crossing some wetlands, drainages, and easements in the project area and proper permits from the US Army Corps of Engineers, Minnesota Wetland Conservation Act, and MNDNR may be required.

WILDLIFE

Wildlife species associated with tilled agricultural landscapes are expected to be the most common species at the ECIIWRA. A list of species observed during the site visit is provided in Table 4.

Table 4. Wildlife or sign observed in the ECIIWRA during the site visit on February 10, 2009.

Species	Scientific Name
Birds	
American crow	*Corvus brachyrhynchos*
American tree sparrow	*Spizella arborea*
black-capped chickadee	*Poecile atricapilla*
European starling	*Sturnus vulgaris*
horned lark	*Eremophila alpestris*
house sparrow	*Passer domesticus*
red-tailed hawk	*Buteo jamaicensis*
ring-necked pheasant	*Phasianus colchicus*
rock pigeon	*Columba livia*
snow bunting	*Plectrophenax nivalis*
Mammals	
American beaver	*Castor canadensis*

Federal Listed Wildlife Species

There are no wildlife species listed as endangered, threatened, or candidate by the USFWS under the Endangered Species Act (ESA 1973) known to occur in the project area (ECOS 2008; MDNR 2009b). However, WEST has not received a reply from the USFWS regarding the project; it's possible that issues regarding sensitive wildlife species may arise once WEST receives this reply. The federal response regarding the adjacent Elm Creek I wind-energy facility did not report any federally protected species utilizing the area.

Minnesota Rare Wildlife Species

The MNDNR NHIS identified that the Loggerhead Shrike (*Lanius ludovicianus*) was observed in 1992 in the vicinity of the proposed project. No other wildlife species were identified. Table 5 was created by WEST searching MNDNR's Rare Species Guide (MDNR 2009b) for species that occur in Martin or Jackson Counties.

Table 5. Rare wildlife species known to occur in Martin or Jackson Counties, Minnesota.

Common name	Scientific name	Group	State status	Habitat
American White Pelican	*Pelecanus erythrorhynchos*	bird	special concern	Large, shallow bodies of water, islands or peninsula cut-offs for nesting
Bald Eagle	*Haliaeetus leucocephalus*	bird	special concern	Large prairie rivers, lakes, tall large trees for nesting
Burrowing Owl	*Speotyto cunicularia*	bird	endangered	Open, grazed pasture or grassland with burrowing mammals
Common Moorhen	*Gallinula chloropus*	bird	special concern	Freshwater marshes, abundant vegetation
Forster's Tern	*Sterna forsteri*	bird	special concern	Extensive marshes with emergent vegetation and open water
Franklin's Gull	*Larus pipixcan*	bird	special concern	Large prairie marshes, low vegetation density
King Rail	*Rallus elegans*	bird	endangered	Shallow marshes, wetland complexes, dense vegetation, maybe associated with muskrats
Loggerhead Shrike	*Lanius ludovicianus*	bird	threatened	Grassland, agricultural areas, perches needed
Trumpeter Swan	*Cygnus buccinator*	bird	threatened	Ponds, lakes, extensive aquatic vegetation, open water also needed
Wilson's Phalarope	*Phalaropus tricolor*	bird	threatened	Wet prairie, fen, grass or sedge wetlands, short vegetation and shallow open water
Blanding's Turtle	*Emydoidea blandingii*	reptile	threatened	Wetland complexes, calm shallow water, aquatic vegetation, wet sandy areas near water
Black Sandshell	*Ligumia recta*	mussel	special concern	Sand, gravel, riffle areas of medium to large rivers
Round Pigtoe	*Pleurobema coccineum*	mussel	threatened	Rivers, fast current, coarse sand and gravel substrate
Spike	*Elliptio dilatata*	mussel	special concern	Rivers, reservoirs, lakes, sand and gravel substrate
Monkeyface	*Quadrula metanevra*	mussel	threatened	Rivers, water over 6 ft, stable substrates
Mucket	*Actinonaias ligamentina*	mussel	threatened	Medium to large rivers with sand or gravel substrate

Table 5. Rare wildlife species known to occur in Martin or Jackson Counties, Minnesota.

Common name	Scientific name	Group	State status	Habitat
Ottoe Skipper	*Hesperia ottoe*	insect	threatened	Native, dry prairie with short to medium vegetation
Powesheik Skipper	*Oarisma powesheik*	insect	special concern	Native prairie
Regal Fritillary	*Speyeria idalia*	insect	special concern	Native prairie
Arogos Skipper	*Atrytone arogos*	insect	special concern	Native prairie
Jumping Spider	*Marpissa grata*	spider	special concern	Wetlands, ponds, rivers, sedges, emergent vegetation, found in Jackson Co. in 2007

Based on habitat requirements, it seems possible that several of these species could occur in the project area in the limited grassland habitats and waterways. These species are discussed further below. If impacts to these areas are avoid during construction, impacts to most sensitive wildlife should also be avoided.

American White Pelican
The American white pelican (*Pelecanus erythrorhynchos*) is a species of special concern in Minnesota. Pelicans require large, shallow water bodies with plentiful fish for feeding (MDNR 2009d). They nest on islands or peninsula cut-offs. Use of the project area by the pelican would probably be restricted to Watkins Lake on the eastern edge of the ECIIWRA during migration and as a foraging location.

Bald Eagle
The bald eagle (*Haliaeetus leucocephalus*) is a species of special concern that may migrate through or winter in the project area. The presence of bald eagles are often associated with lakes, rivers, and reservoirs where they feed primarily on fish (MDNR 2009e). Bald eagles may also be found during migration and winter periods in areas away from major rivers if sufficient forage is available. If waterfowl concentrate in an area during winter, they could serve as a food base for eagles.

Bald eagles nest in areas with mature forest, typically along major waterways, lakes, and reservoirs; nests are typically built in tall, large trees. However, with increasing bald eagle populations, nesting eagles are also being found in areas away from “major” waterbodies. No eagle nests or eagles were observed during the site visits but it is possible for bald eagles to occur in the project area, most likely during migration or winter. Watkins Lake, on the eastern border of ECIIWRA, seems the most likely location for bald eagles to occur.

Loggerhead Shrike
The loggerhead shrike (*Lanius ludovicianus*) population in Minnesota has declined sharply; the once widespread population is now found primarily in western and east-central Minnesota (MDNR 2009f). The loggerhead shrike, which is a summer resident of the state, is often

confused with the northern shrike (*Lanius excubitor*) which is a winter resident. The loggerhead shrike is a species that impales some of its prey items on trees, shrubs, or fences and then consumes them later. The habitat requirements of this shrike include open hunting areas, such as grasslands with short vegetation, and agricultural areas, and perching, impaling, and nesting areas such as shrubs, small trees, and hedgerows. The state response made note of a Jackson County loggerhead shrike siting southwest of the project area.

Trumpeter Swan
The trumpeter swan (*Cygnus buccinator*), once widespread throughout the prairies of Minnesota, suffered a severe population decline. In recent years, recovery efforts in Minnesota have resulted in increased population numbers (MDNR 2009g). The species is now considered a species of special concern by the state. The trumpeter swan breeds in small ponds, lakes, or bays; they prefer habitat with extensive vegetation, such as cattails, bulrush, and sedges, as well as open water areas. If the swan utilizes the project area, it would most likely occur in Watkins Lake.

Wilson's Phalarope
The Wilson's phalarope (*Phalaropus tricolor*) is a prairie wetland species that is threatened in Minnesota. They are commonly found in wet prairie, fens, or vegetation-dominated wetlands (MDNR 2009h). They require short vegetation and open shallow water in proximity to each other. Sometimes, this habitat type can be found in flooded pastures and wastewater ponds. If the phalarope occurs in the project area, it would likely be at Hassings Slough in the Artz Wildlife Management Area, Watkins Lake, or in flooded fields during migration.

Jumping Spider
A jumping spider (*Marpissa grata*) is a Minnesota species of special concern. This jumping spider appears to prefer habitats with sedges and emergent vegetation. The spider is often found around wetlands, ponds, and rivers. Specimens have been found in marshes, grass, cattails (*Typha* spp.), and willow (*Salix* spp.); however, the spider is also found in drier sites associated with both tall and short grasses. This spider was documented in Jackson County in 2007 (MDNR 2009c).

