

Emmons-Logan Wind Energy Center and 230 kV Transmission Line

Revised Appendix C

PU-18-280

PU-18-281

Final Northern Long-Eared Bat Habitat Assessment

Final Whooping Crane Habitat Review

2017 Grassland Assessment

2017 Sharp-tailed Grouse Lek Report

**Northern Long-Eared Bat Desktop Habitat Assessment
Emmons-Logan Wind Energy Center and 230 kV Transmission Line
Emmons and Logan Counties, North Dakota**

Final Report

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Emmons-Logan Wind, LLC

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INTRODUCTION

Emmons-Logan Wind, LLC (Emmons-Logan Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC, is considering the development of the Emmons-Logan Wind Energy Center and 230 kV Transmission Line (Project) in east-central Emmons and southwest Logan counties, North Dakota. To evaluate potential northern long-eared bat (*Myotis septentrionalis*; NLEB) habitat and use within the proposed Project area and to address past recommendations from the U.S. Fish and Wildlife Service (USFWS) and North Dakota Game and Fish Department, Emmons-Logan Wind requested that Western Ecosystems Technology, Inc. (WEST) evaluate potential habitat for NLEB within the Project area during the summer months.

This report describes the results of the NLEB desktop habitat assessment completed for the Project by WEST, which was done following the Phase 1 survey recommendations found in the USFWS' *Northern Long-Eared Bat Interim Conference and Planning Guidance* (Guidance; USFWS 2014) and *2016 Range-Wide Indiana Bat Summer Survey Guidelines* (Guidelines; USFWS 2016).

Northern Long-eared Bat Summer Habitat Requirements

The NLEB is a federally threatened species throughout its range listed under the Endangered Species Act (1973), but take due to operation of wind projects is exempt under a 4(d) rule (81 Federal Register 9: 1900-1922. 2016). The NLEB is a forest-dependent species that tends to avoid open habitats, generally relying on forest features for both foraging and roosting during the summer months (Owen et al. 2003, USFWS 2017), and requiring forest interior habitat with adequate canopy closure for both roost and foraging (Lausen 2009). Abundance of NLEB prey items, particularly beetles and moths, are typically higher in more closed forest stands than in forest openings, and wing morphology makes this bat species ideally suited for the high maneuverability required for gleaning-type foraging within a cluttered forest interior (Henderson and Broders 2008). Additionally, riparian areas are considered critical resource areas for many species of bats because they support higher concentrations of prey, provide drinking areas, and act as unobstructed commuting corridors (Grindal et al. 1999).

It is unlikely that NLEB would cross over large open areas (i.e., land lacking suitable habitat) to search for foraging and roosting habitats. Henderson and Broders (2008) found that NLEB did not travel more than 255 feet (ft; 68.6 meters [m]) from the edge of intact forest structure; however, they also have been documented to occur in agricultural settings where forest habitats have been highly fragmented. A study of nine female NLEB using an intensively managed forest in West Virginia found this species forages in areas with forest patch sizes between 114 – 161 acres (ac; 46.1 – 65.2 hectares [ha]; Owen et al. 2003), while studies in landscapes dominated by agricultural activities found NLEB used woodlots and riparian zones with as little as 15 – 50 ac (6.1 – 20.2 ha) of forest cover (Foster and Kurta 1999, Henderson and Broders 2008).

During the summer months, NLEB roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees (USFWS 2014). In general, NLEB seem opportunistic in selecting roosts, using tree species that retain bark or provide cavities or crevices. Rarely, NLEB have also been found roosting in structures like barns and sheds (USFWS 2015); however, any structures that may be used as roosts would be expected to be located relatively close to wooded habitat that would be used for foraging. Cooler roost locations such as caves and mines may be used by non-reproductive females and males (Bat Conservation International 2017); no caves or mines are present within the Project area or 2.5-mile (mi; 4-kilometer [km]) buffer.

PROJECT AREA

The analysis was completed based on a Project boundary provided by Emmons-Logan Wind in 2017 encompassing about 75,056 acres (ac; 303.7 square kilometers [km²]; 117.3 square miles [mi²]) but is applicable to current Wind Energy Center boundary and the 230 kV Transmission Line as only minor adjustments have been made. The Project is located in the south-central North Dakota counties of Emmons and Logan, approximately 7 miles (mi; 11.3 kilometers [km]) northeast of the City of Linton (Figure 1). The landscape area is generally rolling to flat. Elevations range from 1,917.1 to 2,176.0 feet (ft; 584.3 to 663.2 meters [m]) above sea level. Historically, the landscape was grassland but has since been converted to agricultural use with crop production and livestock grazing the primary practices. Trees and shrubs can be found around farmsteads, within planted shelter belts, and along/within drainages. Natural wetlands are present and scattered throughout the Project and surrounding area. Common agricultural crops include small grains, corn, soybeans, sunflowers, and alfalfa.

HABITAT ASSESSMENT

Methods

The NLEB Guidance provides an estimate of the average maximum movement distance of 1.5 mi (2.4 km) for NLEB and 2.5 mi for Indiana bats. Using US Department of Agriculture's (USDA) 2016 National Agricultural Imagery Program imagery (USDA 2016) and National Land Cover Database (US Geological Survey 2011, Homer et al. 2015) data, WEST digitized trees, considered potential NLEB summer habitat, within the Project area and within a 2.5 mi buffer around the Project. The larger 2.5 mi buffer was used to provide a conservative estimate of the potential foraging range of NLEB and to depict any potential corridors of connected habitat in the vicinity of the Project.

A habitat analysis was then conducted to assess connectivity of suitable foraging (i.e., woodlots, forested riparian corridors, and areas adjacent to these habitats), roosting, or commuting (i.e., shelterbelts/tree-lines, wooded hedgerows) habitats. Given that NLEB have similar habitat requirements as Indiana bats, the approach used in this habitat evaluation followed recommendations for habitat assessment included in the USFWS' *Indiana Bat Section 7 and Section 10 Guidance for Wind Energy Projects* (USFWS 2011). This guidance assesses the

potential for bats to use the Project area based on presence of travel/commuting corridors within the Project boundary and connectivity to foraging or roosting habitat within a 2.5 mi buffer of the Project. Connectivity is defined in the guidance as commuting habitat within 1,000 ft (304.8 m) and connected to roosting or foraging habitat within 2.5 mi of the Project boundary (USFWS 2011). The 1,000 ft distance is based on studies of Indiana and NLEB behavior using telemetry data on foraging activity, which indicated that isolated trees or small patches might only be suitable as habitat when they are less than 1,000 ft from other forested/wooded habitats; therefore, it is reasonable to conclude that these bats are unlikely to occur within areas located more than 1,000 ft from roosting/foraging habitat (USFWS 2011, 2014).

For purposes of this review, WEST categorized habitat patches equal to, or smaller than 14 ac (5.6 ha), as potential commuting/travel corridors (generally shelterbelts or small woodlots); patches 15 – 50 ac (6.1 – 20.2 ha) were considered small roosting/foraging areas (larger woodlots or riparian forests); and patches greater than 50 ac (20.2 ha) were considered medium-large roosting/foraging areas (larger contiguous forests or riparian corridors).

Results

Wooded habitat within the Project area is generally confined to small (less than 14 ac [6.1 ha]), scattered woodlots and tree rows that would not be considered suitable summer habitat for NLEB (Figure 1). There are three small (15 to 50 ac [6.1 – 20.2 ha]) wooded fragments in the northern half of the Project area that could provide potential roosting habitat for NLEB. One wooded area is partially within the 230 kV Transmission Line corridor. These wooded areas were analyzed to determine potential foraging and/or travel corridors around them by looking at the area within a 1,000-foot buffer. There were no direct wooded travel corridors between these three small patches and each other or other larger patches of wooded areas. The 2.5 mi buffer did not contain any treed areas greater than or equal to 15 ac (Figure 1).

Imagery analysis shows all potential roost/reproduction sites to consist of planted tree rows with a variety of tree sizes and species; both the potential roost sites and corresponding foraging areas are associated with, or encompass, active farmsteads.

