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April 26, 2016

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NORTH DAKOTA
PUBLIC SERVICE COMMISSION

Hand Delivery

Mr. Darrell Nitschke
Executive Director
NORTH DAKOTA PUBLIC
SERVICE COMMISSION
600 E. Boulevard Avenue, Dept. 408
Bismarck, ND 58505-0480

In re: Oliver Wind III, LLC
Case Nos. PU-16-122 and PU-16-123
Our File No. 35-218-029

Dear Mr. Nitschke:

Please find enclosed for filing eleven copies of the whooping crane report in the captioned cases.

Please let me know if you have any questions. Thank you.

Sincerely,

Wade Mann

Wade C. Mann

WCM/lh
enc.

cc: Sara Cardwell (via email)
Mitchell D. Armstrong (via email)
Brian Schmidt (via email)
Patrick J. Ward (via email)

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Whooping Crane Report
Oliver Wind III, LLC
Wade Mann, Crowley Fleck, PLLP

24 PU-16-122 Filed 04/26/2016 Pages: 28
Whooping Crane Report
Oliver Wind III, LLC
Wade Mann, Crowley Fleck, PLLP

WHOOPING CRANE LIKELIHOOD OF OCCURRENCE REPORT

FOR THE

Oliver III WIND ENERGY CENTER
MORTON & OLIVER COUNTIES, NORTH DAKOTA

Prepared For:

NextEra Energy Resources, LLC
700 Universe Blvd.
Juno Beach, Florida 33408

Prepared By:

Tetra Tech, Inc.
350 Indiana St, Suite 500
Golden, CO 80401

April 2016

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EXECUTIVE SUMMARY

Oliver Wind III, LLC (Oliver Wind III) contracted Tetra Tech, Inc. (Tetra Tech) to conduct a landscape-scale analysis to assess the potential occurrence of whooping cranes (*Grus americana*) at the proposed Oliver III Wind Energy Center (Project) located in Morton and Oliver counties, North Dakota. The whooping crane is a federally endangered species that migrates through the western and central portions of North Dakota during spring and fall. The two most likely impacts of wind development on whooping cranes are: 1) whooping cranes' avoidance of the area around the facility; and 2) direct mortality of whooping cranes due to collisions with transmission lines, turbines, or other facilities. Tetra Tech evaluated the likelihood of whooping cranes to occur within the boundary of the proposed Project (Project Area) using a likelihood index that considers; 1) the location of the proposed Project Area in the well-defined migration corridor, 2) the presence of foraging and roosting sites in the proposed Project Area, and 3) the relative availability of habitat within the proposed Project Area compared to the surrounding landscape. Tetra Tech concluded that the likelihood of whooping cranes occurring in the proposed Project Area is low. The Project is within the 75-percent isopleth of the migration corridor, but the major factor that contributed to this low likelihood finding was that the proposed Project Area had a much lower proportion of suitable wetlands compared to the surrounding 35 mile (56 km) buffer area. Whooping cranes may still migrate through the proposed Project Area but the lower proportion of wetlands within the proposed Project Area compared to the surrounding 35 mile buffer area may potentially make the proposed Project Area less attractive to migrating whooping cranes than the 35 mile buffer area. The low amount of suitable wetlands (1.4 percent of the proposed Project Area) indicates a minimal amount of habitat loss due to any potential avoidance of the area should project development proceed. In addition, Project development is not expected to impact any wetlands as the Project design has made every effort to avoid impacts to wetlands as much as feasible.

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1.0 INTRODUCTION

Oliver Wind III, LLC (Oliver Wind III), a wholly owned, indirect subsidiary of NextEra Energy Resources, LLC (NEER), proposes to develop the Oliver III Wind Energy Center (the Project) in Morton and Oliver Counties, North Dakota (Figure 1). One potential constraint when developing wind energy facilities in parts of the Great Plains is the likelihood of the presence of the federally endangered whooping crane (*Grus americana*). Whooping cranes migrate through the western and central portions of North Dakota during spring and fall. Whooping cranes have been killed by collisions with power lines, and the whooping crane recovery plan lists construction of power lines, fences, and other structures in the migration corridor as a threat to the species (CWS and USFWS 2007). Thus, the construction of wind turbines may pose a risk to whooping cranes through avoidance of areas or direct mortality where turbines are located.

Oliver Wind III contracted Tetra Tech, Inc. (Tetra Tech) to conduct a landscape-scale analysis to assess the potential occurrence of whooping cranes within the boundaries of the proposed Project (Project Area). The objective of this likelihood of occurrence analysis is to evaluate the biological and landscape features within the proposed Project Area to determine the potential for whooping cranes to occur during migration. Certain landscape features may increase the likelihood of whooping crane occurrence during migration. Therefore, Tetra Tech developed a likelihood index to evaluate the proposed Project Area based on its location in the migration corridor, the presence of feeding and roosting sites, and the availability of habitat within the proposed Project Area compared to the surrounding landscape. The likelihood index does not predict how many whooping cranes may occur in the proposed Project Area; rather, it scores the site based on a suite of variables that are related to whooping crane occurrence. Higher scores denote higher likelihood of occurrence. This likelihood index is not intended to replace field surveys. However, the low probability of detecting a whooping crane during field surveys minimizes the utility of surveys in documenting presence in or absence in a given area. Developing an estimate of the likelihood of occurrence is therefore the best means of evaluating potential impacts to the species. Consequently, this assessment tool was designed to take advantage of available migration and habitat data to provide an empirically based assessment of the likelihood of occurrence of the species in the proposed Project Area.

2.0 LEGAL STATUS OF THE WHOOPING CRANE IN THE UNITED STATES

The whooping crane is protected by both federal and state laws in the United States. It was considered endangered in the United States in 1970 and the endangered listing was 'grandfathered' into the Endangered Species Act (ESA) of 1973, which makes it unlawful to knowingly violate the "take" provisions of the ESA (CWS and USFWS 2007). "Take" is defined as: "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (16 U.S.C. §1532(19)). Modification or degradation of listed species' habitats where the modification actually kills or injures wildlife by impairing essential behavioral patterns is considered "harm" under ESA regulations. "Incidental take" occurs when a fatality of an ESA-listed species occurs as an unintended consequence of an otherwise legal activity, as would be the case in the unlikely event of a fatality occurring at a wind farm. To Tetra Tech's knowledge, no whooping crane fatality has occurred at a wind energy facility. North Dakota does not have a state endangered or threatened species list, but instead defers to the USFWS federal listing of endangered and threatened species that occur within North Dakota (NDGF 2012).