Raptors

Species Likely to Occur in the Area
The following raptor species are the ones most likely to occur in or near the project area during one time of year or another: bald eagle, northern harrier, sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*), Swainson's hawk (*Buteo swainsoni*), red-tailed hawk, rough-legged hawk (*B. lagopus*), American kestrel (*Falco sparverius*), and golden eagle (Aquila chrysaetos). During the site visit, a red-tailed hawk was observed in the project area.

Other species often grouped with raptors that could be found in the project area include the great-horned owl (*Bubo virginianus*), eastern screech owl (*Otus asio*), burrowing owl (*Athene cunicularia*), barred owl (*Strix varia*), short-eared owl (*Asio flammeus*), and turkey vulture (*Cathartes aura*).

Four of these species are confirmed or suspected breeders in or near the project area: northern harrier, eastern screech owl, barred owl, and American kestrel (MOU 2009).

Potential Raptor Nesting Habitat
No raptor nests were observed during the site visits but potential nest structures for above ground nesting species were present in the form of living and dead trees. Farmsteads observed during the site visits usually had tree rows or woodlots associated with them. Grassland areas could provide nesting habitats for ground-nesting raptors, such as the northern harrier.

Potential for Prey Densities
No signs of colonial rodents were observed during the site visit; these types of areas are known to attract feeding raptors. However, it is possible that small mammal colonies such as ground squirrels are present within the ECIIWRA, but were not visible from public roads. Other potential raptor prey sources include other rodents, rabbits, and waterfowl.

Overall, it is very difficult to assess potential prey densities during site visits and prey densities can fluctuate rapidly based on habitat and climatic factors. However, overall prey densities are not expected to be significantly different than areas outside of the proposed ECIIWRA. With roost sites and food available, it is likely that raptors will use the area but not to a greater degree than the surrounding areas with similar habitat.

Does the Topography of the Site Increase the Potential for Raptor Use?
Topography in the ECIIWRA is primarily flat to gently rolling. There are no big hills, ridges, or other topographical features that might cause bottlenecks or updrafts where raptors might concentrate (Figures 2 and 7). At other wind-energy facilities located on prominent ridges with defined edges (e.g., rims of canyons, steep slopes), raptors often fly along the rim edges, using updrafts to maintain altitude while hunting, migrating or soaring (Hoover and Morrison 2005; Johnson et al. 2000b).

Bird Migration

Most species of birds are protected by the Migratory Bird Treaty Act (MBTA 1918). Although many species of passerines migrate at night and may collide with tall man-made structures, no large mortality events on the same scale as those seen at communication towers have been documented at wind-energy facilities in North America (NWCC 2004). Large numbers of passerines have collided with lighted communication towers and buildings when foggy conditions occur during spring or fall migration. Birds appear to become confused by the lights during foggy or low cloud ceiling conditions, flying circles around lighted structures until they become exhausted or collide with the structure (Erickson et al. 2001). Most collisions at communication towers are attributed to the guy wires on these structures, which wind turbines do not have. Additionally, the large mortality events observed at communication towers have occurred at structures greater than 500 ft (152 m) in height (Erickson et al. 2001), likely because most small birds migrate at elevations of 500 to 1,000 ft (152 to 305 m) above the ground (USFWS 1998), which is higher than most of the modern turbines. Migrating passerines are likely more at risk of turbine collision when ascending and descending from stopover habitats.

It is likely that birds migrate through the proposed ECIIWRA, including passerines, raptors, and waterfowl. Agricultural fields, wetlands, and treerows scattered throughout the ECIIWRA may provide stopover habitat for migrants or individuals during post-breeding dispersal. Harvested grain crops, such as the corn that was observed during the site visit, could serve as feeding areas that could attract migrating and wintering waterfowl. These types of habitats are found throughout the region and therefore their presence in the ECIIWRA should not concentrate bird use as compared to adjacent areas.

The federal response regarding the adjacent Elm Creek facility stated that the Elm Creek river corridor and vegetated areas of the South Fork of the Elm Creek might provide habitat for migrating woodland birds and raptors.

Breeding Birds

The nearest US Geological Survey (USGS) Breeding Bird Survey (BBS) route is the Fairmont route (Figure 8). Each BBS route is 24.5 mi (39.4 km) long, and all birds seen or heard are tallied for a three-minute period every half mile (0.8 km) along the route. In 2008, 742 individuals comprising 39 species were observed on the BBS route (USGS BBS 2009). The most abundant bird observed by far was the common grackle (*Quiscalus quiscula*). Other abundant birds were the red-winged blackbird (*Agelaius phoeniceus*), American robin (*Turdus migratorius*), vesper sparrow (*Pooecetes gramineus*), and cliff swallow (*Petrochelidon pyrrhonota*).

Recent research has started to focus on the potential displacement of grassland passerines at wind-energy facilities, and some uncertainty currently exists over the effects of wind-energy facilities on the breeding success of these birds. In Minnesota, researchers have found that breeding passerine density on Conservation Reserve Program (CRP) grasslands was reduced in the immediate vicinity of turbines (Leddy et al. 1999), but changes in density at broader scales was not detectable (Johnson et al. 2000a). Erickson et al. (2004) documented a decrease in density of some native grassland passerines, such as grasshopper sparrow (*Ammodramus savannarum*), near turbines in Washington; however, they could not determine if a decrease in post-construction density was the result of behavioral disturbance or a loss of habitat. Piorkowski (2006) conducted a displacement study at a wind-energy facility in Oklahoma where, of the grassland species present on the site, only the western meadowlark (*Sturnella neglecta*) showed significantly lower densities near turbines. Piorkowski (2006) suggested that habitat characteristics were more important to determining passerine breeding densities than the presence of wind turbines. Shaffer and Johnson (2007) documented avoidance by grasshopper sparrows out to 492 ft (150 m) at a wind-energy facility in northern South Dakota. While research concerning displacement impacts to songbirds, waterfowl, and waterbirds is limited, the projects that have been completed have only shown small scale (411-548 feet [150-200 m]), while impacts to birds at larger scales has not been shown. Additional research is ongoing at several projects across the country. The proposed ECIIWRA contains a small percentage of grasslands, some of which could be native grasslands, and some species of sensitive grassland passerines are likely to be present in the ECIIWRA. If the project does not affect the few grasslands in the ECIIWRA, displacement impacts should be negligible.

The federal response regarding the adjacent Elm Creek facility stated that several birds on the Region 3 Regional Conservation Priority List may nest or migrate through Jackson County. These birds included the sedge wren (*Cistothorus platensis*), grasshopper sparrow (*Ammodramus savannarum*), dickcissel (*Spiza americana*), upland sandpiper (*Bartramia longicauda*), black-billed cuckoo (*Coccyzus erythropthalmus*), and Henslow's sparrow (*Ammodramus henslowii*).

Avian Mortality

As a requirement of the first permit issued for a Large Wind Energy Conversion System in 1995, the Minnesota Public Utilities Commission (PUC) required Northern States Power Company to conduct an avian study to determine the effect of the turbines on avian mortality. After a four-year study, investigators reported no significant avian impacts in the Buffalo Ridge area from the turbines (WEST 2000). Since that time, additional avian studies have occurred in the Midwest and across the US. The ECIIWRA is located on the eastern flank of the Buffalo Ridge landform, approximately 45 miles east of the ridge top. The habitat at ECIIWRA is similar to Buffalo Ridge with more intensive agricultural cropping at the ECIIWRA.

To date, overall fatality rates for birds (including nocturnal migrants) at wind-energy facilities have been relatively low in the Midwest. It is anticipated that avian fatalities at ECIIWRA would be similar to the range of overall bird fatality estimates at three Midwest project areas that have ranged from 0.7 to 3.4 birds/MW/year (Howe et al. 2002; Johnson et al. 2002b; Koford et al. 2005). As more research is conducted at projects in the Midwest, more information regarding the potential direct impacts of wind-energy facilities to bird species will be obtained.