Based on the remoteness of the Project from native tree areas (all three areas within the 15-50 ac [6.1-20.2 ha] were planted trees as well as most other smaller treed areas being tree rows or shelter belts), lack of connection to larger riparian areas (e.g., Missouri River), and lack of hibernaculum near the Project, it is unlikely that the NLEB has summer presence in the Project.

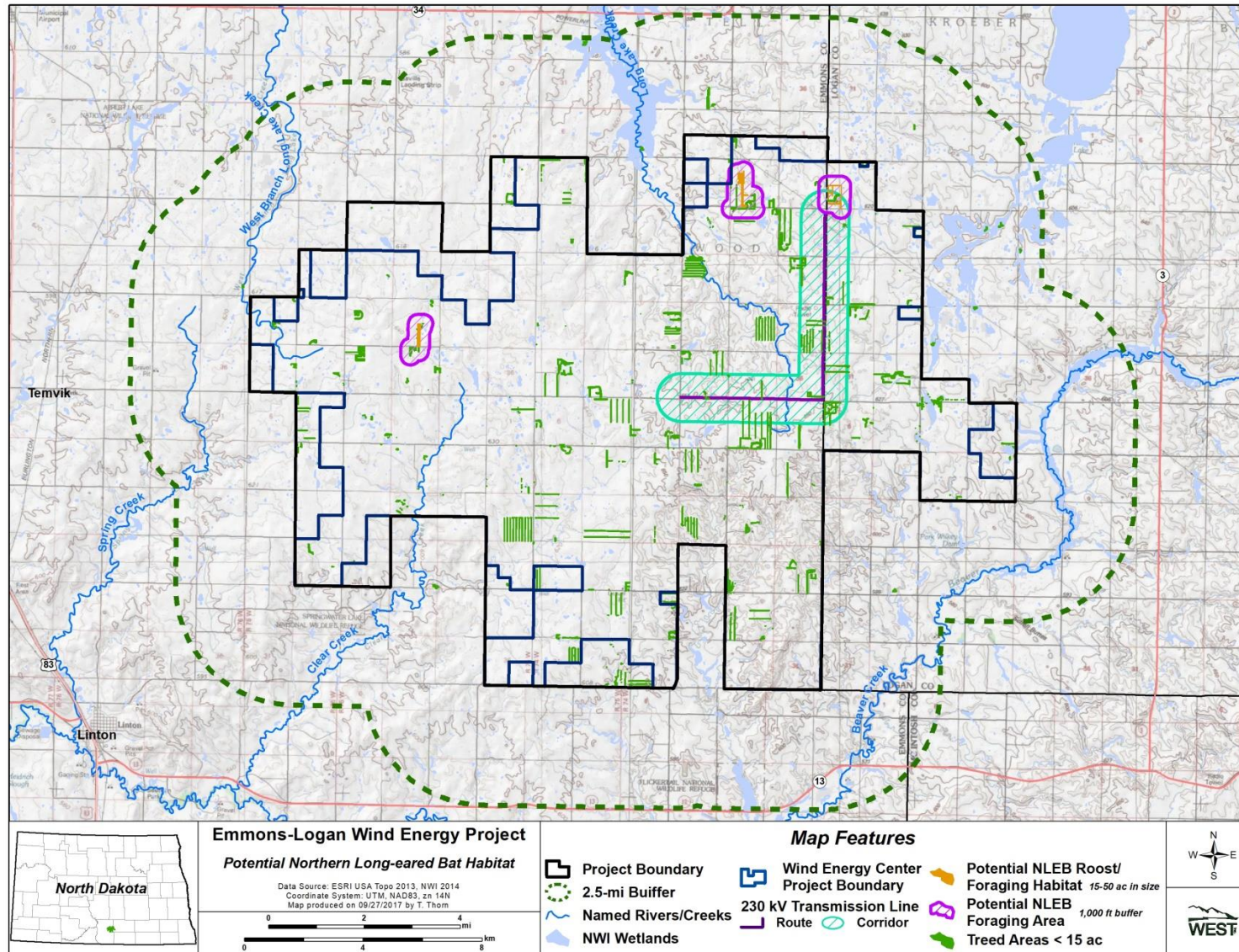


Figure 1. Potential northern long-eared bat habitat within the proposed Emmons-Logan Wind Project in Emmons and Logan Counties, North Dakota, and associated 2.5-mile buffer.

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INTRODUCTION

Emmons-Logan Wind, LLC (Emmons-Logan Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC proposes to develop the Emmons-Logan Wind Energy Center and 230 kV Transmission Line (Project) in Emmons and Logan Counties, North Dakota (Figure 1). Emmons-Logan Wind requested that Western EcoSystems Technology, Inc. (WEST) conduct a desktop review of potential whooping crane (*Grus americana*) habitat resources within the Project and perform a comparative analysis to resources in the surrounding landscape using four adjacent and similarly-sized reference areas.

PROJECT AREA

The analysis was completed based on a Project boundary provided by Emmons-Logan Wind in 2017 encompassing about 75,056 acres (ac; 303.7 square kilometers [km²]; 117.3 square miles [mi²]) but is applicable to the current boundary, including both the Wind Energy Center as well as the 230 kV Transmission Line. The Project is located in the south-central North Dakota counties of Emmons and Logan, approximately 8 miles (mi; 13 kilometers [km]) northeast of the City of Linton (Figure 1). The landscape area is generally rolling to flat. Elevations range from 1,917.1 to 2,176.0 feet (ft; 584.3 to 663.2 meters [m]) above sea level. Historically, the landscape was grassland but has since been converted to agricultural use with crop production and livestock grazing the primary practices. Trees and shrubs can be found around farmsteads, within planted shelter belts, and along/within drainages. Natural wetlands are present and scattered throughout the Project and surrounding area. Common agricultural crops include small grains, corn, soybeans, sunflowers, and alfalfa.