3.0 ENVIRONMENTAL SETTING AND PROJECT AREA DESCRIPTION

3.1 Environmental Setting

The proposed Project Area is located in the Missouri Plateau and River Breaks subregion of the Northwestern Great Plains Ecoregion (Bryce et al. 1996). The topography of the region is a semi-arid rolling plain (Bryce et al. 1996). Vegetation in the region was historically mixed-grass prairie with blue grama (*Bouteloua gracilis*), little bluestem (*Schizachyrium scoparium*), prairie sandreed (*Calamovilfa longifolia*) and other associated prairie grasses (Bryce et al. 1996). Land use within the ecoregion is primarily dryland farming and cattle grazing. Native grasslands still occur in areas of steep topography unsuitable for agriculture. The dissected topography, wooded draws, and uncultivated areas of the River Breaks subregion of the Missouri River may provide additional habitat for wildlife such as deer, small mammals, and migratory birds. Riparian forests of cottonwood (*Populus deltoides*) and green ash (*Fraxinus pennsylvanica*) persist along major tributaries such as the Moreau and Cheyenne rivers, but they have largely been eliminated along the Missouri River by impoundments (Bryce et al. 1996).

3.2 Project Area Description

The 21,878.20-acre proposed Project Area is located on privately owned lands within Morton and Oliver counties in southwestern North Dakota. The Project has a proposed nameplate capacity of approximately 100 megawatts (MW). The Project also includes a planned approximately 10-mile, 230-kilovolt (kV) overhead transmission interconnect line. Additional Project facilities include access roads, electrical collection systems and cabling, a collection substation, an operation and maintenance (O&M) building, and a construction laydown area.

The existing land use in the proposed Project Area is primarily agriculture and cattle production. The area contains a few small wetlands that vary from shallow vegetated depressions, man-made cattle ponds, and intermittent creeks. Nelson Lake is located approximately four miles north of the Project Area. Residences and a few abandoned farmsteads are scattered throughout the proposed Project Area. The proposed Project Area is mostly cattle pastures, hayfields, and agriculture. Trees and forested areas are restricted to riparian areas and windbreaks for residential houses and along agricultural fields.

3.3 Whooping Cranes in North Dakota

In North Dakota, whooping cranes migrate annually through the central parts of the state, mostly along the Missouri River, during the spring and fall (NDGF 2013). During migration, whooping cranes primarily use wetlands and cropland ponds for roosting, feeding, or both. Seasonal and semi-permanent wetlands are the most commonly used. Typically, larger wetlands greater than 90.4 acres (40 hectares) are used for roosting and smaller wetlands for foraging (NDGF 2013). Whooping crane sightings in North Dakota have been documented at Lake Sakakawea / Audubon National Wildlife Refuge (approximately 37 miles to the north of the proposed Project Area), Long Lake National Wildlife Refuge (approximately 42 miles to the southeast of the proposed Project Area), and along the Missouri River (approximately 8 miles to the east of the proposed Project Area) during the annual migration periods (Figure 1; Austin and Richert 2001).

4.0 WHOOPING CRANE BIOLOGY

The whooping crane population in North America sharply declined and disappeared from most of its historic range by the late 1800's (CWS and USFWS 2007). The number of whooping cranes in North America prior to 1870 is estimated to have been between 500 and 1,400 individuals (Allen 1952, Banks 1978), but some biologists suggest that the population may have numbered as many as 10,000 individuals (CWS and USFWS 2007). Activities such as habitat destruction, hunting, and displacement due to anthropogenic activities likely led to widespread population declines (CWS and USFWS 2007). One self-sustaining wild population of whooping cranes currently exists in the world. Members of this population breed primarily within the boundaries of Wood Buffalo National Park in Canada and migrate through the central United States to wintering grounds at the Aransas National Wildlife Refuge along the Gulf Coast of Texas (Figure 2). This flock is referred to as the Aransas-Wood Buffalo National Park Population. As a result of intensive management, this population has increased from 15 birds in 1941 to an estimated 308 birds (with a 95% probability of actual flock size being between 267–350 birds) as of the 2014/2015 winter whooping crane survey conducted by USFWS (USFWS 2015a). An updated winter survey for 2015/2016 is not available as of March 2016, but is expected by June 2016.

The whooping crane is a long-lived species that may reach 28 years old in the wild (Binkley and Miller 1983). Individuals reach sexual maturity at 3 to 5 years of age and form life-long breeding pairs while on the wintering grounds or during spring migration (Stehn 1997; CWS and USFWS 2007). Whooping cranes have low annual reproductive output. Females typically lay two eggs, but only 10 percent of families arrive on the winter grounds with two chicks because the smaller chick usually dies within the first two weeks after hatching (CWS and USFWS 2007). The juveniles become independent of the parents on the wintering ground prior to spring migration. Sexually immature individuals (i.e., subadults) return to the breeding grounds where they may remain solitary or congregate in small groups on the periphery of breeding pairs (CWS and USFWS 2007).

4.1 Reasons for the Population Decline

Populations of long-lived species with low annual reproductive output such as the whooping crane are sensitive to changes in adult survival (Stahl and Oli 2006). Hunting, especially during spring migration, from 1870 to 1930 resulted in 274 documented whooping crane fatalities (Allen 1952). In addition, Hahn (1963) tallied 309 mounts and 9 skeletons in museum collections throughout the world. Because many of these specimens do not contain information regarding the date and location of collection, it is unlikely that the majority were collected by museum personnel. It is possible that mortality from shooting exceeded annual production of juveniles during the early 1900s (CWS and USFWS 2007).

Degradation and loss of breeding habitat eliminated the whooping crane from much of its core breeding range in North America. Whooping cranes once bred from the southern edge of Lake Michigan north through southern Minnesota to northeastern North Dakota through Manitoba, Saskatchewan, and Alberta (Allen 1952). Conversion of prairie and pothole ecosystems to agriculture and ranching made much of the breeding habitat unsuitable (CWS and USFWS 2007).

4.2 Threats to Whooping Cranes

Several factors threaten the whooping crane because of its small population size and concentration of all members of the Aransas-Wood Buffalo National Park population at single breeding and wintering locations. Due to their high degree of site fidelity, members of the Aransas-Wood Buffalo Population are unlikely to naturally recolonize the historic whooping crane range in North America.

Threats to the whooping crane identified in the recovery plan that are related to wind power development include collision with power lines, fences, and other structures, and loss and degradation of stopover and wintering habitat through avoidance (CWS and USFWS 2007; USFWS 2009).

Power lines pose a major threat to whooping cranes when they are located in the vicinity of foraging or roosting habitat because individuals often fly at low altitudes (33 to 49 feet above the ground) when moving among sites (CWS and USFWS 2007; Stehn and Wassenich 2008). The majority of documented fatalities during migration are due to collisions with power lines. Since 1956, 46 whooping cranes have been killed or seriously injured as a result of collisions with power lines (Stehn and Wassenich 2008). Collisions with power lines have resulted in fatalities of whooping cranes in other experimental populations that are maintained by the introduction of captive-reared young (Stehn and Wassenich 2008). Fourteen individuals from the Florida non-migratory population and one individual in the migratory Wisconsin population have died from colliding with power lines (Stehn and Wassenich 2008).

Although no whooping crane mortality has been attributed to wind turbines, the whooping crane recovery plan considers wind power development within the whooping crane migration corridor a threat because of the construction of power lines and associated structures (CWS and USFWS 2007). In a large scale modelling study of the migratory corridor, Pearse et al. (2015) found that nearly 10,000 wind turbines have been constructed within the U.S. study area (migration corridor). Most areas with wind turbines in the migration corridor did not contain whooping crane stopover sites (84 percent), and only 2 percent of cells (a cell being 7.7 $miles^2$ [$20km^2$]) were identified as core migration areas (Pearse et al. 2015). During migration, both sandhill and whooping cranes have been seen in the vicinity of operational wind turbines, and Nagy et al. (2012) showed that the cranes flew either above or around the turbines, therefore minimizing the likelihood of turbine collision. Other studies have documented sandhill cranes gradually climbing as they approach marked power lines (Morkill and Anderson 1991, Murphy et al. 2009). The USFWS (2009) believes that whooping cranes will avoid stopping at areas with operational wind turbines. Thus, behavioral avoidance of wind farms by whooping cranes may reduce the probability of collision but may result in loss of stopover habitat.

5.0 WHOOPING CRANE MIGRATION

Whooping cranes undertake a 5,000 miles (8,046 km) round-trip migration from the breeding area in Canada (Wood Buffalo) to the wintering area in Texas (Aransas) every year (USFWS 2015b). A one-way trip can take about 50 days to complete in the fall (USFWS 2015b) and approximately 28 days in the spring (CWS and USFWS 2007). Individuals depart the breeding ground in Canada and travel south through Alberta, Canada, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas to the wintering ground at Aransas National Wildlife Refuge on the Texas coast. Whooping cranes may travel as singles, in pairs, or as small flocks or family groups of 3 to 5 birds (Johns 1992, CWS and USFWS 2007). Occasionally, whooping cranes may travel with sandhill cranes during migration and stopover sites also used by sandhill cranes may be used by whooping cranes as well (CWS and USFWS 2007).

The whooping crane migration route is well defined and 95 percent of all recorded observations occur within an approximate 200 mile (322km) wide corridor during spring and fall migration (USFWS 2010; Figure 2). The median location of all crane observations was statistically derived and used to describe the migration route from the breeding grounds to the wintering grounds (CWS and USFWS 2007). Buffers were then calculated based on the percentage of observations to further define the migratory corridor. Tacha et al. (2010) identified the migration corridor width by using a distance-from-centerline approach of each whooping crane observation (through 2008) and determined that 75 percent of stopover sites occurred within 29 miles (48 km) of the centerline, 85 percent within 49 miles (80 km), and 95 percent within 84 miles (136 km) which is used by USFWS and in this assessment report (see figures 2 and 3). Pearse et al. (2015) obtained similar results using only data from satellite-telemetry tracking of whooping cranes for the entire migration corridor and (based on the derived centerline) found the average distance of stopovers to the centerline was 27 miles (43.8 km) (median = 17 miles [27.5 km]; SD = 19 miles [31.4 km]; max = 298 miles [480.4 km]). The 75th percentile was 36 miles (58.8 km), 85th percentile was 51 miles (82.3 km), and 95th percentile was 90 miles (144.1 km) (Pearse et al. 2015).

During migration, whooping cranes can occur where suitable habitat is available. Four sites in the migration corridor are used consistently by whooping cranes and have high annual use: the Platte River in Nebraska, Cheyenne Bottoms Wildlife Management Area and Quivira National Wildlife Refuge in Kansas, and the Salt Plains National Wildlife Refuge in Oklahoma. Additionally, Aransas National Wildlife Refuge in Texas is used yearly by whooping cranes as the wintering grounds. These five sites are designated as critical habitat under the Endangered Species Act (Figure 2; CWS and USFWS 2007). The Platte River in Nebraska is the closest of these four sites to the Project Area and is located over 433 miles (697 km) to the south-southeast.

5.1 Fall Migration

Whooping cranes depart the breeding grounds at Wood Buffalo National Park in mid-September and parents with young are usually the last to depart. Birds may travel alone, in pairs, in family groups, or in small flocks (Johns 1992). The birds first travel southeast about 483km (300 miles) to a major staging area in Saskatchewan, where they may remain for 2 to 4 weeks before resuming migration. During fall migration, birds may stay at traditional stopover sites for 7 to 10 days, but stays as long as 6 weeks have been documented at Quivira National Wildlife Refuge (CWS and USFWS 2007). In North Dakota, Long Lake National Wildlife Refuge (42 miles [67 km] southeast of the proposed Project Area) provides stopover habitat for large numbers of migrating sandhill cranes, shorebirds, ducks, geese, swans, and pelicans along with receiving occasional whooping crane use (USFWS 2015b). The majority of whooping cranes reach the wintering grounds by mid-November. In North Dakota, most sightings occur from late September to early November with peak migration occurring in mid-October (Austin and Richert 2001).

5.2 Spring Migration

Whooping cranes depart the wintering grounds in late March; the last birds depart in May. Breeding pairs are typically first to depart and migration is facilitated by winds from the southeast. There is no known staging area in spring as there is in fall, and migration is completed in 2 to 4 weeks. Traditional stopover sites that are used in fall are also used in spring. However, individuals spend fewer days at stopover sites during spring migration. During the spring migration, whooping cranes travel through North Dakota from mid-April to early May with peak migration in late April (Austin and Richert 2001).

5.3 Migration Flight Behavior

Whooping cranes are diurnal (daytime) migrants and primarily fly by using static soaring, but low-level flapping flight may be used when conditions dictate. Migration is initiated after the air has warmed and thermal updrafts are present. Individuals spiral upwards on thermals of warm air to heights of 1,000 (304.8 meters) to 6,000 feet (1,828.8 meters) (Kyut 1992), then enter into long, descending glides. This process is repeated throughout the day until suitable habitat is reached. Static soaring is energy efficient as birds seldom flap after they are airborne. Whooping cranes may travel up to 500 miles (805 km) per day in ideal conditions; during average conditions, they may travel 250 miles (402km) per day (Stehn and Wassenich 2008). During the end of the migration flight, individuals will enter long descending glides and use flapping flight at lower altitudes until they reach suitable roosting and feeding habitat. Whooping cranes do not regularly migrate during unfavorable weather conditions such as a strong headwind, rain or other precipitation, or overcast conditions. When visibility is poor, individuals use flapping flight at lower altitudes until they reach suitable roosting or feeding habitat.