Bats

There are several species of bats that could be found in the WRA, including the big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), eastern red bat (Lasiurus borealis), little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), and the silver-haired bat (*Lasionycteris noctivagans*) (BCI website). The northern myotis is a species of special concern in Minnesota. The USFWS had formerly listed the long-eared bat (*Myotis evotis*), Townsend's big-eared bat (*Corynorhinus townsendii*), long-legged bat (*Myotis volans*), and small-footed myotis (*Myotis leibii*) as candidate species. Based on information from Bat Conservation International (BCI), none of the former candidate species occur in the ECIIWRA (BCI website).

Assessing the potential impacts of wind energy development to bats at the ECIIWRA is complicated by our current lack of understanding of why bats die at wind turbines (Baerwald et al. 2008; Kunz et al. 2007b), combined with the inherent difficulties of monitoring elusive, night-flying animals (O'Shea et al. 2003). To date, monitoring studies of wind projects suggest that a) migratory tree-roosting species (eastern red [*Lasiurus borealis*], hoary, and silver-haired bats) comprise almost 75% of reported bats killed, b) the majority of fatalities occur during the post-breeding or fall migration season (roughly August and September), and c) the highest reported fatalities occur at wind facilities located along forested ridge tops in the eastern United States (Arnett et al. 2008, Gruver 2002, Johnson et al. 2003a, Kunz et al. 2007b), although recent studies in agricultural regions of Iowa and Alberta, Canada, report relatively high fatalities as well (Jain 2005, Baerwald 2006).

Bat casualties have been reported from most wind-energy facilities where post-construction fatality data are publicly available. Reported estimates of bat mortality at wind-energy facilities have ranged from 0.01 – 47.5 fatalities per turbine per year (0.9 – 43.2 bats / MW / Year) in the US, with an average of 3.4 per turbine or 4.6 per MW (NWCC 2004). Most of the bat casualties at wind-energy facilities to date are migratory species which conduct long migrations between summer roosts and winter areas.

Migratory tree bats comprise most of the bats killed at wind-energy facilities in North America with the majority of collisions occurring in the fall (Gruver 2002; Johnson et al. 2003). The reason for disproportionate mortalities during fall are unknown; however it may be that tree bats fly at lower altitudes during spring migration than during fall migration. For example, hoary bats fly 3.3 to 16.4 ft (one to five m) from the ground while migrating through New Mexico in the spring, but apparently not in the fall (Cryan and Veilleux 2007).

At least eleven bat species have been recovered during carcass searches at wind-energy facilities throughout the US (Table 6; Arnett et al. 2008; Johnson 2005; Kunz et al. 2007; NRC 2007). The six species that are likely residents and migrants in the ECIIWRA are all included.

Table 6. Species composition of bat fatalities from wind-energy facilities in the US (adapted from NRC 2007, p. 65).

Common Name	Scientific Name	Total # individuals	%
hoary bat	*Lasiurus cinereus*	1,023	41
eastern red bat	*Lasiurus borealis*	580	23
eastern pipistrelle	*Pipistrellus subflavus*	261	11
silver-haired bat	*Lasionycteris noctivagans*	209	8.4
little brown myotis	*Myotis lucifugus*	145	5.8
Mexican free-tailed bat	*Tadarida brasiliensis*	143	5.7
big brown bat	*Eptesicus fuscus*	59	2.4
northern myotis	*Myotis septentrionalis*	8	0.4
western red bat	*Lasiurus blossivilli*	4	0.2
Seminole bat	*Lasiurus seminolus*	1	0.1
unknown		53	2.1
Total		**2,486**	**100**

Potential roosting habitat within the ECIIWRA is found in the form of trees and buildings; no caves or karsts were observed during the site visits. Bats generally forage over water and open spaces such as agricultural fields, grasslands, streams, and wetlands/ponds. Bats may forage over the entire ECIIWRA, although the extent of use is not known. Bats may prey on insects that are likely to concentrate over water in wetlands and streams; types of areas found in the ECIIWRA are most likely to attract foraging bats.

Construction of the proposed ECIIWRA will likely result in the mortality of some bats. The magnitude of these fatalities and the degree to which bat species will be affected is difficult to

determine, but they should be within or below the average range of bat mortalities found throughout the US. It is anticipated that bat fatalities would be similar to those measured at Buffalo Ridge where there were 2.2 bat fatalities/turbine/year (Johnson et al. 2003c), and much lower than the 20.8 fatalities/turbine/year reported at Buffalo Mountain, Tennessee (Fiedler 2004).

CONCLUSIONS

A summary of the potential for wildlife and habitat conflicts in the proposed wind-energy facility development area is presented in Table 7.

This report describes biological resources present within a potential wind resource area and evaluates these general characteristics as related to potential or known impacts on the resources from wind energy facilities. A reply from MNDNR has been received but not one from the USFWS regarding a project review. It is possible that issues regarding sensitive plant and animal species and habitats may arise once WEST receives the reply from FWS.

Ownership within the ECIIWRA is almost all private with a one MNDNR property, the Artz State Wildlife Management Area is within the current boundary. There are no federal lands or Important Bird Areas with the project area.

About 92% of the ECIIWRA is cropland, including corn and soybeans. The next most common habitat is grassland, which accounts for about 7% of the ECIIWRA. Grasslands observed during the site visit appeared to be dominated by planted species typical of those planted in Conservation Reserve Program lands.

One federally-protected plant species, the prairie bush-clover, is known to occur in Martin and Jackson Counties. The MNDNR lists several endangered, threatened, and special concern plant species that could be or are found in Martin and Jackson Counties. Many of these plant species have specific and unique habitat requirements; it is unlikely that the plants will occur within the ECIIWRA. The MNDNR NHIS identified that Sullivant's milkweed and mesic native prairie is present along the railroad corridor south of the project area. Avoidance of native grasslands would minimize or eliminate any potential impacts to these species.

Wildlife species associated with tilled agricultural landscapes are expected to be the most common species at the ECIIWRA. There are no wildlife species listed as endangered, threatened, or candidate by the USFWS under the Endangered Species Act known to occur in the project area.

The MNDNR NHIS identified the loggerhead shrike as potentially occurring in the project vicinity. Several other species found in the MNDNR's Rare Species Guide may occur in Martin or Jackson Counties. Based on habitat requirements and range distribution, it is possible that several of these species could occur in the project area, including the American white pelican, a jumping spider, bald eagle, trumpeter swan, and the Wilson's phalarope.

The following raptor species could occur in or near the project area: bald eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, rough-legged hawk, American kestrel, and golden eagle. Other raptor-like species that could be found in the project area include the great-horned owl, eastern screech owl, burrowing owl, barred owl, short-eared owl, and turkey vulture.

No raptor nests were observed during the site visits but potential nest structures for above ground nesting species were present. No signs of colonial rodents were observed during the site visits; it is possible that small mammal colonies are present within the ECIIWRA. It is likely that raptors will use the area but not to a greater degree than the surrounding areas with similar habitat. There are no big hills, ridges, or other topographical features that might cause bottlenecks or updrafts where raptors might concentrate.

It is likely that birds migrate through the proposed ECIIWRA, including passerines, raptors, and waterfowl. Agricultural fields, wetlands, and treerows scattered throughout the ECIIWRA may provide stopover habitat for migrants or individuals during post-breeding dispersal. Harvested grain crops, such as the corn, could serve as feeding areas that could attract migrating and wintering waterfowl. These types of habitats are found throughout the region and therefore their presence in the ECIIWRA should not concentrate bird use as compared to adjacent areas.

The nearest US Geological Survey Breeding Bird Survey route is the Fairmont route. The most abundant bird observed by far was the common grackle. Other abundant birds were the red-winged blackbird, American robin, vesper sparrow, and cliff swallow.

The overall fatality rates for birds at wind-energy facilities have been relatively low in the Midwest. The greatest concern with displacement impacts to birds is for wind-energy facilities that are placed in native grasslands and other native habitats, of which few were found within the ECIIWRA. During the site visit, very few areas were observed that were potentially native grasslands although some may exist along waterways, in road ditches, or along railroad right-of-ways. Some species of sensitive grassland passerines are likely to be present in the ECIIWRA. If the project does not affect the few grasslands in the ECIIWRA, displacement impacts should be negligible.