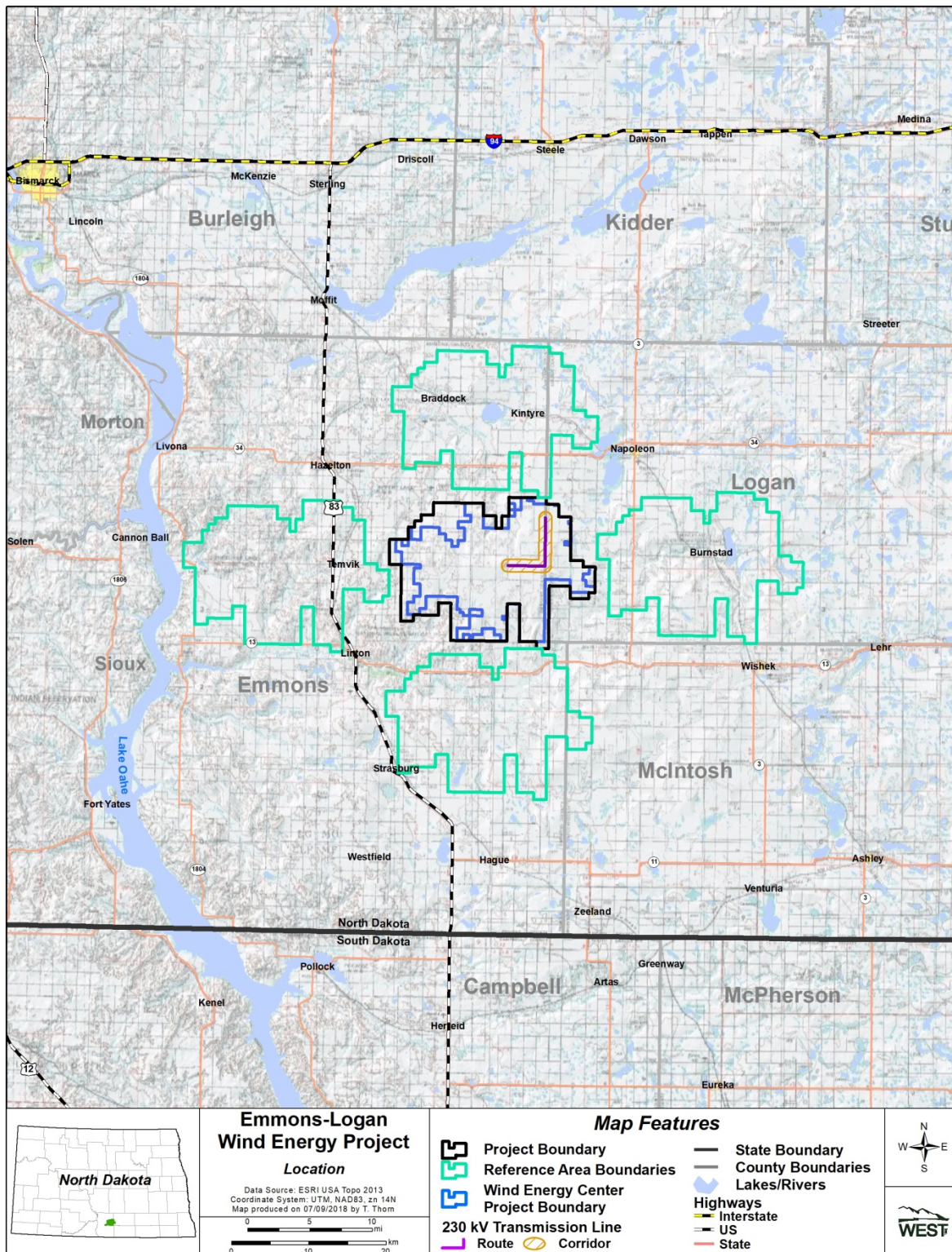


Figure 1. Location of the Emmons-Logan Wind Energy Center, 230 kV Transmission Line, and adjacent reference areas.

METHODS

A desktop review was completed using ArcGIS, ArcMap 10.3.1, National Land Cover Database (NLCD) information, National Wetland Inventory (NWI) data, 2016 National Agricultural Imagery Program (NAIP) aerial imagery, and the Project area as provided by Emmons-Logan Wind in 2017. A site visit was not completed by WEST for this exercise specifically, but WEST has conducted other surveys within the Project area and confirmed that the mapping generally agrees with current conditions.

The whooping crane habitat analysis included a comparison of land cover within the Project and four similarly-sized reference areas (collectively, the “study areas”) located adjacent to the Project in the four cardinal directions. A potentially suitable habitat assessment (Watershed Institute 2012) was also used to quantify and compare whooping crane habitat within the study areas. This assessment first screens all wetlands within the study areas for minimum size, visual obstructions, and disturbances. Those wetlands left are then quantified by their size, density of wetlands around them, distance to food, whether they are natural or man-made, and their water regime as a means to quantify suitability. This work was initially done in Kansas and the results were compared to Quivira National Wildlife Refuge, a traditional migratory stopover area. Further, the study areas were reviewed qualitatively using recent habitat suitability modeling from the USFWS (Niemuth et al. 2018).

RESULTS

There are approximately 48,724 ac of grassland/herbaceous and pasture/hay land cover/ land use types within the proposed Project area, or 64.9% of the total area. Croplands make up slightly more than 31% of the Project area while developed lands occupy another 3.3%. The remaining <1% of the Project area is composed of wetlands, trees, and shrubs (Figure 2; Table 1).

Croplands, Grasslands, and Other Habitats

The percentage of cropland varied by less than 10% between the study areas with the east reference area having the lowest at 23.0% and the Project area having the highest at 31.4% (Figure 2; Table 1). All cropland has the potential as foraging areas for whooping cranes but crop type could influence the extent of use of a particular field during any one migration season.

Grassland habitats (including both the grassland/herbaceous and pasture/hay types) also varied between study areas by 10% (Figure 2; Table 1). The percentage of grassland types ranged from 69.6% (east reference area) to 59.6% (north reference area; Table 1). The influence of grassland habitats on migrating whooping crane behavior is unknown; however, short grasslands (i.e. grazed pasture) adjacent to wetlands may provide loafing areas and cranes may utilize grasslands to some degree for foraging.

All other habitat types comprised approximately 3.3% of the Project area which was similar to the percentage of these habitats found in the reference areas (Table 1).

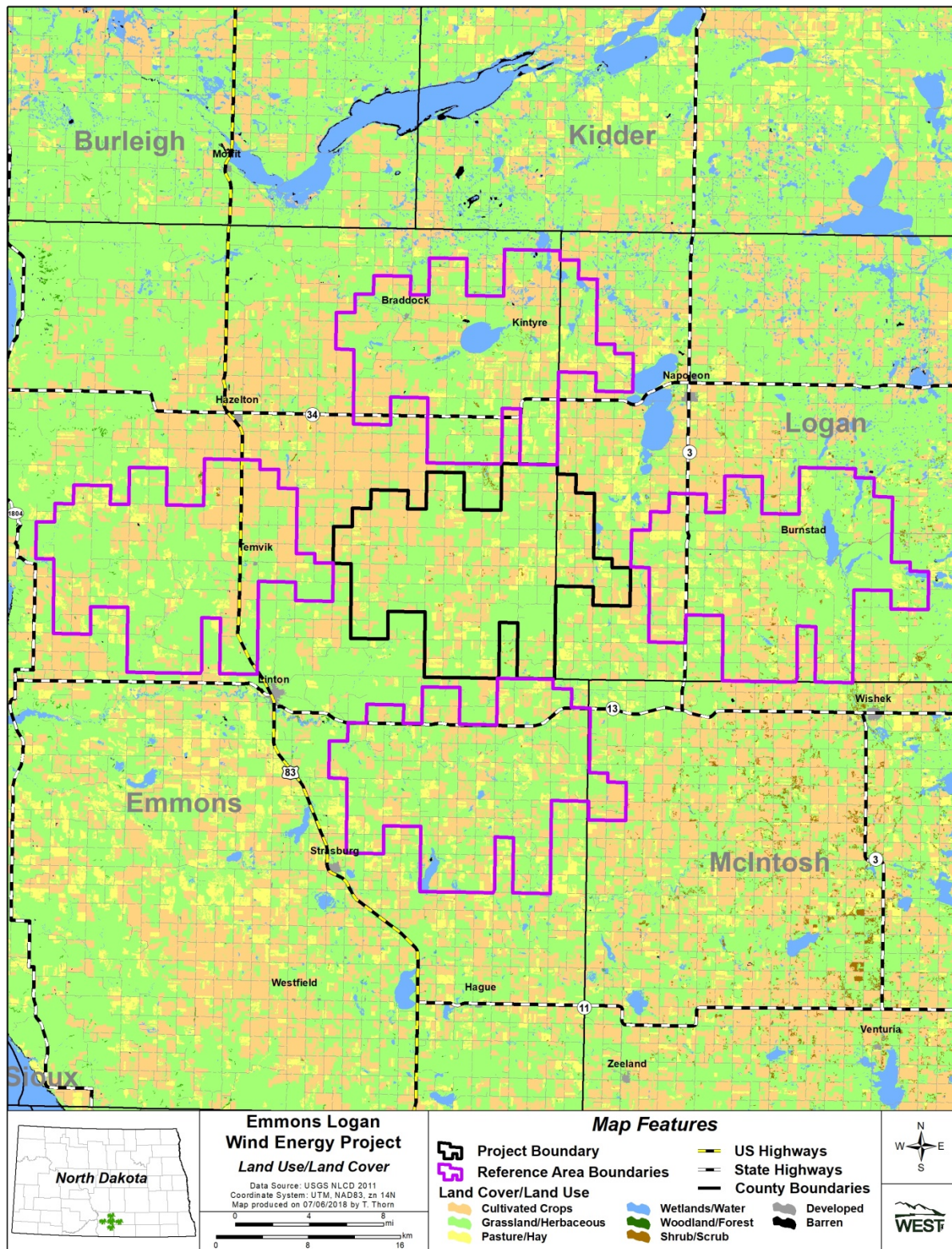


Figure 2. Land Use/Land Cover within and around the Emmons-Logan Wind Project and adjacent reference areas.

Table 1. Land Use/Land Cover within the Emmons-Logan Wind Project and adjacent reference areas.

Habitat Type	Project		North		East		South		West	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Cultivated Crops	23,569.0	31.4	24,108.6	32.1	17,242.9	23.0	19,798.4	26.4	21,346.8	28.4
Grassland/Herbaceous	42,426.1	56.5	38,655.3	51.5	44,652.1	59.5	44,057.3	58.7	44,846.4	59.8
Pasture/Hay	6,297.7	8.4	6,049.4	8.1	7,580.5	10.1	7,120.4	9.5	6,233.8	8.3
Developed	2,470.5	3.3	2,381.5	3.2	2,316.7	3.1	2,752.4	3.7	2,361.6	3.1
Water/Wetlands	57.3	<0.1	3,530.4	4.7	2,570.0	3.4	1,231.9	1.6	173.4	0.2
Shrub/Scrub	219.14	0.3	195.2	0.3	667.4	0.9	39.8	0.1	26.6	<0.1
Forests	15.8	<0.1	72.2	<0.1	18.9	<0.1	41.2	0.1	52.5	0.1
Barren			63.0	<0.1	7.1	<0.1	14.2	<0.1	14.5	<0.1

Data Source: National Land Cover Database (Fry et al. 2011) with similar land cover/land use combined.

Wetlands

NWI wetland data was used for this analysis because it represents wetland features to a higher degree than the NLCD. For this portion of the analysis, it is assumed that all wetlands are potential whooping crane roosting areas under one water regime or another (e.g., drought, normal, or flood). The Project area had the least wetland acreage, smallest mean wetland size, narrowest wetland size range, and third fewest wetlands of all study areas (Figure 3; Table 2). The north reference area had the greatest number of wetlands (1,883), largest mean wetland size (4.7 ac), widest wetland size range (<0.1 to 1,713.9 ac), and the highest wetland acreage (8,915.9 ac).

Freshwater emergent wetlands were the dominant wetland type in all study areas. However, approximately 33% of the east and 20% of the north area wetlands were lakes (Figure 3: Table 3).

In general, wetland characteristics were similar (smallest/fewest) for the Project and west reference area while the north and east reference area characteristics were also similar but they had the largest/greatest wetland numbers with lakes being more prevalent.

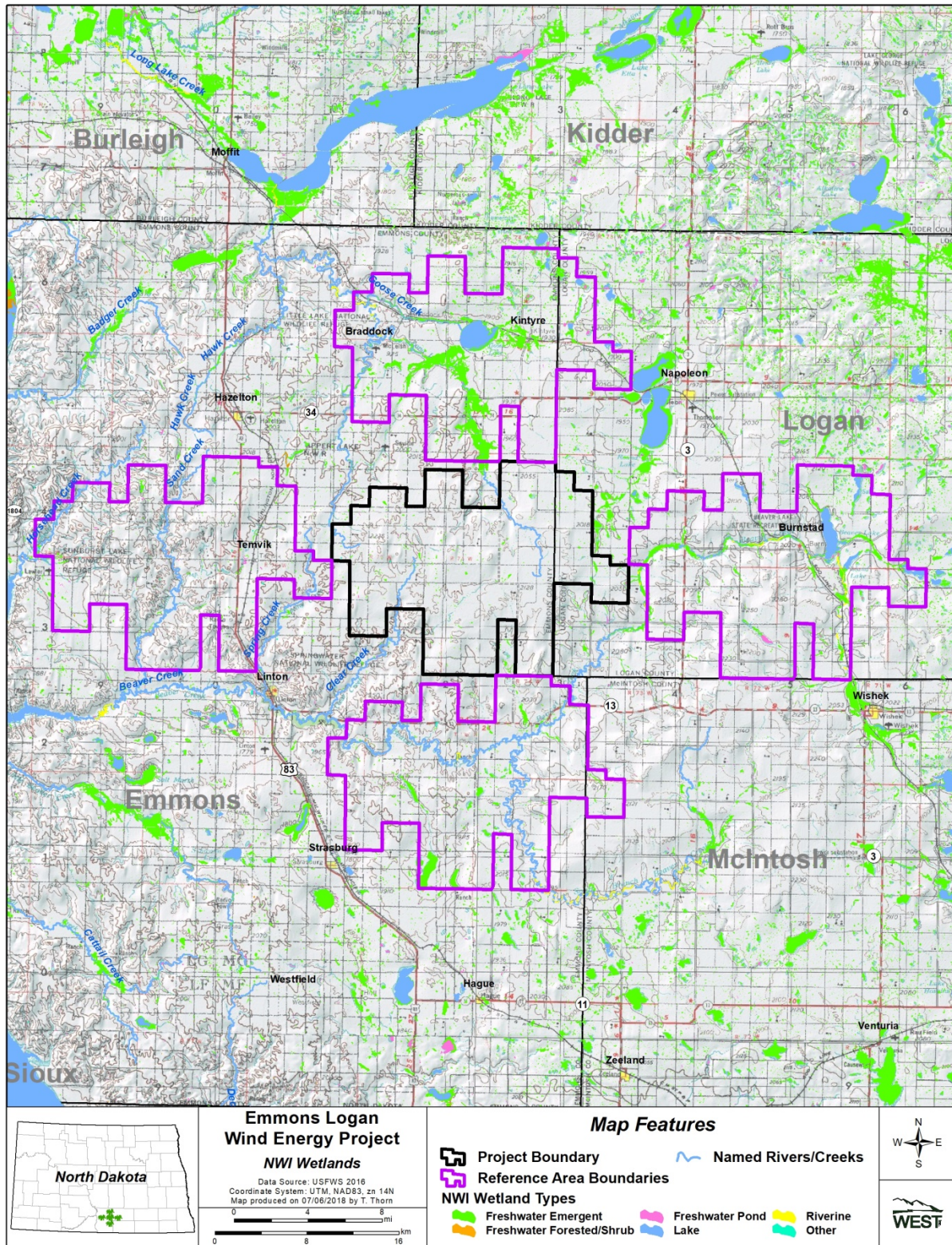


Figure 3. NWI wetlands and rivers/creeks within and around the Emmons-Logan Wind Project and adjacent reference areas.

Table 2. Comparison of the number of wetland basins and mean size within the Emmons-Logan Wind Project and adjacent reference areas.

Area	Basins	Total – acres	Mean Size – acres	Range – acres
Project	975	771.6	0.8	<0.1 – 30.7
North	1,883	8,915.9	4.7	<0.1 – 1,713.9
East	1,223	4,985.4	4.1	<0.1 – 1,130.9
South	967	2,477.2	2.6	<0.1 – 601.8
West	698	777.2	1.1	<0.1 – 58.5

Data Source: NWI 2010 data with wetland parts dissolved.

Table 3. Wetland types within the Emmons-Logan Wind Project and adjacent reference areas.

Wetland Type	Project		North		East		South		West	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Freshwater Emergent	714.1	92.6	7,122.1	79.9	3,059.2	61.4	2,350.5	94.9	625.5	80.5
Freshwater Forested/Shrub	1.7	0.2	7.7	<0.1	0.2	<0.1	6.4	0.3	2.9	0.4
Freshwater Pond	54.7	7.1	138.3	1.6	150.3	3.0	104.6	4.2	141.2	18.1
Lake	-	-	1,617.6	18.1	1,668.1	33.5	-	-	2.3	0.3
Other	1.1	0.1	0.2	<0.1	-	-	2.8	0.1	5.3	0.7
Riverine	-	-	30.1	0.3	107.6	2.1	12.9	0.5	-	-

Data Source: NWI 2010.

Whooping Crane Suitable Habitat Assessment

The habitat assessment model identified 351 wetland basins totaling 450.1 ac within the Project as potential whooping crane roosting habitat (Table 4). The mean suitability score for these wetlands was 10.1 with the scores ranging from seven to 16. Only the west reference area had fewer potential basins (258), less total acres (412.7), and a smaller mean score (9.7) than the Project area. The highest number (559), total acreage (6,178.0), and mean score (11.2) of potential whooping crane wetlands was in the north reference area.

In Kansas, a wetland with a score of 12 or more was considered potentially suitable whooping crane habitat (Watershed Institute 2012). If applied to the Project, 65 (18.5%) of the wetlands scored would have a score greater than 12 and thus be considered potentially suitable habitat. For the reference areas, the percentage of potentially suitable habitat wetlands with a score of 12 or greater was 42.8% in the north, 37.6% in the east, 18.9% in the south, and 12.8% in the west.

Table 4. Comparison of suitable whooping crane habitat within the Emmons-Logan Wind Project and adjacent reference areas.

Area	Basins	Total – acres	Mean Score	Score range
Project	351	450.1	10.1	7 – 16
North	559	6,178.0	11.2	7 – 18
South	381	1,771.5	10.1	7 – 18
East	396	3,098.6	10.8	8 – 18
West	258	412.7	9.7	5 – 16

Data Derived From: Potentially Suitable Habitat Assessment, Watershed Institute 2012.

Whooping Crane Stopover Site Use Intensity

The U.S. Geological Survey (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 from 2010 to 2014 of tagged whooping cranes (Pearse et al. 2015). Stopover sites and their use intensity were based on 20 km square grid cells. USGS describes four use intensity cells (Pearse et al. 2015):

1. "Unoccupied" lacks evidence of use,
2. "Low intensity" show evidence of use and low stopover site use intensity,
3. "Core intensity" contains density of stopovers identified as high use intensity and crane days of lower intensity, and
4. "Extended use core" show high use intensity of stopovers and crane days.

The Project falls within core intensity and unoccupied cells, with most of the Project in a low intensity region (Figure 4). The reference areas include a mix of all use types. The north reference area includes more core intensity areas, because Long Lake National Wildlife Refuge is a common stopover for whooping cranes during migration. The west reference area includes extended use core intensity cells due to whooping crane use along the Missouri River. The east and south reference areas only fall within unoccupied and low intensity cells.

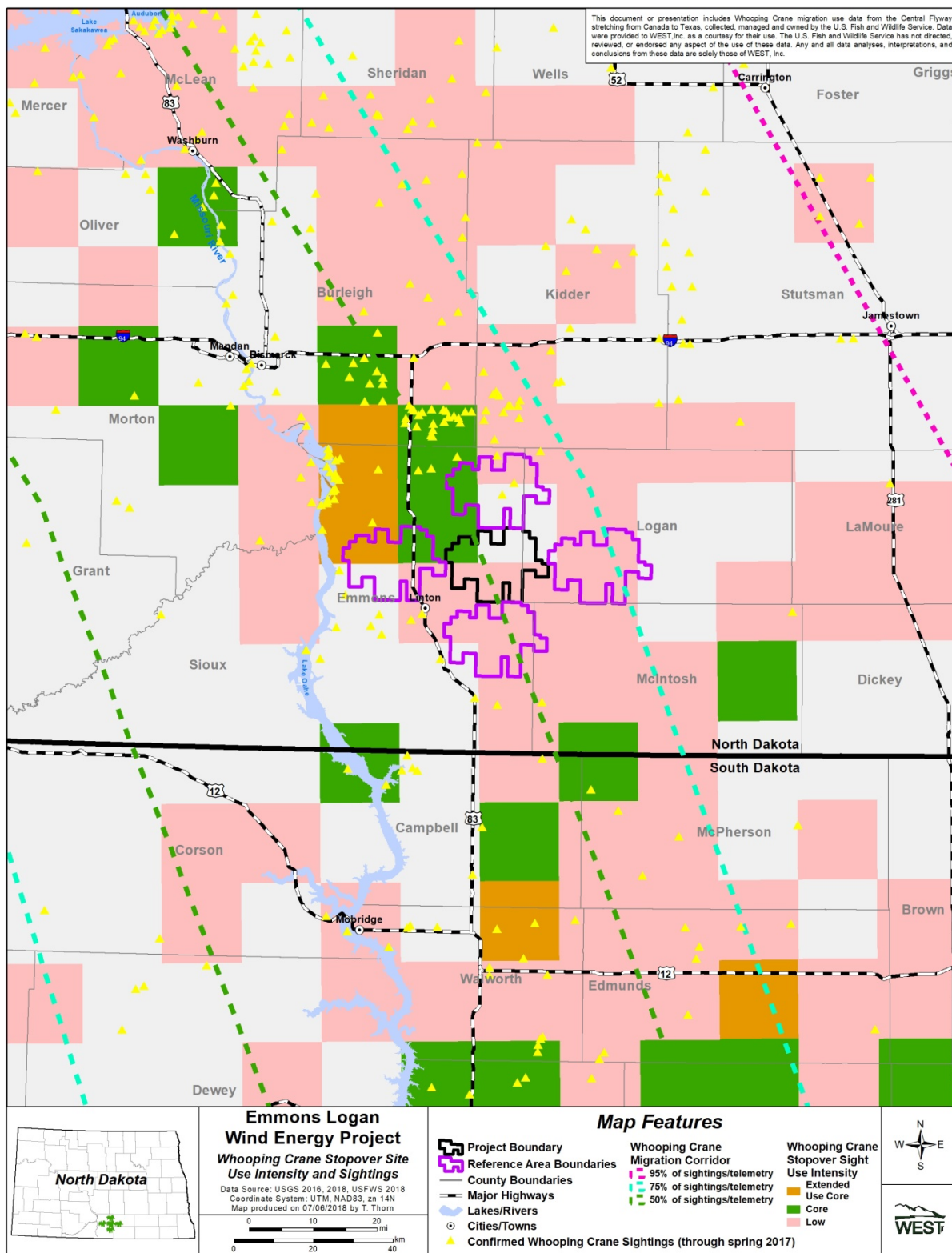


Figure 4. Location of the Emmons-Logan Wind Project, adjacent reference areas, and whooping crane stopover site use intensity and sightings.

USFWS Whooping Crane Habitat Suitability Model

The USFWS Habitat and Population Evaluation Team (HAPET) developed a habitat suitability model based on opportunistically collected whooping crane observation data with landscape level data within a GIS (Niemuth et al. 2018). The landscape data used included NWI wetland information, distance to whooping crane migration centerline, upland cover types, disturbance factors, and other variables. The report and associated spatial data were reviewed to help evaluate potential whooping crane habitat suitability within the Project.

The Project falls within an area of variable potential whooping crane use based on the habitat suitability, from low potential to higher potential, with higher potential in the northwest part of the Project (Figure 5) that contains more agriculture (Figure 2). All four reference areas also contain variable potential use based on the model, with the western and northern areas having a larger percentage of higher use potential than the Project or other reference areas.

Whooping cranes are currently listed as endangered under the Endangered Species Act (32 FR 4001) except where nonessential experimental populations exist (66 FR 33903-33917, 2001 June 26; 62 FR 38932-38939, 1997 July 21; and 58 FR 5647-5658, 1993 January 22). In the US, the whooping crane was listed as threatened with extinction in 1967 and endangered in 1970 – both listings were “grandfathered” into the Endangered Species Act of 1973 (ESA 1973). The 2015 – 2016 winter population within the primary wintering grounds was estimated at 329 birds (291 – 371, 95% confidence interval.). There was another 10 whooping cranes thought to be outside of the primary wintering grounds when systematic surveys were conducted (USFWS 2016a). Whooping cranes typically migrate from their breeding grounds in Wood Buffalo National Park, Canada to their wintering areas in Aransas National Wildlife Refuge, Texas. During the migration, most birds pass through central North Dakota.

The Project is within the central 75% migration corridor band. The USGS has recently determined whooping crane stopover sites and their intensity of use within the Great Plains from radio telemetry information. This information shows that at least a part of all reference areas lay within an area of low intensity crane use, with the western reference area within a portion of extended core use area. Similarly, the USFWS habitat suitability model shows varying levels of potential use based on habitat suitability. The model largely follows the results of the USGS telemetry data that indicates more actual use to the north and west of the Project. No confirmed whooping crane sightings have been reported within the Project through spring 2016 (USFWS 2016b) but there have been reports of whooping cranes around the Project, mainly to the north and west (Figure 5). Although the majority of the Project falls within a low intensity region and no whooping crane sightings have been reported to the USFWS from within the Project, it is possible that whooping cranes would fly over or through the Project area during migration. Whooping cranes generally migrate at 1,000-6,000 ft (305-1830 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, including those corresponding to the rotor swept area (generally less than 200 m). In summary, low altitude flight is generally of short duration in the

mornings and evenings with more time and distance covered at higher elevation during typical migration flight; reducing potential risk to whooping cranes.

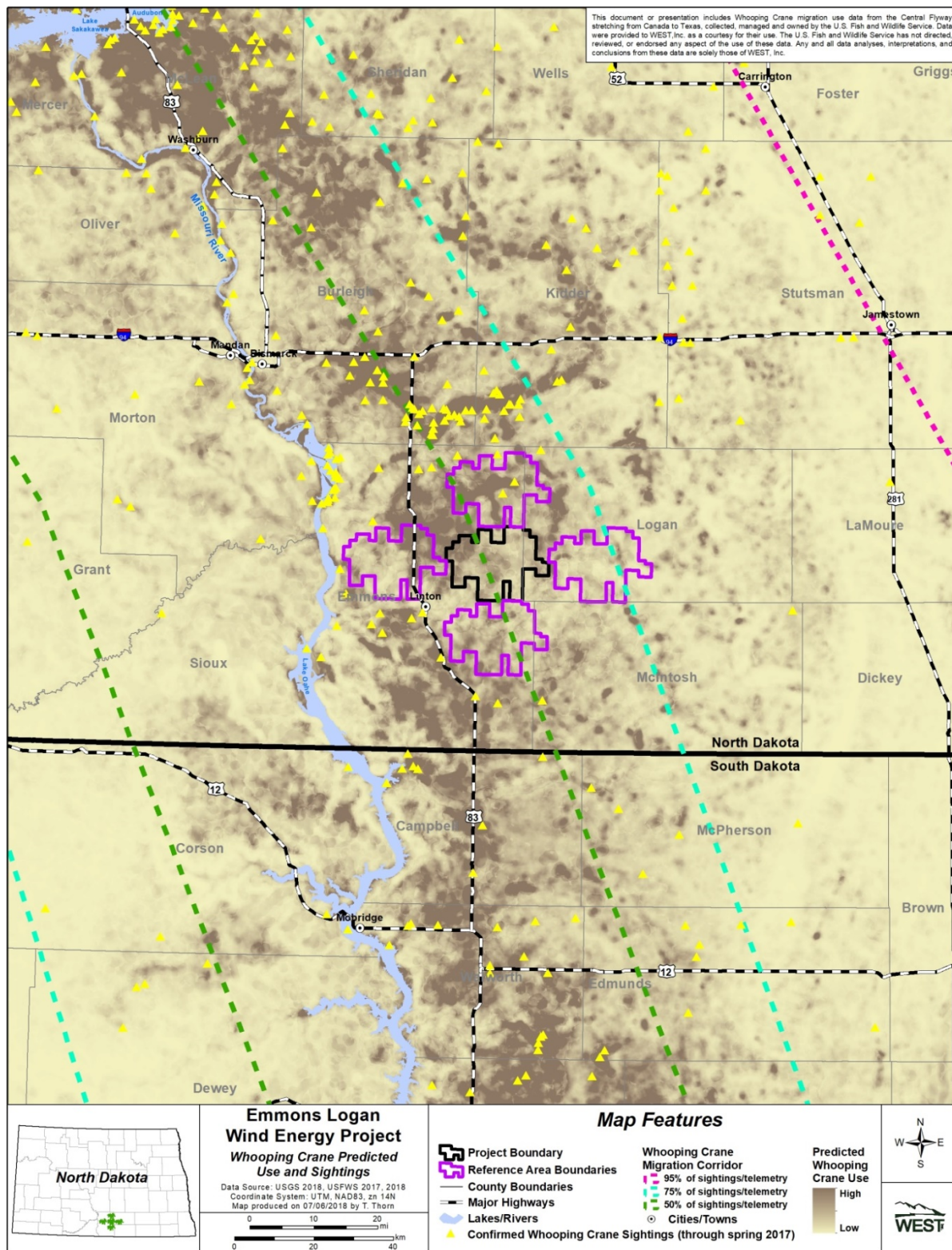


Figure 5. Potential whooping crane use based on the USFWS habitat suitability model for the Emmons-Logan Wind Project and adjacent reference areas.

DISCUSSION

A review of whooping literature reveals no whooping cranes have been reported as being killed or injured by wind turbines. One sandhill crane (*Grus canadensis*) mortality was reported at the Altamont wind energy facility in California (Smallwood and Karas 2009), it is unclear if this was a result of turbine collision or collision with a power line. Two sandhill cranes were also apparently collided with turbines during a study of wintering cranes in Texas (Navarrete and Griffis 2011a). 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). It appears that cranes are not overly susceptible to collision with turbines given that 100,000's sandhill cranes migrate twice annually through the Great Plains and none have been documented as wind turbine collision fatalities in this region during migration.

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 a proposed wind energy project. This tool indicates that the Project had the second fewest potential whooping crane wetland basins, total acres, and mean score. Only the west reference area had fewer/less potential wetland basin statistics. About 20% of the identified potential whooping crane habitat in the Project had a score 12 or greater. Again, only the west reference area had a lower percentage (12.8) of wetland basins with a score of 12 or more. A score of 12 or higher was considered quality whooping crane (Watershed Institute 2012).

SUMMARY

In analyzing the potential for significant impacts from wind development on whooping crane stopover habitat, Stehn (2007) suggests assessing whether there is "*lots of suitable stopover habitat in the general area ... or is the proposed wind farm site the only suitable whooping crane stopover habitat for miles around*". This issue was investigated by comparing the potential whooping crane stopover habitat (using wetlands as this indicator) in the Project to adjacent reference areas. GIS was used to calculate the amount of the various habitats and in the case of wetlands, number of individual basins and their type, in each of the reference areas compared to the proposed Project (Tables 1, 2, and 3). This analysis shows that both roosting (i.e. wetlands) and foraging (i.e. croplands) habitats are available in the Project and alternate areas. In general, potential whooping crane habitat within the Project appears to be most similar to that in the west reference area and less suitable than that found in the north reference area. Based on recent whooping crane telemetry tracking and confirmed sighting data, whooping cranes will likely migrate over or through the Project during some migration period. While there is potential whooping crane habitat within the Project, impacts resulting from Project activities are unlikely given low historic use, low or lack of use based on radio telemetry information, similar or more wetland roosting habitat in adjacent areas, and the lack of recorded whooping crane fatalities at other facilities and scarcity of sandhill crane fatalities across the U.S.

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2017 Grassland Assessment
Emmons-Logan Wind Energy Center and 230 kV
Transmission Line
Emmons and Logan Counties, North Dakota

Final Report



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INTRODUCTION

Emmons-Logan Wind, LLC (Emmons-Logan Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC, is developing the Emmons-Logan Wind Energy Center and 230 kV Transmission Line (Project), in Emmons and Logan counties, North Dakota (Figure 1). Emmons-Logan Wind tasked Western EcoSystems Technology, Inc. (WEST) to conduct a grassland assessment, identifying unbroken (native prairie) and previously broken grasslands, to inform siting within the Project area.

PROJECT AREA

The Project area, located in Emmons and Logan counties, approximately 8 miles (mi; 13 kilometers [km]) north of the town of Linton, North Dakota (Figure 1), encompasses approximately 75,375 acres (ac; 30,503 hectares [ha]). The Project topography is flat to rolling and is within the Northwestern Glaciated Plains Level III Ecoregion, a region dominated by agricultural cropland followed closely by grassland (both unbroken and broken, including hay land; US Environmental Protection Agency 2016). Ownership within the Project area is largely private, but three areas of North Dakota State School Land are found within the Project (US Geological Survey [USGS] 2013).

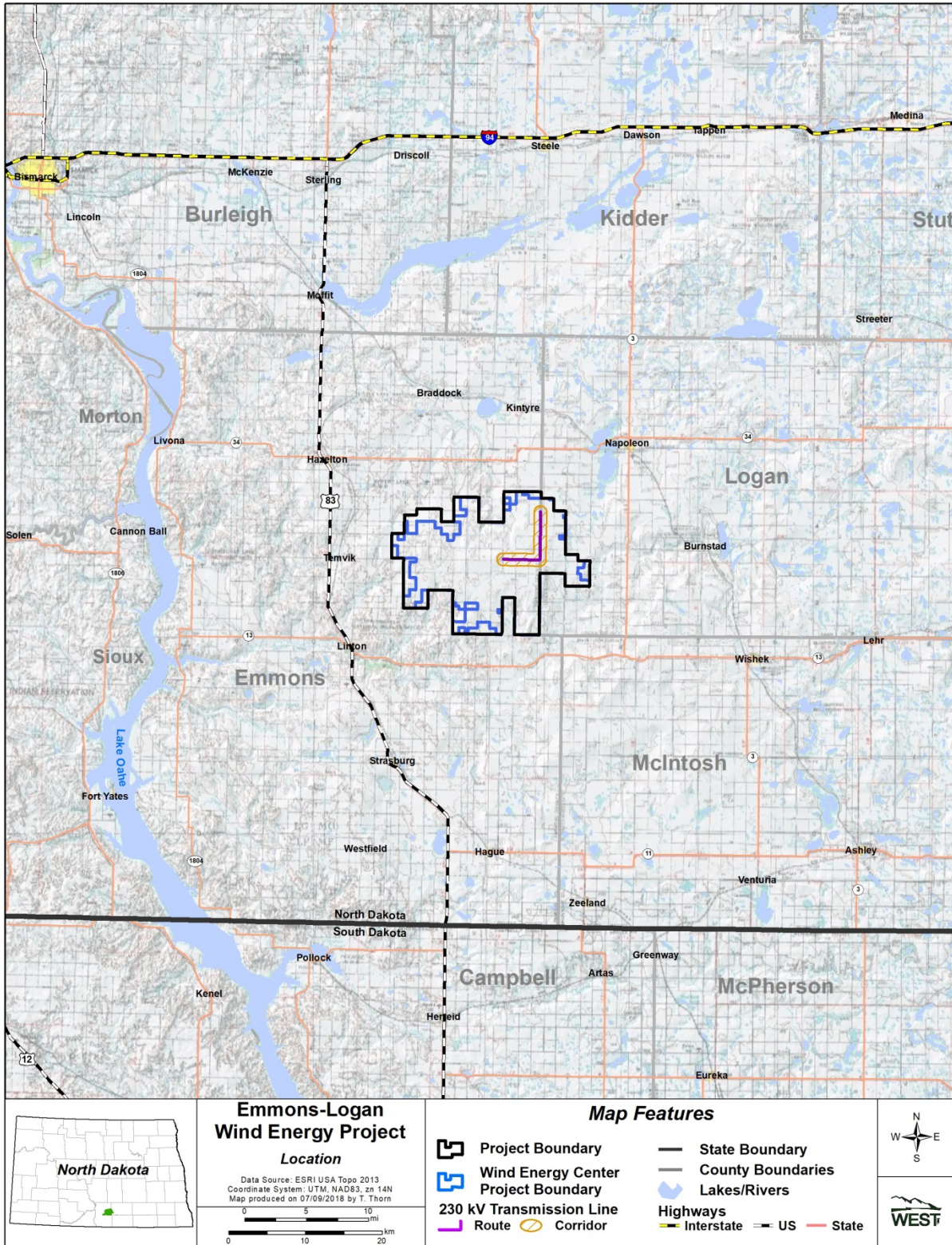


Figure 1. Location of the Emmons-Logan Wind Energy Center and 230 kV Transmission Line in Emmons and Logan counties, North Dakota.

METHODS

WEST completed a desktop review of existing land use/land cover features within the Project area using current aerial photography (US Department of Agriculture [USDA] National Agriculture Imagery Program [NAIP] 2016), existing land cover and wetland data (USGS National Land Cover Database 2011, USFWS NWI 2017), and North Dakota Game and Fish Department's (NDGFD) "Native Prairie" layer (NDGFD 2014), resulting in a digital data layer of polygons delineating grassland cover.

Once all grassland areas were identified, each grassland polygon was examined through a series of historical USDA NAIP aerial photography, ESRI imagery (larger scale/higher resolution; ESRI 2018), and North Dakota statewide historical imagery from 1957 – 1962 (USDA 2017) to determine the grassland sod type (broken or unbroken). Broken sod was identified based on features such as rock piles indicating extensive mechanized rock clearing; presence and amount or height of trees and shrubs; field edge changes; absence of scattered rocks; straight line features indicating plowing, disking, harvesting, or planting; or any other features indicating human disturbance.

Field surveys were completed to further evaluate if tracts of grassland were broken or unbroken. Grassland areas were assessed on foot where access was permitted, from roadsides where access was not permitted, or a combination of both if a grassland included areas with and without access. Sod was considered broken if rock piles or tillage lines were present. Areas within grasslands that appeared different than the surrounding area were delineated on a map, identified as broken or unbroken sod, and digitized by a GIS specialist at a later date. At each grassland area, notes were taken on the dominant grass type (native versus introduced), forb species present, and grazing status. Multiple photographs were taken to document the condition of the grassland area. The priority for the field surveys was larger blocks of continuous grassland and fine scale mapping was not completed during the field survey.

Upon completion of field surveys, field survey data were again compared to the NDGFD's "Native Prairie" layer, and those digitized grasslands with sod type not matching NDGFD's determination were re-examined to further evaluate sod type. WEST also coordinated with consultants from AECOM to agree upon grassland sod type where AECOM's turbine micro-siting assessment and WEST's assessment were inconsistent. Figures and tables included herein reflect these small micro-siting assessments.

RESULTS

The Project consists of approximately 30,479.7 ac (12,334.7 ha; 40.4%) of potential grassland, of which field survey types varied based on survey permission, accessibility, etc. (Table 1; Figure 2). Table 2 categorizes grassland sod type by percentage of total grassland (Figure 3) and by percentage in the Project.

Table 1. Summary of grassland acres by field survey type during surveys conducted by WEST with micro-siting adjustments from AECOM in 2017 at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line, in Emmons and Logan counties, North Dakota.

Survey Type	Acres of Grassland	% of Total
Walk-in	21,611.5	70.9
Roadside	5,378.8	17.6
No survey	2,731.6	9.0
Walk-in and roadside	757.9	2.5
Total	30,479.7	100

Table 2. Summary of grassland acres by sod type during surveys conducted by WEST with micro-siting adjustments from AECOM in 2017 at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line, in Emmons and Logan counties, North Dakota.

Sod Type	Acres of Grassland	% of Total Grassland	% of Project
Unbroken	22,340.5	73.3	29.6
Broken	8,139.2	26.7	10.8
Total	30,479.7	100	40.4

Geospatial Data

Two shapefiles were created as a result of the grassland assessment to describe grassland polygons that were surveyed and polygons that were not field surveyed (Table 3). Attribute data associated with each polygon are described in Table 2.

Table 3. Titles and definitions of column attributes on shapefiles created for fields surveyed and not surveyed. Shapefiles were based on desktop review and field surveys conducted in 2017 at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line, in Emmons and Logan Counties, North Dakota.

Attribute Column Name	Definition
Field Surveyed File: EL_WEST_Ic_grassland_12152017	
Type	Polygon land use/cover type; all areas labeled grassland
Acres	Total acres included in the grassland polygon
Sod_Type	Grassland sod type (unbroken or broken) identified during field surveys and desktop analysis
ImpactType	Grassland disturbance type identified as tilled (farmed) or untilled during desktop analysis
Not Surveyed File: EL_grassland_NOTfieldsurveyed_08152017	
Acres	Total acres included in the grassland polygon
Tillage	Grassland disturbance type identified as tilled (farmed) or untilled during desktop analysis
Habtype	Polygon land cover type; all areas labeled unknown after desktop analysis

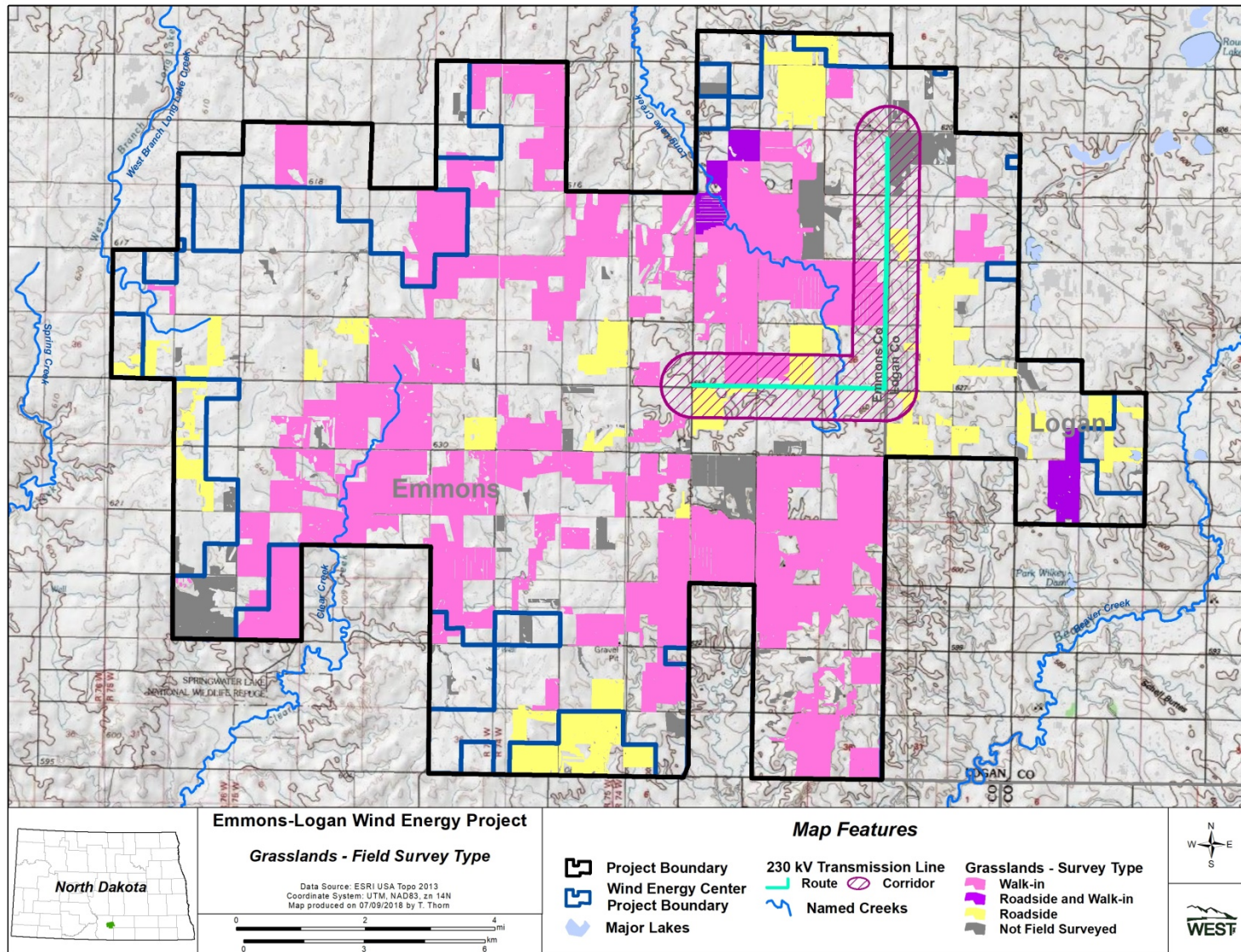


Figure 2. Survey types for grassland areas at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line in Emmons and Logan counties, North Dakota.

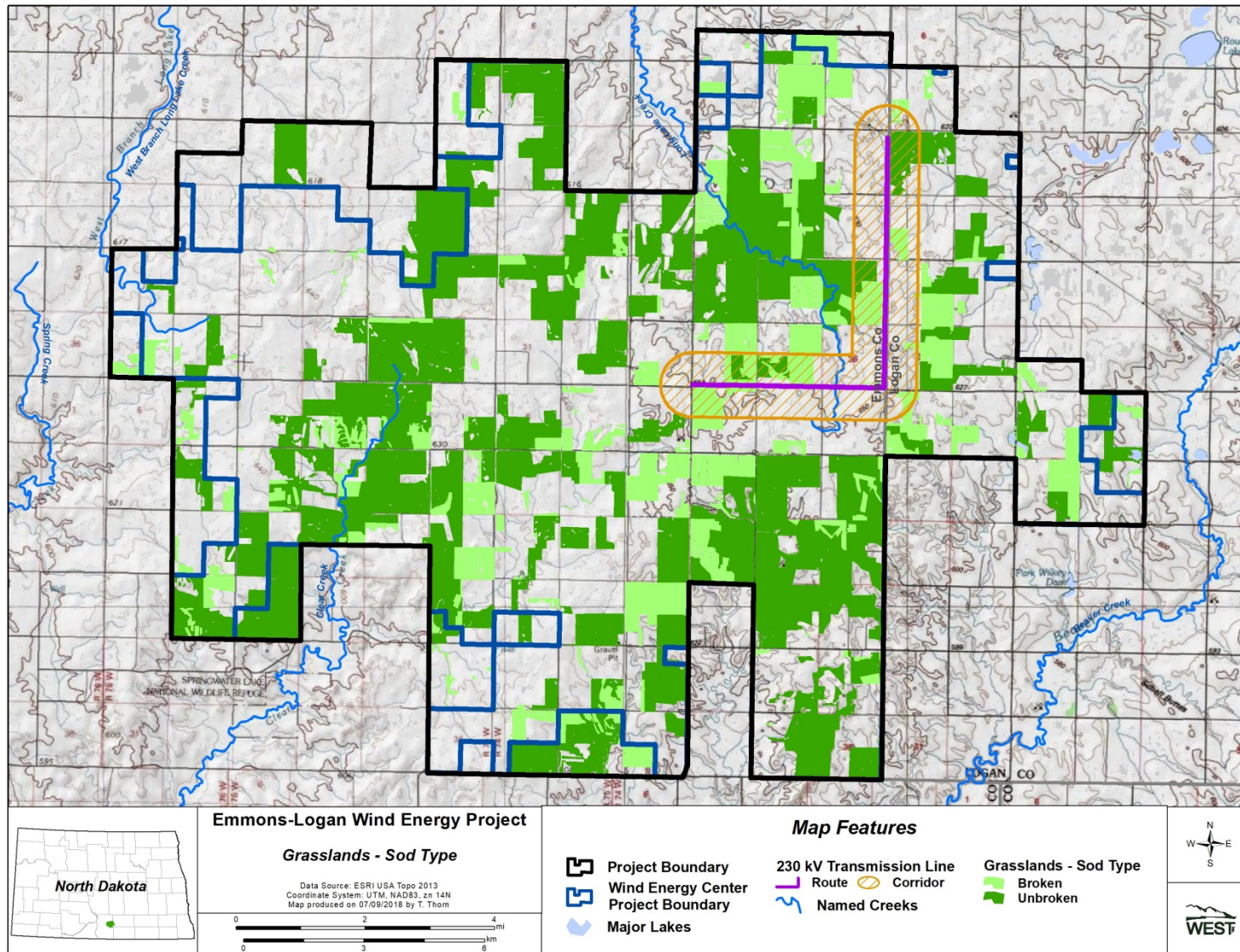


Figure 3. Grassland sod type within grassland areas at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line in Emmons and Logan counties, North Dakota.

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2017 Sharp-tailed Grouse Lek Report
Emmons-Logan Wind Energy Center and 230 kV Transmission Line
Emmons and Logan Counties, North Dakota

Final Report

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Figure 1. Sharp-tailed grouse leks observed during aerial surveys at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line conducted in April and May 2017.3

INTRODUCTION

Emmons-Logan Wind, LLC (Emmons-Logan Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC, is proposing to construct the Emmons-Logan Wind Energy Center and 230 kV Transmission Line (Project) in Emmons and Logan Counties, North Dakota. Emmons-Logan Wind tasked Western EcoSystems Technology, Inc. (WEST) to survey sharp-tailed grouse (*Tympanuchus phasianellus*) leks within the Project and a 0.5-mile (mi; 0.8-kilometer [km]) buffer (collectively, the “study area”). This report presents results of aerial lek surveys conducted during April and May 2017. Data includes sharp-tailed grouse observation locations, number of grouse observed, and lek status.

PROJECT AREA

The Project encompasses approximately 75,375 acres (ac; 30,503 hectares [ha]) and is located in south-central North Dakota in Emmons and Logan counties approximately eight miles (13 kilometers [km]) northeast of Linton, North Dakota. The Project is within the Northwestern Glaciated Plains Level III Ecoregion with a flat to gently rolling landscape (USEPA 2016). