Whooping Crane Habitat Analysis

Aurora Wind Energy Project

Williams County, North South Dakota

Final Report

Prepared for:

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Data disclaimer for the confirmed records of whooping crane:

This document or presentation includes Whooping Crane migration use data from the Central Flyway stretching from Canada to Texas, collected, managed and owned by the US Fish and Wildlife Service (USFWS). Data were provided to Western EcoSystems Technology, Inc. (WEST) as a courtesy for their use. The USFWS has not directed, reviewed, or endorsed any aspect of the use of these data. Any and all data analyses, interpretations, and conclusions from these data are solely those of the WEST.

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INTRODUCTION

Aurora Wind Project, LLC (Aurora) is proposing to develop the Aurora Wind Energy Project (Project) in Williams and Mountrail counties, North Dakota. While the overall Project includes a portion of the transmission line in Mountrail County, the Project area, as evaluated initially in 2016 and as included in this report, is limited to Williams County. Aurora requested that Western EcoSystems Technology, Inc. (WEST) implement a desktop review and analysis of potential whooping crane (*Grus americana*) habitat resources within the Project area and compare these resources to areas outside of the Project boundary to the north, south, east, and west. The whooping crane is federally endangered and protected under the Endangered Species Act (ESA; 16 United States Code [USC] Sections [§§] 1531–1544 1973). The Project is located within the migration corridor of the Aransas-Wood Buffalo whooping crane population (Figure 1) which migrates through North Dakota in the spring, from April through May, and in the fall, from mid-September through mid-November (US Fish and Wildlife Service [USFWS] 2013).

The habitat review and analysis presented in this report evaluated whether or not the proposed Project area represents the only unique whooping crane habitat compared to the surrounding landscape. The purpose of this analysis was to quantify the potential suitability of wetlands within the Project area for whooping cranes and to compare the suitability of these wetlands with preferred whooping crane stopover habitat. From this analysis all parties can then discuss what impacts there may be to whooping cranes from development of the Project. This analysis is part of the Project's Tier 2 Site Characterization assessments, in accordance with the USFWS's voluntary *Final Land-Based Wind Energy Guidelines* (WEG; USFWS 2012a).

Regulations and Guidelines

Endangered Species Act

The whooping crane is listed as endangered under the ESA, because it is in danger of extinction throughout all or a significant portion of its range. The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. The ESA makes it unlawful for a person to "take" a listed species without a permit. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct" (16 USC §§ 1531–1544 1973). Harm also includes significant habitat modification or degradation that results in death or injury to a whooping crane by significantly impairing essential behavioral patterns (50 Code of Federal Regulations § 17.3 1975).

The USFWS may also designate critical habitat for listed species under the ESA; federal agencies are required to avoid destruction or adverse modification of critical habitat. The Platte River bottoms between Lexington and Denman, Nebraska; Cheyenne Bottoms State Waterfowl Management Area and Quivira National Wildlife Refuge (NWR) in south-central Kansas; and Salt Plains NWR in north-central Oklahoma, are the designated critical habitats during migration for whooping cranes in the US (Canadian Wildlife Service and USFWS 2005). The Project is approximately 550.0 miles (mi; 885.1 kilometers [km]) north of the Platte River bottoms, which is the closest designated critical habitat for the species.

Due to habitat loss and hunting pressure, the Aransas-Wood Buffalo population had been reduced to an estimated 15 individuals in 1941 (Harrell and Bidwell 2013). This prompted conservation efforts by United States and Canadian wildlife agencies, including captive breeding efforts and an emergency listing as "threatened with extinction" in the US in 1967 (32 Federal Register [FR] 48: 4001 1967). This listing was grandfathered into the Endangered Species Act, and whooping cranes are currently listed as federally endangered except where nonessential experimental populations exist (62 FR 139: 38932-38939 1997; 66 FR 123: 33903-33917 2001; see USFWS 2012b). As a result of joint recovery efforts by Canadian and US agencies, the Aransas-Wood Buffalo wintering population was estimated was estimated at 431 whooping cranes (95% confidence interval = 371.1–492.7; USFWS 2017).

Land-based Wind Energy Guidelines

The USFWS designed the WEG to provide a structured process for evaluating and addressing wildlife conservation concerns during all stages of land-based wind energy development (USFWS 2012). The WEG is voluntary and is meant to facilitate communication among wind energy developers and federal, state, and local conservation agencies. The WEG includes a five-tiered process for assessing potential adverse impacts to species of concern and their habitats. The first three tiers include pre-construction evaluations (Tier 1: Preliminary Site Evaluation, Tier 2: Site Characterization, and Tier 3: Pre-construction Field Studies); Tier 4 and Tier 5 involve post-construction monitoring and evaluations (USFWS 2012).