There are several species of bats that could be found in the WRA, including the big brown bat, hoary bat, eastern red bat, little brown myotis, northern myotis, and the silver-haired bat. The northern myotis is a species of special concern in Minnesota.

Bat casualties have been reported from most wind-energy faculties where post-construction fatality data are publicly available. At least eleven bat species have been recovered during carcass searches at wind-energy facilities throughout the US. The six species that are likely residents and migrants in the ECIIWRA are all included.

Potential roosting habitat within the ECIIWRA is found in the form of trees and buildings. Bats may forage over the entire ECIIWRA, although the extent of use is not known. Construction of the proposed ECIIWRA will likely result in the mortality of some bats. The magnitude of these fatalities is difficult to determine, but they should be within or below the average range of bat mortalities found throughout the US.

Table 7. A summary of the potential for wildlife and habitat conflicts in the ECIIWRA.

Issue	VH	H	M	L	Notes
	VH = Very High, H = High, M = Medium, and L = Low.				
Potential for raptor nest sites			✓		Several tree rows and woodlots
Concentrated raptor flight potential				✓	The general lack of stark topography over the majority of the ECIIWRA decreases the potential for concentrated raptor use.
Potential for migratory pathway			✓		The project area has no topography or other prominent features likely to concentrate birds during migration.
Potential for raptor prey species			✓		Suitable habitat for small mammals
Potential for protected species to occur			✓		Protected species may occur in the area (e.g., bald eagles, loggerhead shrike, American white pelican).
Potential for State Issues				✓	Protection of native grasslands and woodlands, likely state species issues.
Uniqueness of habitat at wind-energy facility				✓	Overall, habitat in the ECIIWRA is not unique compared to the surrounding landscape, but is of concern on a broader scale.
Potential for rare plants to occur				✓	No federally listed plants known to occur in county.
Potential for use by bats			✓		The site has scattered trees, buildings, and wetlands.

REFERENCES

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

Barclay, R.M.R., E.F. Baerwald, and J.C. Gruver. 2007. Variation in Bat and Bird Fatalities at Wind Energy Facilities: Assessing the Effects of Rotor Size and Tower Height. Canadian Journal of Zoology 85: 381-387. http://www.bio.ucalgary.ca/contact/faculty/pdf/Barclay07Tur.pdf

Bat Conservation International (BCI) website. Bat Species: US Bats. Bat Conservation International, Inc., Austin, Texas. Accessed January-February 2009. Accessed January-February, 2009. Homepage: http://www.batcon.org Species Profiles: http://batcon.org/index.php/education/article-and-information/species-profiles.html

Cryan, P.M. and J.P. Veilleux. 2007. Migration and the Use of Autumn, Winter, and Spring Roosts by Tree Bats. In: Bats and Forests. M. J. Lacki, J. P. Hayes, and A. Kurta, eds. The Johns Hopkins University Press, Baltimore, Maryland. Pp. 153-175.

Endangered Species Act (ESA). 1973. 16 United States Code § 1531-1544. December 28, 1973.

Environmental Conservation Online System (ECOS). 2008. US Fish and Wildlife Service (USFWS) Threatened and Endangered Species System (TESS). USFWS Endangered Species Program Homepage: http://www.fws.gov/endangered/ ECOS: http://ecos.fws.gov/tess_public

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report: July 2001 - December 2003. Technical report for and peer-reviewed by FPL Energy, Stateline Technical Advisory Committee, and the Oregon Energy Facility Siting Council, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington, and Northwest Wildlife Consultants (NWC), Pendelton, Oregon. December 2004. http://www.west-inc.com

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, Jr. , K.J. Sernka, and R.E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Bird Collision Mortality in the United States. National Wind Coordinating Committee (NWCC) Publication and Resource Document. Prepared for the NWCC by WEST, Inc., Cheyenne, Wyoming. August 2001. http://www.nationalwind.org/publications/default.htm and http://www.west-inc.com

Gruver, J.C. 2002. Assessment of Bat Community Structure and Roosting Habitat Preferences for the Hoary Bat (Lasiurus cinereus) near Foote Creek Rim, Wyoming. M.S. Thesis. University of Wyoming, Laramie, Wyoming. 149 pp.

Hoover, S.L. and M.L. Morrison. 2005. Behavior of Red-Tailed Hawks in a Wind Turbine Development. Journal of Wildlife Management 69(1): 150-159.

Johnson, G.D. 2005. A Review of Bat Mortality at Wind-Energy Developments in the United States. Bat Research News 46(2): 45-49.

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, and D.A. Shepherd. 2000a. Avian Monitoring Studies at the Elm Creek Wind Resource Area, Minnesota Wind Resource Area: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp. http://www.west-inc.com

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2003. Mortality of Bats at a Large-Scale Wind Power Development at Buffalo Ridge, Minnesota. The American Midland Naturalist 150: 332-342.

Johnson, G.D., Young, D. P. Jr., W.P. Erickson, C.E. Derby, M.D. Strickland, and R.E. Good. 2000b. Wildlife Monitoring Studies, SeaWest Windpower Plant, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, San Diego, California, and the Bureau of Land Management, Rawlins, Wyoming, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 9, 2000. http://www.west-inc.com

Kunz, T.H., E.B. Arnett, W.P. Erickson, A.R. Hoar, G.D. Johnson, R.P. Larkin, M.D. Strickland, R.W. Thresher, and M.D. Tuttle. 2007. Ecological Impacts of Wind Energy Development on Bats: Questions, Research Needs, and Hypotheses. Frontiers in Ecology and the Environment 5(6): 315-324.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. Wilson Bulletin 111(1): 100-104.

Migratory Bird Treaty Act (MBTA). 1918. 16 United States Code § 703-712. July 13, 1918.

Minnesota Department of Natural Resources (MDNR). 2009a. Homepage. Accessed January-February, 2009. http://www.dnr.state.mn.us/

Minnesota Department of Natural Resources (MDNR). 2009b. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/index.html

Minnesota Department of Natural Resources (MDNR). 2009c. Species Profile: A Jumping Spider. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ILARAC0010

Minnesota Department of Natural Resources (MDNR). 2009d. Species Profile: American White Pelican. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNFC01010

Minnesota Department of Natural Resources (MDNR). 2009e. Species Profile: Bald Eagle. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNKC10010

Minnesota Department of Natural Resources (MDNR). 2009f. Species Profile: Loggerhead Shrike. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABPBR01030

Minnesota Department of Natural Resources (MDNR). 2009g. Species Profile: Trumpeter Swan. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNJB02030

Minnesota Department of Natural Resources (MDNR). 2009h. Species Profile: Wilson's Phalarope. Rare Species Guide. Accessed January-February, 2009. http://www.dnr.state.mn.us/rsg/profile.html?action=elementDetail&selectedElement=ABNNF20010

National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press. Washington, D.C. www.nap.edu

National Wind Coordinating Committee (NWCC). 2004. Wind Turbine Interactions with Birds and Bats: A Summary of Research Results and Remaining Questions. Fact Sheet, Second Edition. November 2004. http://www.nationalwind.org/publications/default.htm

Piorkowski, M.D. 2006. Breeding Bird Habitat Use and Turbine Collisions of Birds and Bats Located at a Wind Farm in Oklahoma Mixed-Grass Prairie. M.S. Thesis. Oklahoma State University, Stillwater, Oklahoma. 112 pp.

Shaffer, J.A. and D.H. Johnson. 2007. Effects of Wind Developments on Grassland Birds in Native Habitats in the Northern Great Plains. Presented at the 2007 International Meeting of The Wildlife Society, Tucson, Arizona.

Soil Survey Geographic (SSURGO) Database, website. SSURGO Soils Data. United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). Accessed January-February, 2009. http://soils.usda.gov/survey/geography/ssurgo/

The Minnesota Ornithologists' Union (MOU). 2009. Species Occurrence Maps. Accessed January-February, 2009. http://www.moumn.org/cgi-bin/occurrence.pl

US Department of Agriculture (USDA) National Agriculture Imagery Program (NAIP). 2007. NAIP Imagery and Status Maps. http://www.fsa.usda.gov/FSA/apfoapp?area=home&subject=prog&topic=nai

US Environmental Protection Agency (USEPA). 2009. Level III and IV Ecoregions. USEPA, Corvallis, Oregon. Available online at http://www.epa.gov/wed/pages/ecoregions.htm; ecoregion data available at http://www.epa.gov/wed/pages/ecoregions/level_iii.htm and http://www.epa.gov/wed/pages/ecoregions/level_iv.htm

US Fish and Wildlife Service (USFWS). 1998. Migration of Birds, Circular 16. US Department of the Interior, USFWS.

US Fish and Wildlife Service (USFWS). 2008. Prairie Bush Clover (Lespedeza leptostachya) Fact Sheet. Last updated November 25, 2008. http://www.fws.gov/midwest/endangered/plants/prairieb.html

US Fish and Wildlife Service (USFWS). 2009. County Distribution of Federally-Listed Threatened, Endangered, Proposed, and Candidate Species. http://www.fws.gov/midwest/endangered/lists/minnesot-cty.html

US Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI). 2007. Region 3 NWI, Great Lakes-Big Rivers (Midwest) Region: Minnesota, Wisconsin, Michigan, Iowa, Missouri, Illinois, Indiana, and Ohio. Fort Snelling, Minnesota. http://wetlandsfws.er.usgs.gov/nwi/ and http://www.fws.gov/midwest/

US Geological Survey (USGS), (Breeding Bird Survey) BBS. 2009. BBS Database, North American Breeding Bird Survey Internet Data Set. USGS Patuxent Wildlife Research Center. Accessed January-February, 2009.

US Geological Survey (USGS) National Land Cover Database (NLCD). 2001. Land Use/Land Cover NLCD Data. USGS. Sioux Falls, South Dakota.

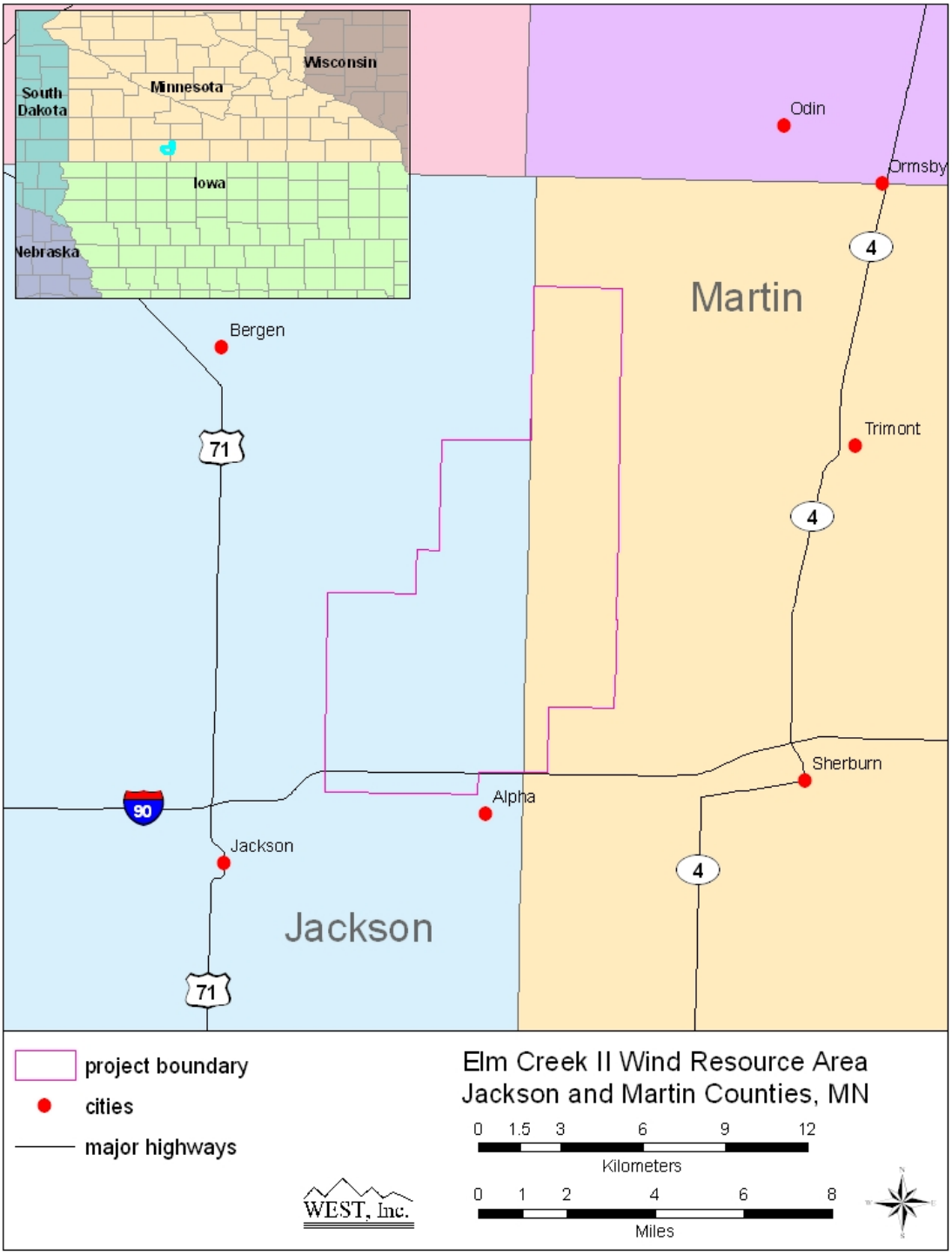

Figure 1. Location of the ECIIWRA.

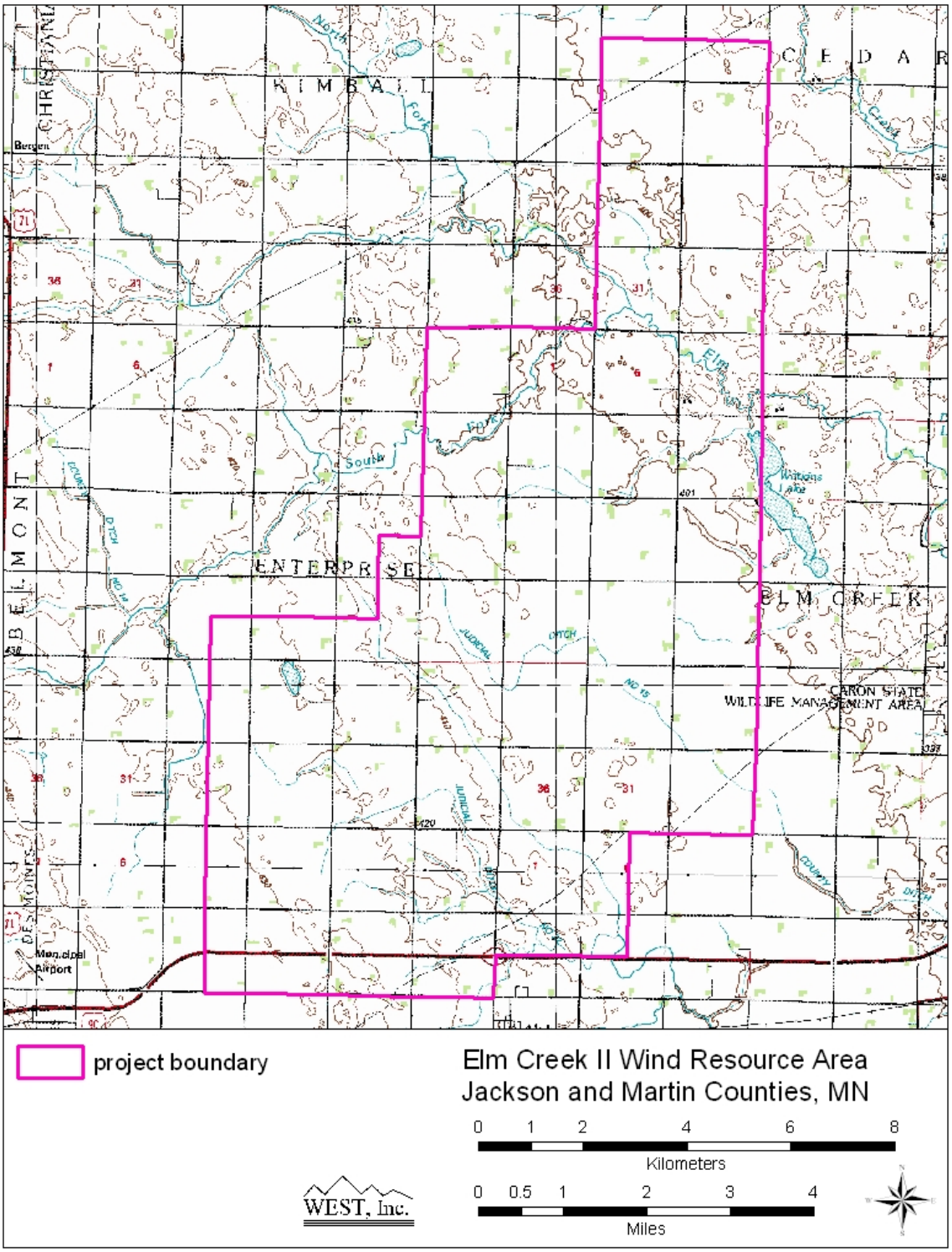

Figure 2. Topographic map of the ECIIWRA.

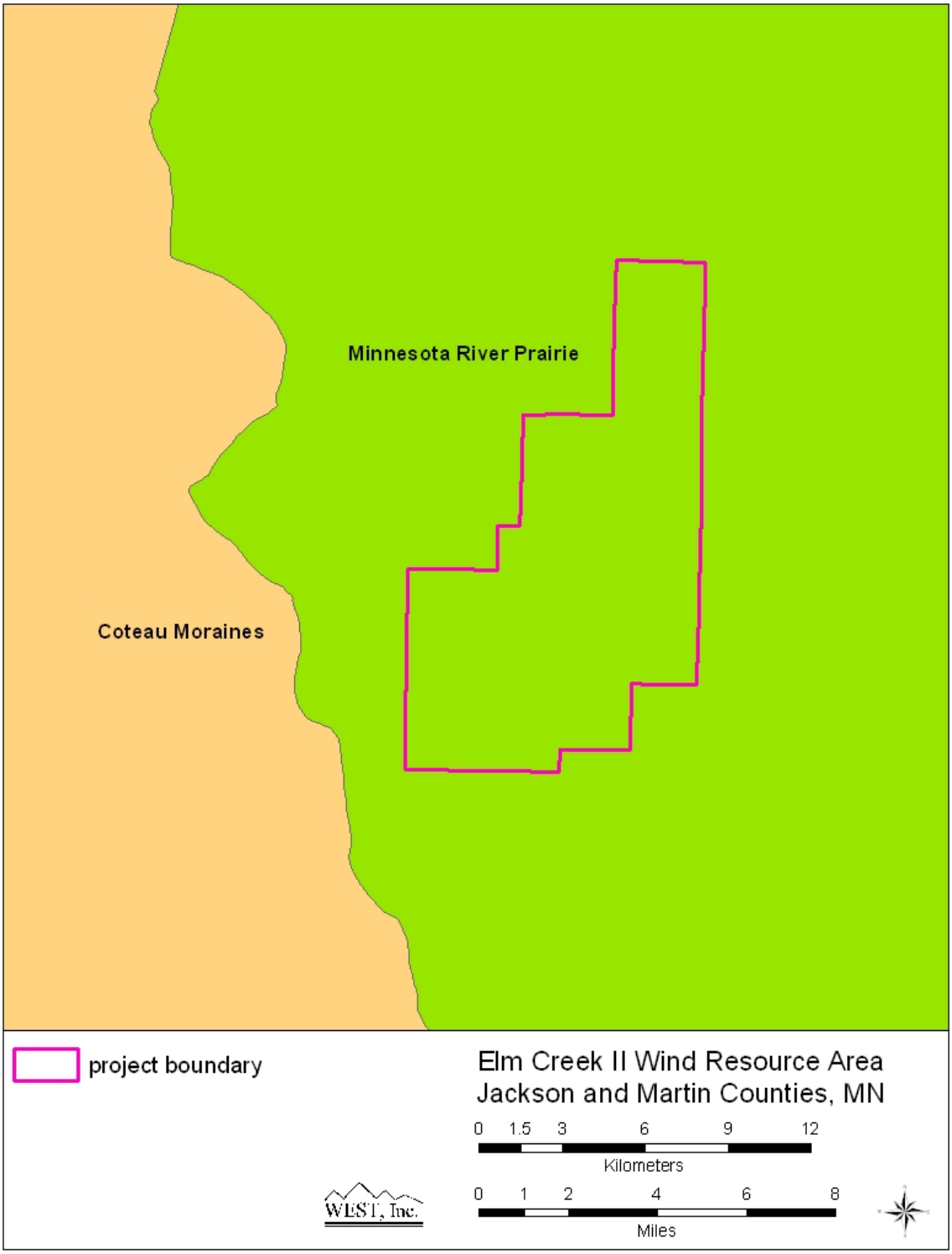

Figure 3. Ecoregion map of the ECIIWRA.

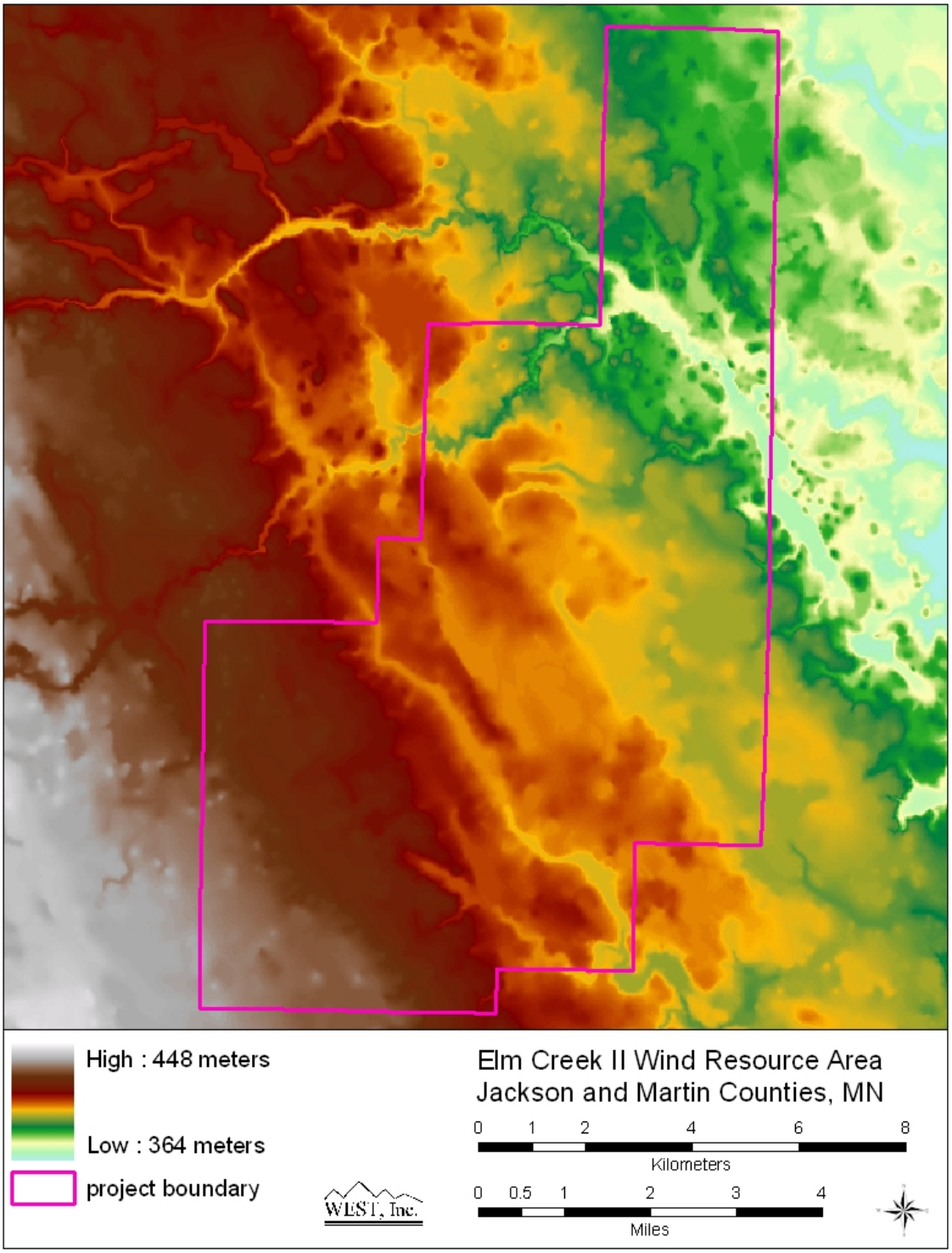

Figure 4. Digital elevation model of the ECIIWRA.