5.4 Stopover Habitat Characteristics

Whooping cranes require roosting habitat when they stop during migration. At a broad scale, whooping cranes appear to adhere closely to a specific migratory route and a narrow range of directional headings during migration (Howe 1989, Austin & Richert 2001, Belaire et al. 2014). Within this migratory route, certain areas are often preferred (e.g., areas closer to crops and wet natural habitats), whereas others are avoided (e.g., areas of high road and human settlement cover) as stopover sites (Belaire et al. 2014, Pearse et al. 2015). Whooping cranes often select sites with unobstructed visibility (Austin and Richert 2001). Palustrine wetlands (freshwater wetlands characterized by emergent vegetation) are most often used as roosting sites, but individuals have been found roosting at lacustrine wetlands (wetlands around a lake), and riverine wetlands (wetlands along a river; Howe 1989; Austin and Richert 2001). The size of wetlands used during spring and fall migration ranges from 1 acre (0.4 hectare) to over 1,236 acres (500 hectares), and no seasonal use patterns are evident (Austin and Richert 2001); 75 percent of recorded roost wetlands were smaller than 10 acres (4 hectares). Although size of the wetlands used for roosting varies, water depth ranges from 18 to 20 inches (46 - 51cm) and little variability is found among sites.

Whooping cranes forage in wetlands and agricultural fields during migration and may commute between roosting and feeding areas. Palustrine wetlands are used most often when whooping cranes forage in wetlands, but lacustrine and riverine wetlands have also been used as feeding sites (Austin and Richert 2001). Among agricultural crops used as feeding sites, the use of winter wheat was higher than other crop types in the fall and the use of row-crop stubble (comprised mostly of corn) was higher in the spring than other crop types (Austin and Richert 2001). Whooping cranes have also been observed feeding in sorghum, sunflower, and soybean stubble (Austin and Richert 2001). Feeding sites are often located adjacent to roosting sites. For example, 94.9 and 72.9 percent of roosting sites were within 0.62 mile (1 km) of feeding sites in spring and fall, respectively (Johns et al. 1997; USFWS 2009).

6.0 ASSESSMENT OF WHOOPING CRANE LIKELIHOOD OF OCCURENCE

The primary threats of wind energy development to whooping cranes are mortality due to collision with transmission lines and associated structures and loss of habitat due to avoidance. Because of the high level of concern regarding whooping cranes, the ability to evaluate the risk to whooping cranes at an individual project area is a critical component to understanding the environmental impacts of a proposed wind energy facility. Here, Tetra Tech utilizes a method to evaluate the likelihood of whooping cranes to occur at the proposed Project Area. This evaluation considers the location of the Project Area in the well-defined migration corridor, the presence of feeding and roosting sites, and the availability of habitat within the Project Area compared to the landscape in the 35 mile (56.3 km) buffer area (Table 1). Tetra Tech expects whooping cranes to be more likely to occur over the life of a project at project areas with high scores. For the purposes of this analysis, the scores calculated for each parameter were entered into a formula and the resulting score represented the likelihood of occurrence for whooping cranes in the proposed Project Area which was ranked as: Low (less than 5); Moderate (5-10); or High (greater than 10). This likelihood index is not intended to replace field surveys. However, the low probability of detecting a whooping crane during field surveys minimizes their utility in documenting likelihood of occurrence in a given area. Consequently, this likelihood index was designed to take advantage of available data regarding habitat use by cranes and the availability of habitat in the Project Area. A description of each of the three factors included in this analysis (location in the migration corridor, attractiveness of the landscape, and presence of foraging and roosting sites) and how scores are assigned for each is provided in Table 1.

Table 1 Summary of parameters used in the likelihood index calculation

Parameter	Score	Justification
Location in the Migration Corridor (L)		
Within the 75-percent buffer	7.5	75 percent of all whooping crane observations occur within the 75-percent buffer
Between the 75-percent and 95-percent buffers	2.0	20 percent of all observations occur between 75-percent and 95-percent buffers
Outside the 95-percent buffer	0.5	5 percent of observations occur outside the 95-percent buffer
Attractiveness on the Landscape (A)		
Ratio of wetlands per total acreage for Project Area / wetland per total acreage for the 35 mile buffer area	Actual ratio	Indicates if the proposed Project Area is similar (=), less (<), or more (>) attractive than the surrounding landscape to migrating cranes searching for roosting habitat
Presence of Foraging and Roosting Habitat (W)		
Proportion of Project Area that is a wetland-agricultural matrix	Actual proportion	Indicates the proportion of the proposed Project Area that is favored by cranes for foraging and roosting habitat

6.1 Location of a Project Area in the Migration Corridor (L)

Biological Justification

Belaire et al. (2014) found that adhering to the appropriate orientation (bearing) appears to be a strong factor acting on whooping cranes during migration which results in a well-defined migratory corridor. As a result, stopover areas further away from the center and areas outside of the migratory corridor, however suitable, are often found to be rarely used (Berthold 2001, Belaire et al. 2014). The location of a potential wind facility in relation to the migratory corridor may influence whooping crane migration and land use as stopover areas. The median location of all crane observations was statistically derived and was used to describe the migration route from the breeding grounds to the wintering grounds (CWS and USFWS 2007). Buffers were then calculated based on the percentage of observations to further define the migratory corridor (Figure 3). These percentile buffers were later identified to have remained relatively the same since the initial 2007 data (see Tacha et al. 2010, Pearse et al. 2015 in Section 5.0). For example, 75 percent of all observations occurred within the 75-percent buffer. If two sites are compared, whooping cranes are more likely to stop over at a site within the 75-percent buffer than at a site outside the 95-percent buffer. Therefore, for modeling purposes, the closer a potential wind energy facility was to the center of the migratory corridor, the greater the chance of risk to whooping cranes being impacted by the project's development.

Scoring

Tetra Tech developed scores for the location of a project area based on the percent of observations within each USFWS buffer (CWS and USFWS 2007). If a project area fell within the 75-percent buffer, it was given a score of 7.5. If a project area fell between the 75-percent and 95-percent buffers, it was given a score of 2.0 because 20 percent of all observations occur between these buffers. If a project area fell outside of the 95-percent buffer, it was given a score of 0.5 because 5 percent of all observations occur outside the 95-percent buffer.

Assumptions

- The likelihood of whooping crane occurrence in the future will not deviate from the patterns observed through the fall of 2010 which is the most current available data (USFWS 2010).
- If a portion of the proposed Project Area fell on the boundary of a buffer or in two buffers, the proposed Project Area was assumed to be within the buffer closer to the center of the migratory corridor.

6.2 Attractiveness of the Landscape (A)

Biological Justification and Data Source

Wetlands are used by whooping cranes for feeding and roosting and the amount of wetlands within a given area compared to the surrounding landscape may influence whooping crane use of a site during migration. After whooping cranes have descended from migration flight altitudes, they may travel up to 35 miles in search of suitable roosting habitat (USFWS 2008). Therefore, Tetra Tech determined that if the proposed Project Area contained a higher proportion of wetlands than was found within the 35 miles surrounding the proposed Project Area, the proposed Project Area would be more attractive than the surrounding area.

Scoring

Tetra Tech used National Wetlands Inventory (NWI) data (USFWS 2014) and National Land Cover Database (NLCD) data (Jin et al. 2013, USGS 2014) to determine the total acreage of wetlands within the proposed Project Area and within 35 miles of the proposed Project Area. The use of multiple data sources helped to avoid the limitations of any one data source (e.g., Stahlecker 1992). Tetra Tech then calculated the proportion of the total acreage of the Project Area and the 35 mile buffer area that was comprised of wetlands to get the wetland proportion of each. Tetra Tech then divided the wetland proportion of the proposed Project Area by the wetland proportion of 35 mile buffer area to determine the ratio of the proposed Project Area to 35 mile buffer area. Tetra Tech used the ratio as the score in the likelihood index equation. If the ratio was greater than one, the proposed Project Area contained more wetlands and was considered to be more attractive to whooping cranes than the 35 mile buffer area. If the ratio was equal to one, the proposed Project Area contained a similar proportion of wetlands and was considered to be as attractive as the 35 mile buffer area. If the ratio was less than one, the proposed Project Area contained a lower proportion of wetlands and was considered to be less attractive than the 35 mile buffer area.

Assumptions

- The wetlands in the 35 mile buffer area shown in the NWI and NLCD Database were accurate and are considered useable by whooping cranes.
- 35 miles is an appropriate scale to examine whooping crane habitat use.

6.3 Presence of Foraging and Roosting Sites (W)

Biological Justification

Whooping cranes often make low altitude flights between roosting and foraging habitat and are thus at risk of collision with power lines and other structures (CWS and USFWS 2007; Stehn and Wassenich 2008; USFWS 2009).

A desktop study conducted by Belaire et al. (2014) indicated that areas of high agricultural cover, low coverage of roads and urban areas, and intermediate wetland cover had higher predicted relative suitability for whooping cranes than other cover types. In a telemetry study of marked individuals, Pearse et al. (2015) found that areas close to wetlands (328.1 feet [less than 100 m]) and simultaneously less than 0.62 miles 1 km from agricultural land were most likely to be used by whooping cranes. This predicted suitability increases with proximity to the center of the whooping crane migratory corridor (See Section 6.1). An earlier study by Austin and Richert (2001) found the majority of foraging sites were upland crops (73.8 percent) adjacent to wetland roosting sites. Wetland roosting sites were defined in three broad categories as palustrine (58.2 percent), riverine (33.3 percent), or lacustrine (7.8 percent) roost sites (Austin and Richert 2001). For the upland crop foraging sites: 83 percent of grain stubble was wheat stubble, 75 percent of row-crop stubble was corn, and 80 percent of green crop was winter wheat (Austin and Richert 2001). The distances traveled between roost to foraging sites varied by wetland systems with 75 percent feeding sites being 0.5 miles (0.8 km) or less from the palustrine roost sites to over 50 percent of riverine roost sites being 0.75 miles (1.2 km) or greater from foraging sites (Austin and Richert 2001). Based on these published assessments, Tetra Tech used an average of 0.62 miles (1 km) to assess the presence of foraging and roosting sites within the Project Area and a 35 mile (56.3 km) buffer area around the Project Area. Tetra Tech considered wetlands located within 0.62 mile (1 km) of agricultural crops to form a wetland-agricultural matrix that may be used by whooping cranes during migration (Austin and Richert 2001). Tetra Tech used a geographic information system (GIS) to calculate the proportion of the Project Area that was comprised of this wetland-agricultural crop matrix, using a minimum 1-acre (0.41 hectare) patch size for both wetlands and crops. The 1.0 acre minimum for wetlands was used to avoid including wetlands unusable by whooping cranes (e.g., borrow pits). The 1.0 acre minimum size for agriculture was used because the majority of whooping crane observations occurred in agriculture patches larger than 1.0 acre (Austin and Richert 2001).

Scoring

To quantify the amount of roosting and foraging habitat in the proposed Project Area, GIS land cover data (NLCD data) was obtained for North Dakota (Jin et al. 2013, USGS 2014). Water features and the spatial extent of waters were verified with NWI data (USFWS 2014). The GIS analysis was designed to calculate the total area of wetland-agricultural matrix, which may have included other habitat types between patches of wetlands and agriculture. Thus, based on the size restrictions and spatial configuration, the total acres of wetland-agricultural matrix could be greater or less than the sum of the acres of wetland and agriculture. Tetra Tech calculated the proportion of the proposed Project Area that was wetland-agricultural matrix by dividing the total acres of wetland-agricultural matrix by the total acres of the proposed Project Area. Tetra Tech used the proportion as the score in the likelihood index; therefore, scores could range from 0 to 1.

Assumptions

- The average distance of foraging habitat from roosting habitat is 0.62 mile (1 km).
- Habitats not classified as wetlands or agriculture are of neutral value and do not influence the availability of wetlands or agriculture on the landscape.

6.4 Likelihood Index Formula (LI)

The likelihood index of whooping cranes occurring at the proposed Project Area was calculated by evaluating the landscape features in and around the proposed Project Area. Tetra Tech used the following formula to calculate the likelihood index:

$$LI = (L * A) + W$$

Where L = location of a project area in relation to the migration corridor score, A = attractiveness score, or the ratio of wetlands in a project area to wetlands in a 35 mile buffer area around the project area, and W = wetland-agricultural matrix score. The equation places the most weight on the location in the migration corridor because of the wide range of scores for each feature in the likelihood index. Thus, a project area within the 75-percent corridor will tend to score higher than a project area within the 95-percent corridor unless the attractiveness score for the project area within the 75-percent corridor is low (e.g., less than 0.50) or the attractiveness score for the project area within the 95-percent corridor is high (greater than 4.0), when other values are equal. Project areas located outside of the 95-percent corridor will tend to score low unless the attractiveness score is high because the location score is less than 1.0.

7.0 PROJECT AREA ASSESSMENT AND SUMMARY

The proposed Project Area is located approximately 22 miles (35 kilometers) west of the center of the migratory corridor and within the 75-percent buffer. Therefore, the Location (L) parameter used in the analysis was 7.5 which indicate the Project Area is near the center of the whooping crane migration corridor. The proportion of wetlands within the proposed Project Area is lower than the surrounding 35 mile buffer area, with a calculated Attractiveness on the Landscape (A) value of 0.22. Seventy-five percent of the proposed Project Area consists of suitable wetland-agriculture matrix habitat, making the Presence of Foraging and Roosting Sites (W) value 0.75 (Figure 4). The likelihood index score was 2.41 for the proposed Project Area (Table 2) implying low likelihood of occurrence. The low likelihood index score was driven by the Attractiveness on the Landscape (A) value which indicates that whooping cranes migrating in the vicinity of the proposed Project Area would be more likely to stopover in areas outside of the proposed Project Area even though it is within the migration corridor because of the lower proportion of wetland habitat within the proposed Project Area compared to the surrounding 35 mile buffer area.

Overall, based on the location of the proposed Project Area within the migration corridor, whooping cranes may still migrate thought the proposed Project Area and would be at risk of colliding with wind turbines and any utility lines associated with the proposed Project Area. Although flying at the height of the rotor swept area represents a collision risk, sandhill and whooping cranes have been documented altering flight direction in response to turbines at wind facility in South Dakota (Nagy et al. 2011). The marking of overhead utility and power lines has been shown to reduce the risk of collisions as the marked utility lines are more visible to birds. Studies have documented sandhill cranes gradually climbing as they approach marked power lines (Morkill and Anderson 1991, Murphy et al. 2009). The avoidance behavior observed and lack of documented turbine-related fatalities of whooping and sandhill cranes suggests a low risk of Project-related fatalities.

Finally, habitat loss due to the development of the proposed Project Area would be minimal due to the low Attractiveness on the Landscape (A) value. Project development is not expected to impact any wetlands as the Project design has made every effort to avoid impacts to wetlands as much as feasible. The proposed Project Area has 301.82 acres (1.4 percent of the proposed Project Area) of wetlands. The majority of the wetlands within the proposed Project Area appear to be cattle pond impoundments, intermittent creeks, or along wooded windbreaks. Most of these wetlands are also near to residential housing, roadways, and existing utility lines which whooping cranes may perceive as unsuitable due to human activities (TWI 2013).

Table 2 Likelihood index scores for the Oliver III Wind Energy Center

Location in the Migration Corridor (*L*)[1]	Attractiveness on the Landscape (*A*)[2]	Presence of Foraging and Roosting Habitat (*W*)[3]	Likelihood Index Score (*LI*)[4]	Likelihood Index Category[5]
7.5	0.22	0.75	2.41	Low

1. Location in the Migration Corridor (L) values: 7.5 = within the 75% buffer, 2.0 = between the 75% and 95% buffers, or 0.5 = outside of the 95% buffer
2. Attractiveness on the Landscape (A) value: Ratio of wetlands per total acreage for Project Area / wetland per total acreage for 35 mile area not including Project Area
3. Presence of Foraging and Roosting Habitat (W) value range: Proportion of Project Area that is a wetland-agricultural matrix
4. Likelihood Index Score (LI): LI = (L×A) + W
5. Likelihood Index Category values: Low = less than 5, Medium = 5-10, High = greater than 10

8.0 LITERATURE CITED

Allen, R.P. 1952. The whooping crane. National Audubon Society Resource Report 3. 246pp.

Austin, J.E. and A.L. Richert. 2001. A comprehensive review of the observational and site evaluation data of migrant whooping cranes in the United States, 1943-99. U.S. Geological Survey, Northern Prairie Wildlife Research Center, Jamestown, North Dakota, and State Museum, University of Nebraska, Lincoln, Nebraska. 157 pp.

Banks, R. 1978. The size of the early whooping crane populations. Unpublished Report USFWS files. 10pp.

Belaire, J.A, B.J. Kreakie, T. Keitt, and E. Minor. 2014. Predicting and Mapping Potential Whooping Crane Stopover Habitat to Guide Site Selection for Wind Energy Projects. Conservation Biology 28(2):541-550.

Berthold, P. 2001. Bird migration: a general survey. Oxford University Press, New York, 253 pp

Binkley, C.S., and R.S. Miller. 1983. Population characteristics of the whooping crane, *Grus americana*. Canadian Journal of Zoology 61:2768–2776.

Bryce, S.A., J.M. Omernik, D.A. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S.H. Azevedo. 1996. Ecoregions of North Dakota and South Dakota, (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).

CWS (Canadian Wildlife Service) and USFWS (U.S. Fish and Wildlife Service). 2007. International recovery plan for the whooping crane. Ottawa: Recover of the Nationally Endangered Wildlife (RENEW), and U.S. Fish and Wildlife Service, Albuquerque, NM.

Hahn, P. 1963. Where is that vanished bird? Royal Ontario Museum, Univ. Toronto, Canada.

Howe, M.A. 1989. Migration of radio-marked whooping cranes from the Aransas-Wood Buffalo population: patterns of habitat use, behavior, and survival. U.S. Fish & Wildlife Service Technical Report 21. Washington, D.C.

Jin, S., L. Yang, P. Danielson, C. Homer, J. Fry, and G. Xian. 2013. A comprehensive change detection method for updating the National Land Cover Database to circa 2011. *Remote Sensing of Environment*, 132: 159 – 175.

Johns, B.W. 1992. Preliminary identification of whooping crane staging areas in prairie Canada. Proceedings of the 1988 North American Crane Workshop. Pgs. 61–66.

Johns, B.W., E.J. Woodsworth, and E.A. Driver. 1997. Proceedings of the North American Crane Workshop 7:123–131.

Kyut, E. 1992. Aerial radio-tracking of whooping cranes migrating between Wood Buffalo National Park and Aransas National Wildlife Refuge, 1981-84. Occasional Paper 74, Canadian Wildlife Service, 53 pp.

Murphy, R.K, S.M. McPherron, G.D. Wright, and K.L. Serbousek. 2009. Effectiveness of avian collision averters in preventing migratory bird fatality from powerline strikes in the central Platte River, Nebraska. 2008-2009 Final Report.

Morkill, A.E. and S.H. Anderson. 1991. Effectiveness of marking powerlines to reduce sandhill crane collisions. Wildlife Society Bulletin 19: 442-449.

Nagy, L., B. Gibson, K.L. Kosciuch, J. Jones, and J. Taylor. 2012. Whooping and Sandhill Crane Behavior at an Operating Wind Farm. Poster presented at National Wind Coordinating Committee Annual Research Meeting, Denver, CO.

North Dakota Game and Fish Department (NDGF). 2012. Threatened and Endangered Species. Available online at: http://gf.nd.gov/wildlife/fish-wildlife/threatened-and-endangered-species.

NDGF. 2013. Whooping Crane. Available online at: http://gf.nd.gov/wildlife/fish-wildlife/id/birds/grassland-birds/whooping-crane. Accessed December 2015.

Pearse, A.T., D.A. Brandt, W.C. Harrell, K.L Metzger, D.M. Baasch, and T.J. Hefley. 2015, Whooping crane stopover site use intensity within the Great Plains: U.S. Geological Survey Open-File Report 2015–1166, 12 p., http://dx.doi.org/10.3133/ofr20151166.

Stahl, J.T. and M.K. Oli. 2006. Relative importance of avian life-history variables to population growth rate. Ecological Modeling 198:23-39.

Stahlecker, D.A. 1992. Using National Wetlands Inventory maps to quantify whooping crane stopover habitat in Oklahoma. Proceedings of the North American Crane Workshop 6:62–68.

Stehn, T.V. 1997. Pair formation by color-marked whooping cranes on the wintering grounds. Proceedings of the North American Crane Workshop 7:24–28.

Stehn, T.V. and T. Wassenich. 2008. Whooping crane collisions with power lines: an issue paper. Proceedings of the North American Crane Workshop 10:25–36.

Tacha, M, A. Bishop, and J. Brei. 2010. Development of the whooping crane tracking project geographic information system: Proceedings of the North American Crane Workshop, v. 11, p. 98–109.

The Watershed Institute (TWI). 2013. Potentially Suitable Habitat Assessment for the Whooping Crane (*Grus americana*). Prepared by Watershed Institute Inc. Topeka, KS. June 2013.

U.S. Fish and Wildlife Service (USFWS). 2015a. Winter 2014-2015 Whooping Crane Survey Results. Available online at: http://www.fws.gov/uploadedFiles/Region_2/NWRS/Zone_1/Aransas-Matagorda_Island_Complex/Aransas/Sections/What_We_Do/Science/Whooping_Crane_Updates_2013/WHCR_Update_Winter_2014-2015.pdf.

USFWS. 2015b. Fall Migration Update: September 15, 2015. Available online at: http://www.fws.gov/nwrs/threecolumn.aspx?id=2147578614.

USFWS. 2014. National Wetlands Inventory: Classification of Wetlands and Deepwater Habitats of the United States, May 2014. Available online at: http://www.fws.gov/wetlands/.

USFWS. 2010. Whooping crane migration corridor in the United States.

USFWS. 2009. Whooping cranes and wind development – An issues paper. USFWS Regions 2 and 6. Available at: http://www.fws.gov/southwest/es/library/

USFWS. 2008. Biological Opinion for the Wessington Springs Wind Project, Jerauld County, South Dakota. USFWS Ecological Services, Bismarck, ND. March 2008.

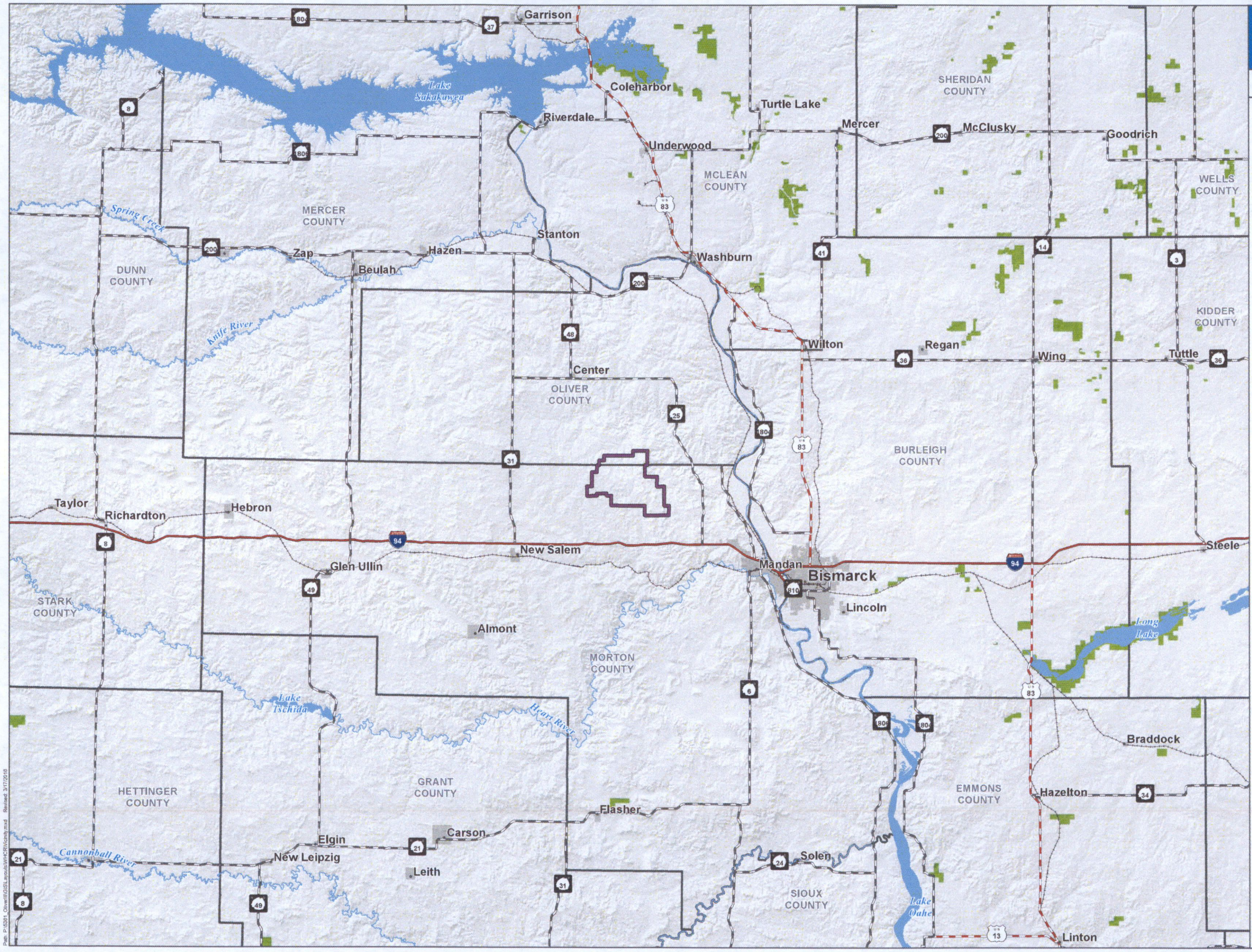
U.S. Geological Survey (USGS). 2014. National Land Cover Database 2011. Available online at http://www.mrlc.gov/nlcd11_data.php.

FIGURES

Oliver III Wind Energy Center

Morton & Oliver Counties, ND

Figure 1 Vicinity Map



Legend

- Proposed Project Area
- County Boundary
- Major River
- Municipal Boundary

Transportation

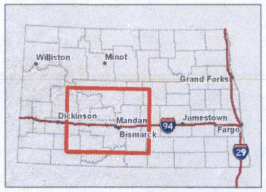
- Interstate Highway
- U.S. Highway
- State Highway
- Rail

Jurisdiction

- U.S. Fish and Wildlife Service

0 6 12 Miles

Scale is 1:300,000 when printed at 22 x 34



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Legend

Whooping Crane Critical Habitat	
State Border	
County Border	

Percentage of Sightings Within the Whooping Crane Migration Corridor

- 75%
- 80%
- 85%
- 90%
- 95%

0 100 200 Miles

Scale is 1:13,000,000 when printed at 8.5x11"

Path: P:\5361_OliverIII\GIS\Layouts\WHCR\Migration_Corridor.mxd *Source: ESRI, BTS, NWI, NLCD, USFWS* *Last modified: 1/12/2016*

Oliver III Wind Energy Center

Morton & Oliver Counties, ND

Figure 2 Whooping Crane Migration Corridor

TETRA TECH

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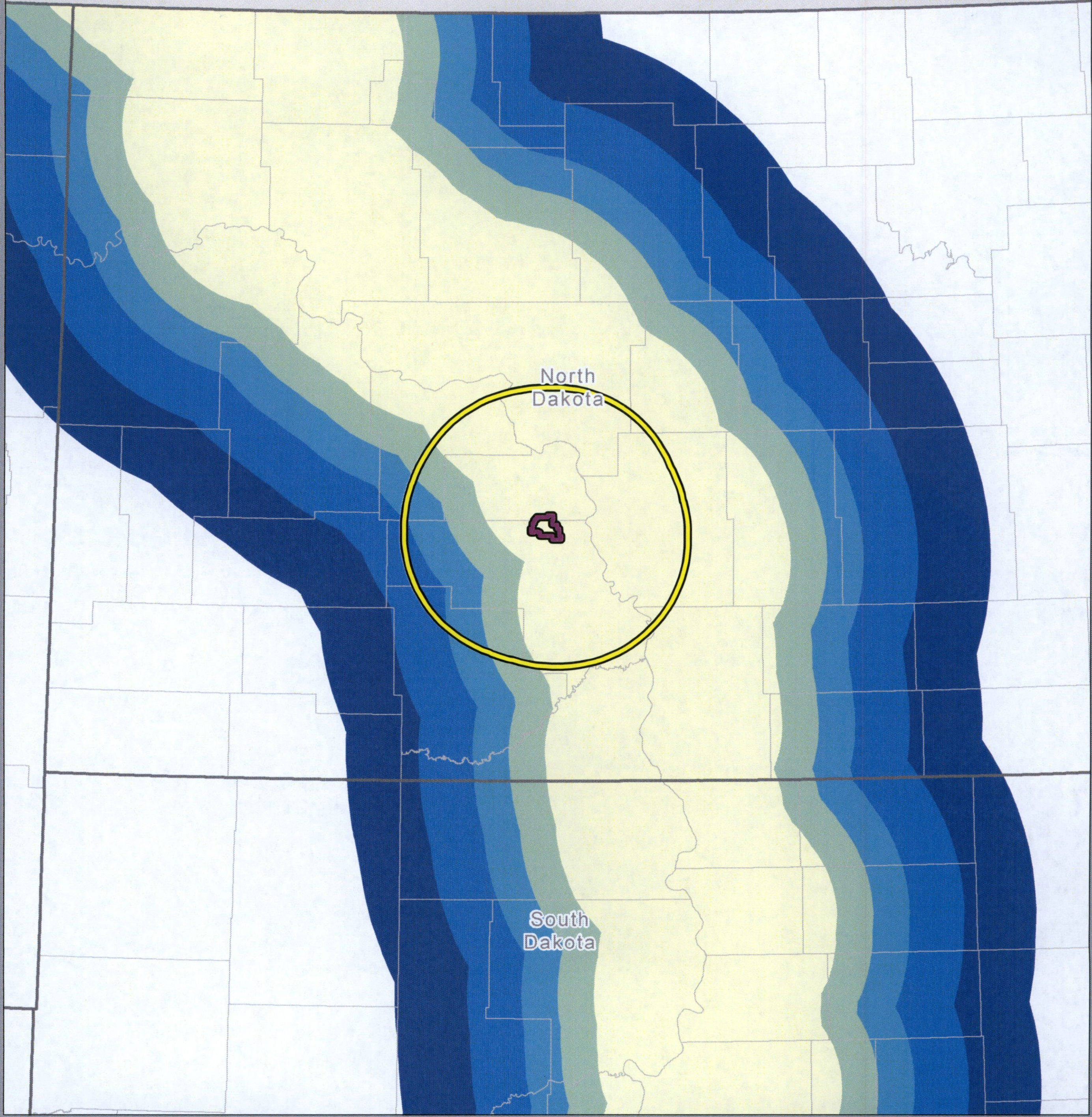

Legend

- Proposed Project Area
- 35-mile Buffer Area
- State Border
- County Border

Percentage of Sightings Within the Whooping Crane Migration Corridor

- 75%
- 80%
- 85%
- 90%
- 95%

0 20 40 Miles
Scale is 1:2,500,000 when printed at 8.5x11"

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Oliver III Wind Energy Center

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Figure 3
Whooping Crane Migration: North Dakota

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Morton & Oliver Counties, ND

Figure 4 Whooping Crane Habitat Map

Legend

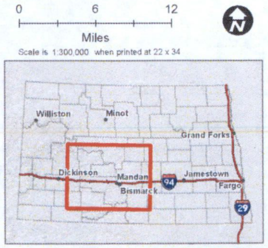
- Proposed Project Area
- 35-mile Buffer Area
- County Boundary
- Major River
- Wetland
- Wetland/Agricultural Matrix

Transportation

- Interstate Highway
- U.S. Highway
- State Highway
- Rail

Jurisdiction

- U.S. Fish and Wildlife Service



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