PROJECT AREA

The Project area is located approximately four mi (6.43 km) northwest of the City of Tioga in northwest North Dakota, (Figure 1) and covers an area of approximately 54,318.0 acres (ac; 21,981.7 hectares [ha]). The landscape within the Project area is flat to gently rolling, with elevations ranging from 2,190.4–2,479.1 feet (ft; 667.6 – 755.6 meters [m])) above sea level (US Geological Survey [USGS] 2016). Historically, the Project area was dominated by short- and mixed-grass prairies but has since been largely converted to agricultural use with crop production (mainly wheat [*Triticum* spp], corn [*Zea mays*], and soybeans (*Glycine max*) and livestock grazing being the primary practices (Griffith 2010, Sayler 2016). Trees and shrubs can be found around farmsteads, within planted shelter belts, and along/within drainages; wetlands are scattered throughout the Project area (WEST 2017).

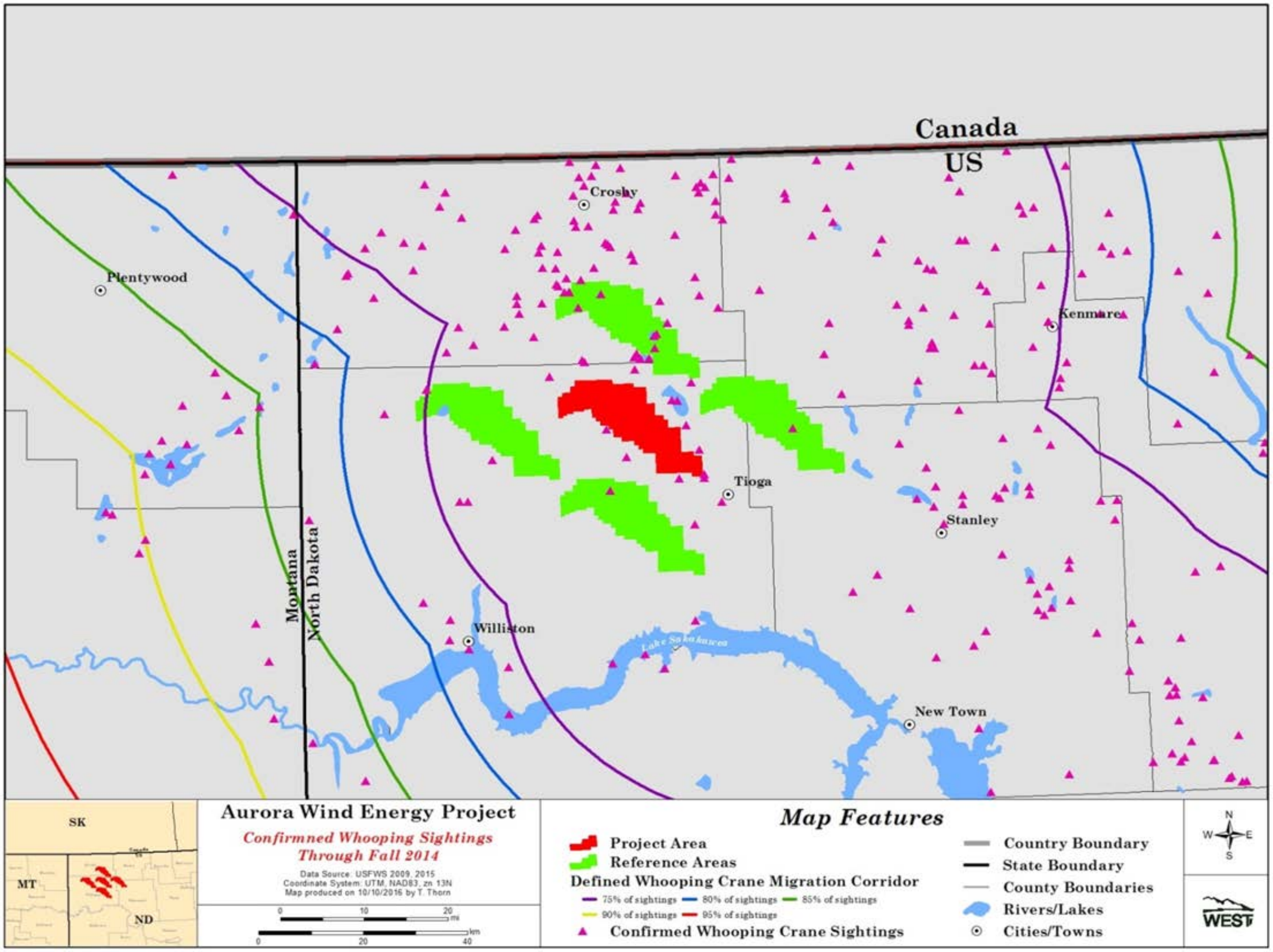

Figure 1. Location of the Aurora Wind Energy Project in Williams County, North Dakota, and reference areas, in relation to the whooping crane migration corridor and confirmed sightings through fall 2014.