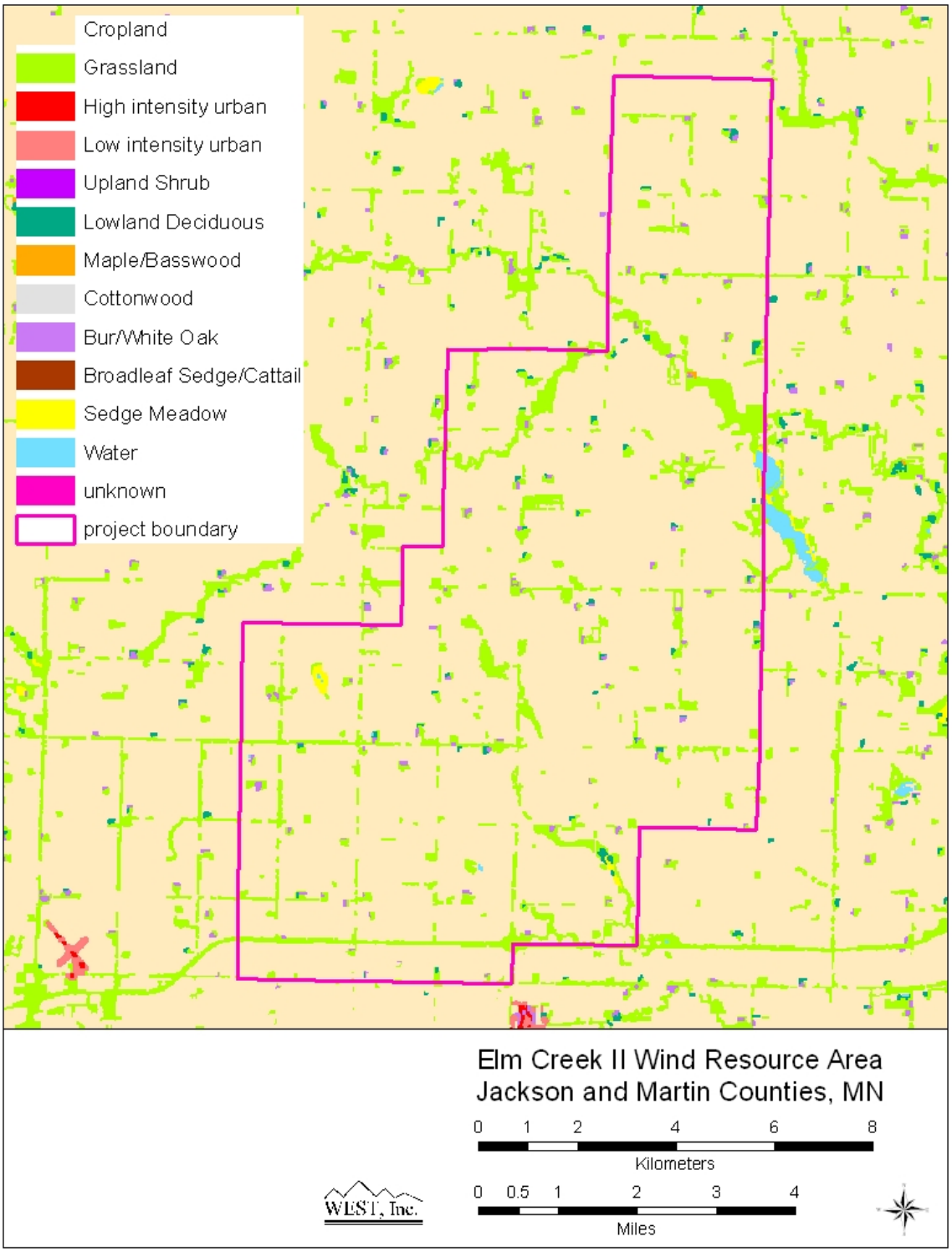

Figure 5. Land cover on the ECIIWRA.

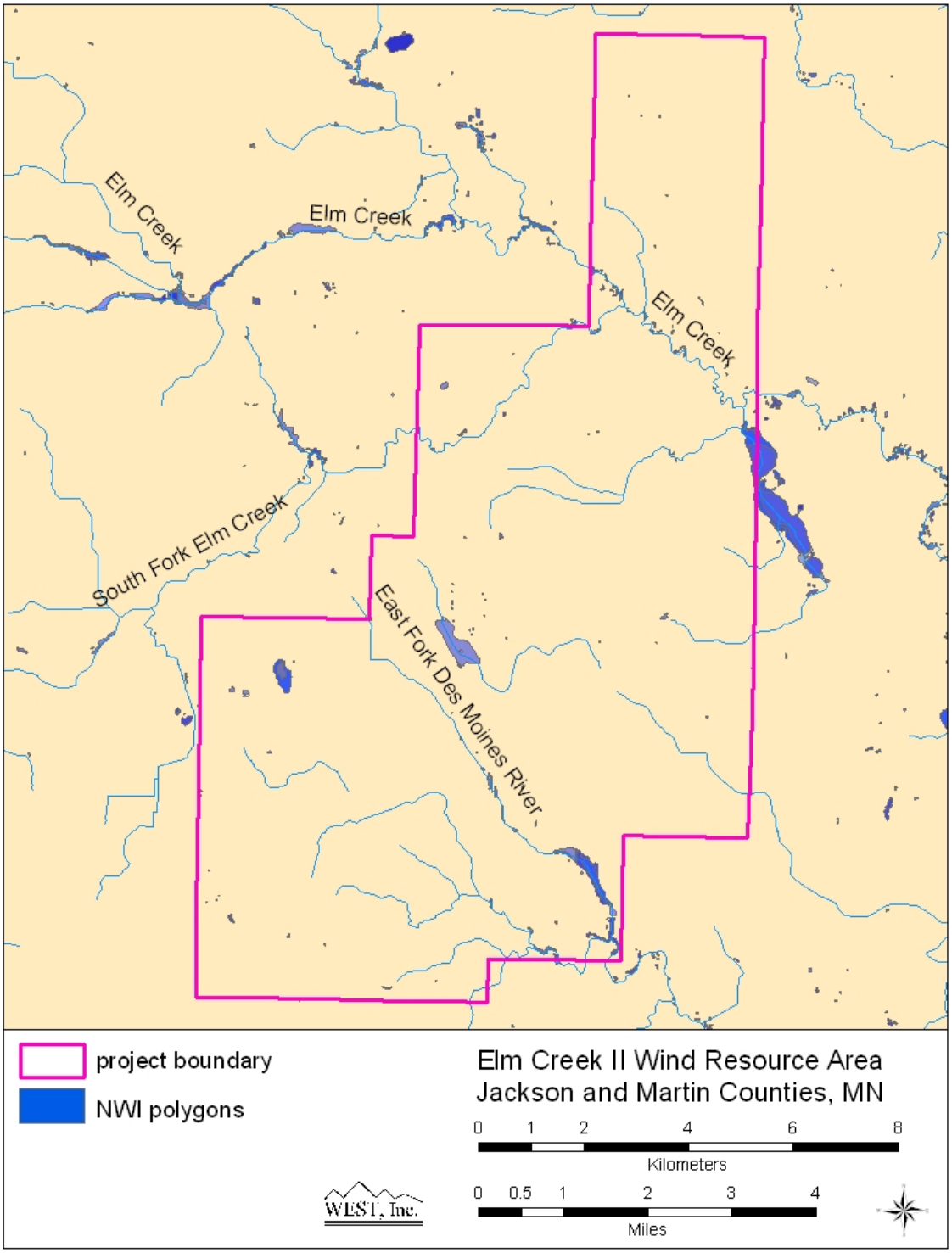

Figure 6. Wetlands and rivers in the ECIIWRA.

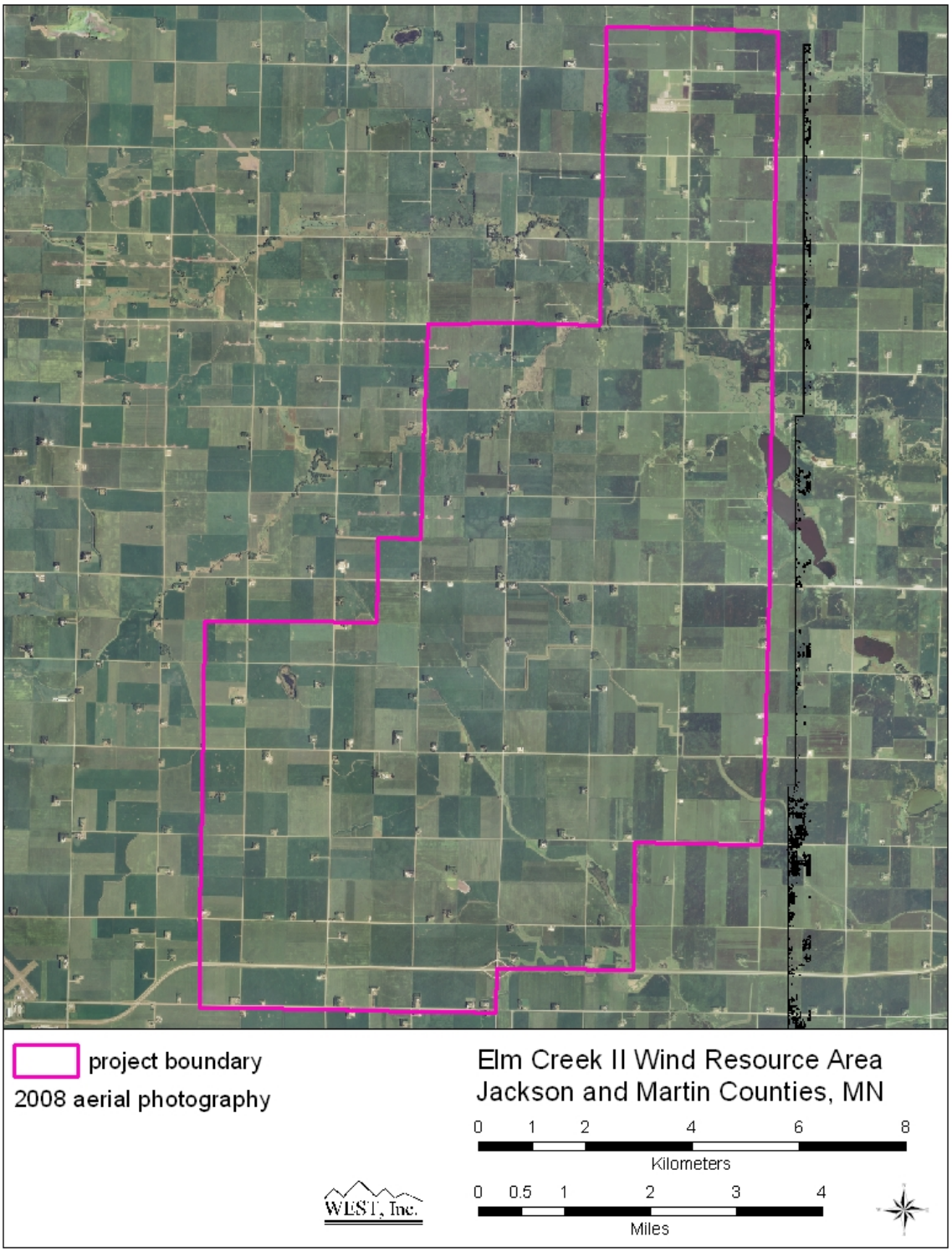

Figure 7. Aerial photo of the ECIIWRA (USDA NAIP 2007).

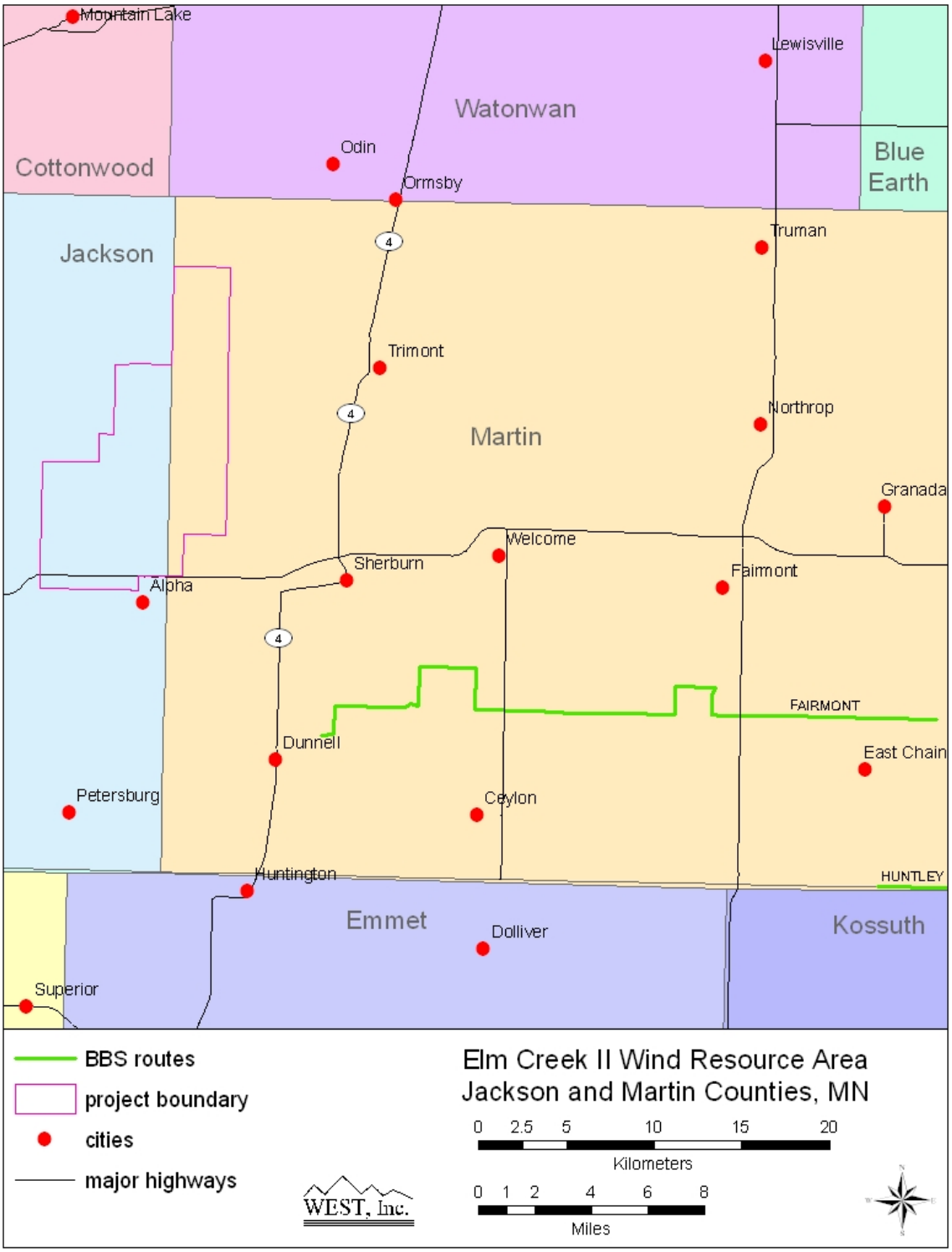

Figure 8. Breeding bird survey routes near the ECIIWRA.