METHODS

The whooping crane habitat analysis included a comparison of landscape features within the proposed Project area and four reference areas of the same dimensions located adjacent (based on the Project's boundary extent) to the Project boundary in the four cardinal directions. A desktop review was completed using ArcGIS ArcMap 10.3.1, land cover information from the USGS National Land Cover Database (NLCD; USGS NLCD 2011, Homer et al. 2015), wetland data from the USFWS National Wetland Inventory (NWI; USFWS NWI 2014), National Agricultural Imagery Program (NAIP) aerial imagery (US Department of Agriculture NAIP 2017), and the current Project boundary provided by Aurora. A site visit was not completed by WEST for this exercise specifically, but WEST has conducted other surveys at the Project and confirmed that the mapping generally agrees with current conditions.

An assessment of the suitability of whooping crane habitat in the Project area and the four reference areas was conducted using methodology developed by the Watershed Institute (2012). The assessment first screens all wetlands for minimum size, visual obstructions, and disturbances; wetlands that do not meet criteria are eliminated from analysis. Those wetlands left are then quantified by their size, density of wetlands around them, distance to food, whether they are natural or constructed, and their water regime as a means to quantify suitability. A habitat quality score is then assigned to the wetlands left in the analysis; a score of 12 or higher represents potentially suitable whooping crane migratory stopover habitat.

USGS and its partners recently determined whooping crane stopover sites and the intensity of use of these areas within the Great Plains using radio telemetry information of tagged whopping cranes from 2010 – 2014 (Pearse et al. 2015). Using a grid-based approach, Pearse et al. (2015) assessed occupied grid cells based on density of stopover sites and the amount of time whooping cranes spent in the area, resulting in four categories of stopover site use: unoccupied, low intensity, core intensity, and extended-use core intensity. This tool allows for the identification of landscapes that may be important for whooping crane use and potentially conservation.

RESULTS

Terrestrial Habitats

According to USGS NLCD, cultivated crops was the dominant land type, composing 86.7% of the Project area (47,091.1 ac [19,057.1 ha]; Table 1, Figure 2). Grass/herbaceous lands composed 6.6% of the Project area, while developed areas and water/wetlands composed another 3.8% and 2.5%, respectively; all other land types composed less than 1.0% of the Project area (Table 1, Figure 2).

The percentage of cultivated crops varied between the Project area and reference areas, with the Project area containing the highest percentage (86.7%) and the North reference area the least (42.7%; Table 1, Figure 2); the percentage of cultivated crops in the remaining reference areas ranged from 50.6%–76.9% (Table 1). The percentage of grassland/herbaceous lands also varied between the Project and reference areas (Table 1, Figure 2). The North and East reference areas had the highest percentages (35.2% and 31.6%, respectively) while the Project area had the least percentage (6.6%); grassland /herbaceous lands composed 20.8% or less of the other reference areas (Table 1). Pasture/hay composed 10.8% of the North reference area and 0% of the Project area, ranging from 0.1%–4.2% in all other areas (Table 1). The percentage of developed lands was similar across areas, ranging from 3.0%– 4.7%; wetlands composed 8.1% of the North reference area, compared to 1.2% of the South reference area; all other land types composed 2.9% or less of all areas (Table 1).

Table 1. Land use/Land cover types, by acreage and percent of total coverage (%), within and in the vicinity of the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas, based on the US Geological Survey (USGS) National Land Cover Database (NLCD).

	Project		North		East		South		West	
Land Use/Land Cover	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Cultivated Crops	47,091.1	86.7	23,175.7	42.7	27,497.2	50.6	41,793.5	76.9	36,637.0	67.4
Grassland/Herbaceous	3,564.8	6.6	19,101.2	35.2	17,142.9	31.6	8,506.7	15.7	11,291.6	20.8
Pasture/Hay			5,854.2	10.8	2,260.3	4.2	36.5	0.1	385.1	0.7
Developed	2,074.4	3.8	1,648.7	3.0	2,202.7	4.1	2,538.3	4.7	2,469.8	4.5
Water/Wetlands	1,352.7	2.5	4,376.3	8.1	2,297.4	4.2	641.7	1.2	2,886.3	5.2
Forest	20.9	<0.1	40.7	0.1	1,593.4	2.9	83.2	0.2	47.3	0.1
Shrub/Scrub	214.1	0.4	114.7	0.2	1,308.9	2.4	715.1	1.3	595.8	1.1
Barren			7.1	<0.1	15.3	<0.1	3.0	<0.1	5.1	<0.1

Sources: USGS NLCD 2011, Homer et al. 2015.

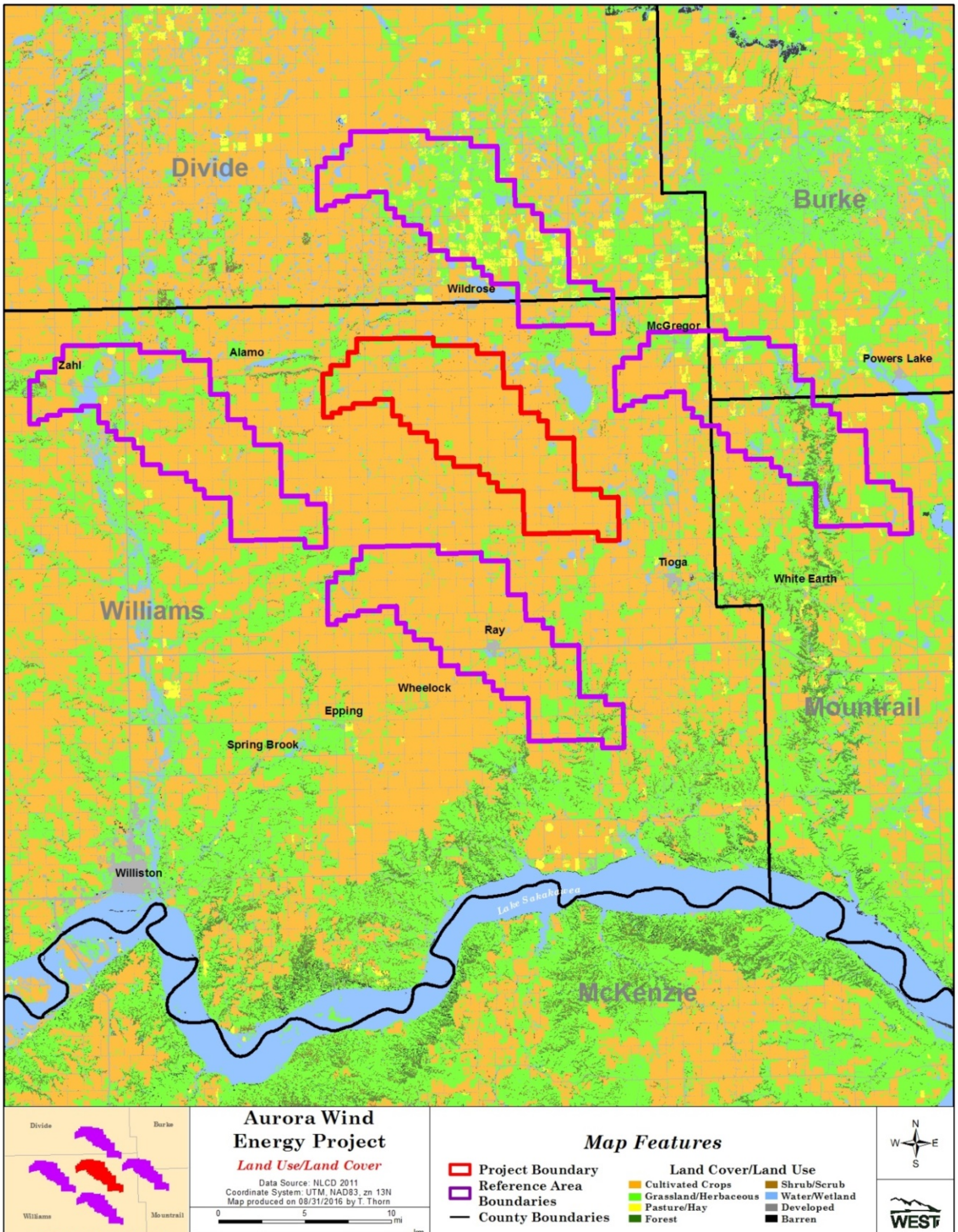

Figure 2. Land use/land cover types within and in the vicinity of the Aurora Wind Energy Project in Williams County, North Dakota, and the four reference areas (Sources: US Geological Survey National Land Cover Database [NLCD] 2011, Homer et al 2015).

Wetlands

For this analysis, it was assumed that all wetlands were potential whooping crane roosting areas under one water regime or another (e.g., drought, normal, or flood); USFWS NWI wetland data was used for this analysis because it represents wetland features to a higher degree than the USGS NLCD.

Based on the USFWS NWI (2014), the Project area had similar wetland basin statistics as the South reference area, with the least wetland acreages, smallest mean basin sizes, and narrowest basin size ranges (Table 2). The North reference area had by far the highest number of basins (2,620) and of total wetland acreage (5,930.1 ac [2,399.8 ha]), the second largest mean basin size (2.3 ac [0.9 ha]), and the third greatest basin size range (less than 0.1–373.8 ac [less than 0.04–151.3 ha]; Table 2). The West reference area had the fewest basins (1,063) but the second highest total wetland acreage (2,674.0 ac [1,082.1 ha]), the largest mean basin size (2.5 ac [1.0 ha]), and the greatest wetland size range (less than 0.1–616.4 ac [less than 0.04–249.4 ha]; Table 2); these characteristics were likely attributable to several large lakes in the northwest part of this reference area (Figure 3). The East reference area had a total of 1,620 wetland basins covering 2,117.8 ac (857.0 ha), a mean basin size of 1.3 ac (0.5 ha), and wetland sizes ranging from less than 0.1–3.80.3 ac (less than 0.04–153.9 ha).

Freshwater emergent wetlands composed the vast majority of wetlands in the Project area (91.4%) and the South reference area (93.0); coverage of freshwater emergent wetlands ranged from 50.4%–75.1% in the other reference areas (Table 3). Lakes composed 43.2%, 22.8%, and 19.0% of the West, North, and East reference areas, respectively, compared to only 4.3% and 2.9% of the total wetland acreage in the Project area and South reference area, respectively (Table 3). Freshwater ponds composed 11.6% of the North reference area, and ranged from 3.7%– 4.4% in the other areas.

To summarize, the Project and South reference area had similar wetland basin statistics and wetland types while the North reference area had the most basins and total acreages of wetlands. The West reference area had the least number of basins but the largest mean basin size and greatest size range, likely attributable to several large lakes present in this area

Table 2. Number and size characteristics of wetland basins present within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas.

Area	Number of Basins	Acres (ac)	Mean Basin Size (ac)	Size Range (ac)
Project	1,315	1,515.1	1.1	<0.1–98.6
North	2,620	5,930.1	2.3	<0.1–373.8
East	1,620	2,117.8	1.3	<0.1–380.3
South	1,244	1,459.6	1.2	<0.1–101.1
West	1,063	2,674.0	2.5	<0.1–616.4

Source: US Fish and Wildlife Service National Wetland Inventory 2014.

Table 3. Wetland types, by acreage and percent (%) of total wetlands, within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas.

	Project		North		East		South		West	
Wetland Type	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Freshwater Emergent Wetland	1,281.5	91.4	3,406.7	65.4	1,559.4	75.1	1,316.8	93	1,348.2	50.4
Freshwater Forested/Shrub Wetland	4.9	0.4	12.9	0.2	1	<0.1	1	0.1	2.8	0.1
Freshwater Pond	51.6	3.7	602.3	11.6	87	4.2	57.1	4	118.5	4.4
Lake	59.8	4.3	1,185.4	22.8	394.4	19	40.7	2.9	1,155.0	43.2
Other	3.7	0.3	0	0	0.9	<0.1	0	0	4.8	0.2
Riverine	0	0	0	0	32.9	1.6	0	0	45.1	1.7

Source: US Fish and Wildlife Service National Wetland Inventory 2014.

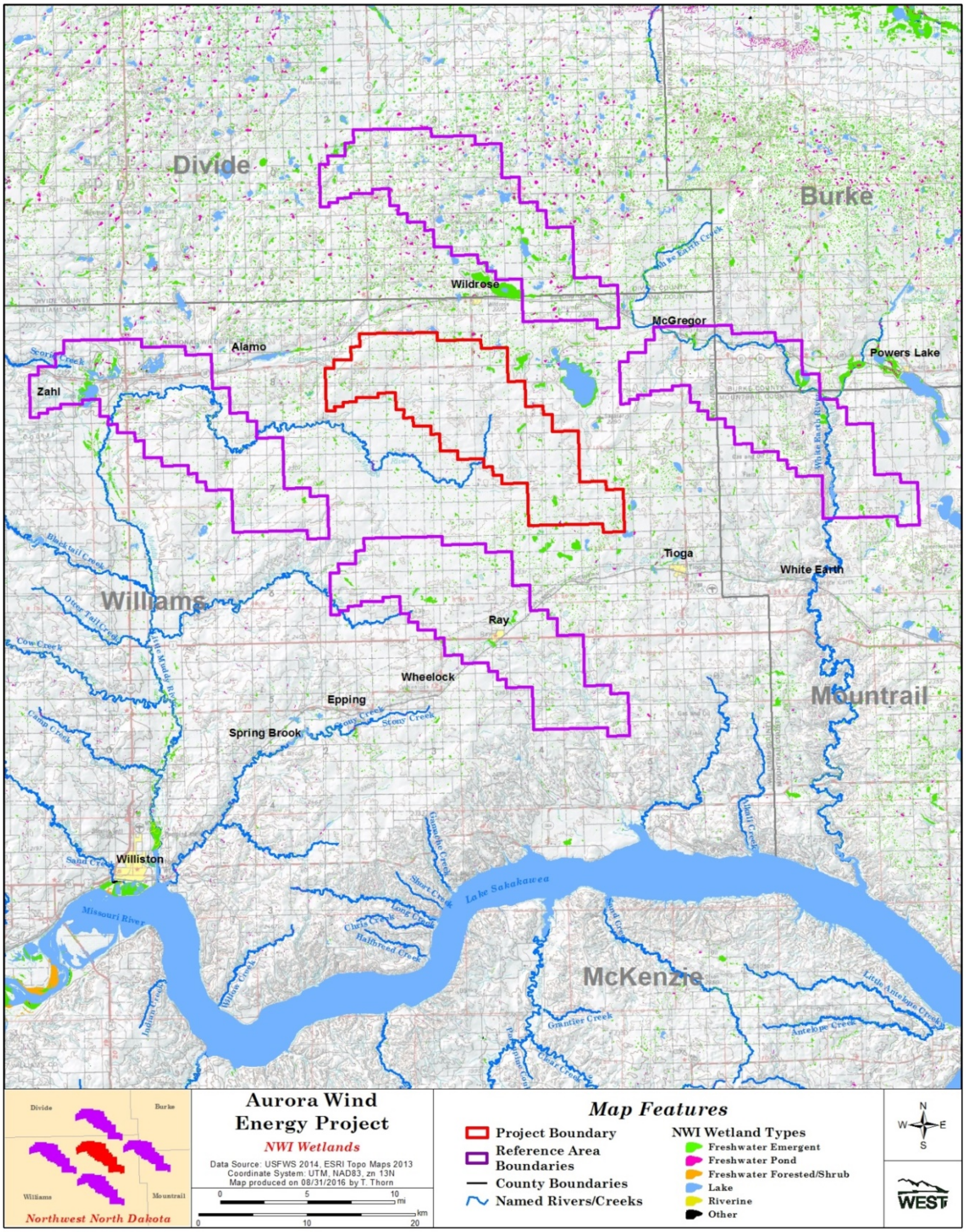

Figure 3. National Wetlands Inventory (NWI) wetlands, rivers, and streams within the Aurora Wind Energy Project in Williams County, North Dakota, and four reference areas (Source: US Fish and Wildlife Service NWI 2014).

Habitat Suitability Assessment

The habitat assessment identified 442 wetland basins totaling 865.5 ac (350.3 ha) within the Project area as potential whooping crane roosting habitat (Table 4). The mean suitability score for these wetlands was 11.9 with the scores ranging from seven–19. The north reference area had the highest number of potential suitable basins (935), the highest acreage of wetlands (3,697.0 ac [1,496.1 ha]), and the highest mean suitability score (12.0); scores ranged from 10.6–11.9 in all other areas (Table 4).

In Kansas, a wetland with a score of 12 or more was considered suitable potential whooping crane habitat (Watershed Institute 2012). If applied to the Project, 242 (54.8%) of the potential whooping crane habitat wetlands would be considered as such. The number of potential whooping crane habitat with a score of 12 or greater was highest in the North reference area (544) and ranged from 79–151 in all other reference areas.

Table 4. Number of wetland basins and mean size in acres and potential suitable whooping crane migration habitat within the Philip Wind Energy Project in Haakon County, South Dakota, and four reference areas.

Area	Number of Basins	Total Wetland Acres	Mean Score	Score Range
Project	442	865.5	11.9	7–19
North	935	3,697.0	12.0	5–19
East	344	646.3	10.6	6–18
South	367	1,042.8	10.9	6–16
West	290	1,921.8	10.7	7–16

Data derived from Potentially Suitable Habitat Assessment (Watershed Institute 2012).

Whooping Crane Stopover Site Use Intensity

The Project and the South and West reference areas fall within “unoccupied” grid cells while the East and North reference areas intersect both “core intensity” and “low intensity” cells (Pearse et al. 2015; Figure 4). The USGS describes an “unoccupied” cell as “lacking evidence of use”, “low intensity” cells show “evidence of use and low stopover site use intensity”, and a “core intensity” cell “contains density of stopovers identified as high use intensity and crane days of lower intensity” (Pearse et al. 2015).

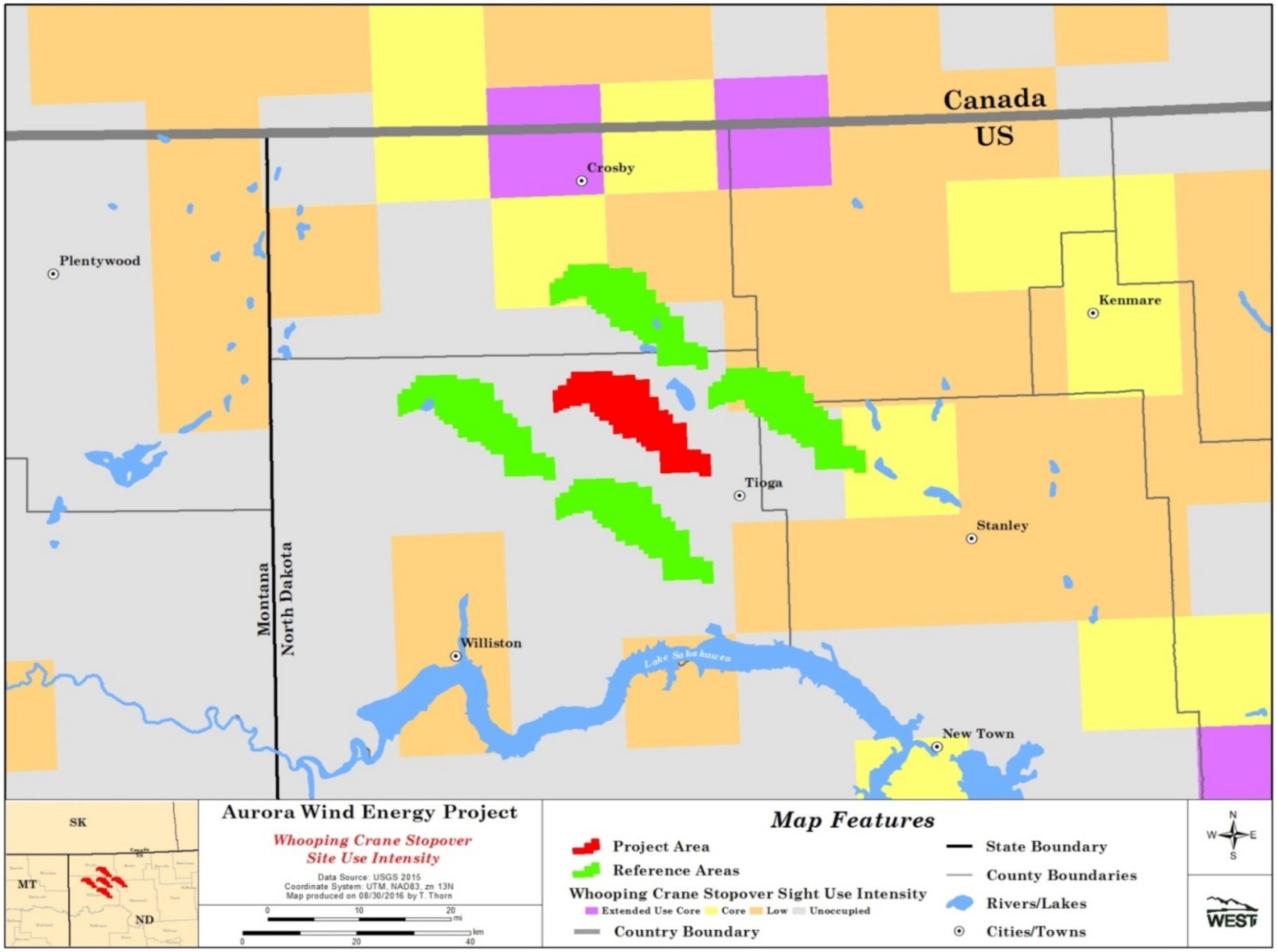

Figure 4. Location of the Aurora Wind Energy Project in Williams County, North Dakota, and reference areas, in relation to whooping crane stopover site use intensity cells (Source: Pearse et al. 2015).

Whooping Crane Migration Corridor and Confirmed Sightings

Stehn (2007) documented a 200.0-mi (321.9-km) wide migration corridor for whooping cranes based on the historical sightings of whooping cranes from the early 1960's through 2006. This 200-mi wide corridor (100.0 mi [160.9 km] on either side of the centerline) encompasses approximately 95% of the observations and a 100.0-mi wide corridor subset of this encompasses approximately 82.0% of the observations. The Project area and all four reference areas are located within the defined (95% of confirmed sightings) whooping crane migration corridor; however, no whooping cranes have been documented within the Project (Cooperative Whooping Crane Tracking Project 2009, USFWS 2015; Figure 1). There are, however, six confirmed sightings within one mi (1.6 km) of the Project's boundary; the North, South, and East reference areas each contain whooping crane sightings while at least one sighting has been reported within one mi of the West reference area (Figure 1). It should be noted that reported whooping crane observations are mostly random events by the public or focused around refuges and other areas of management interest and not the result of a systematic search. Therefore, a lack of documented whooping crane sightings in a particular area does necessarily mean that birds do not use the area.

DISCUSSION

Threats to whooping cranes include collisions with manmade objects (e.g., power lines, fences), shooting, predators, disease, habitat destruction, severe weather, and a genetic bottleneck caused by their severe decline prior to 1941 (USFWS 2012b). According to the USFWS (2009), direct mortality may occur when whooping cranes collide with turbines in bad weather or low light conditions at the beginning or end of migration flights, or when flying between roosts and foraging areas at stopover sites. Because individuals of this species are particularly vulnerable during migration, recovery activities have included providing opportunities for cranes to stop and rest (i.e., stopover) during their journey (Harrell and Bidwell 2013).

Whooping cranes have the potential to occur in the Project and reference areas due to their location relative to the migration corridor and confirmed sightings in the general region. Potential whooping crane habitat within the Project area was similar to the reference areas. The Project area and reference areas all had substantial amounts of cultivated croplands with lesser amounts of grassland/herbaceous. Additionally, all areas had some wetlands, although percent of the total area was low. These results verify that both roosting (i.e., wetlands) and foraging (i.e., croplands and grassland) habitats are available in the Project and reference areas.

Although developed for transmission line impacts on whooping crane habitat in Kansas, the Watershed Institute's (2012) potentially suitable habitat assessment for whooping cranes can help to quantify potential whooping crane habitat in and around proposed wind energy projects. According to this model, the range of scores and mean scores of wetlands within the Project area was similar to the four reference areas. Overall, the average score and the majority of the individual wetland scores were lower than the reference score of 12 developed for quality habitat at the Quivira National Wildlife Refuge. Use of the Watershed Institute's (2012) model as a tool for assessing habitat suitability at Project suggests that whooping cranes are not likely to use the Project area for migratory stopovers.

No confirmed whooping crane sightings have been reported within the Project area through spring 2017 (USFW 2017); however, observations of whooping cranes within the vicinity of the Project have been recorded (Figure 1). As such, it is possible that whooping cranes could fly over or through the Project during migration. Whooping cranes generally migrate at 1,000.0–6,000.0 ft (304.5–1,828.8 m) altitude, well above turbine height (Stehn 2007), and thus for the most part are unlikely to collide with turbines. However, as whooping cranes ascend and descend during takeoff and landing, or migrate during inclement weather, they may fly at lower altitudes and may fly at altitudes corresponding to the rotor-swept areas of wind turbines. In summary, low altitude flight is generally of short duration in the morning and evenings with more time and distance covered at higher elevation during typical migration flight, reducing potential risk to whooping cranes.

To date, there have been no recorded instances of whooping cranes being killed or injured by wind turbines (National Wind Coordinating Collaborative 2004); however, one sandhill crane (*Antigone canadensis*) was reported killed at the Altamont wind energy facility in California (Smallwood and Karas 2009); it is unclear if this fatality was a result of turbine collision or collision with a power line. Additionally, two sandhill cranes struck turbines during a study of wintering cranes in Texas (Navarrete and Griffis-Kyle 2014). No sandhill cranes or whooping cranes have been found as fatalities at five wind facilities searched daily for crane mortalities during migration in North Dakota and South Dakota for up to three years (Derby et al. 2012).Thus, it appears that cranes are not particularly susceptible to collision with wind turbines given that large numbers of sandhill cranes and lesser numbers of whooping cranes that migrate biannually through the Great Plains region with no documented fatalities as a result of collision with wind turbines during migration.

According to the USGS stopover site use intensity (Pease et al. 2015), whooping crane use occurs directly to the north and east of the Project area with lesser use to the west and south. Although no whooping crane use was document for the birds carrying the telemetry units within the grid cells intersected by the Project area, it is possible that whooping cranes would fly over the Project area during migration and/or use wetlands and croplands within the Project area for roosting and foraging.

SUMMARY

In summary, there is potential whooping crane habitat within the Project area and the potential for whooping cranes to utilize suitable habitats within the Project while migrating. This analysis showed that both roosting (i.e., wetlands) and foraging (i.e., croplands) habitats are available in the Project and reference areas. Potential whooping crane habitat within the Project area appeared to be most similar to that in the North reference area and more suitable than that found in the other reference areas. Although according to the USGS's recent determination of whooping crane stopover use sites, the Project area did not intersected any occupied grid cells, the reference areas adjacent to the proposed Project area had use. Given there is potential habitat and documented use in the region, whooping cranes will likely migrate over or through the Project area during migration. There is potential whooping habitat within the Project but this habitat is not unique compared to adjacent areas.

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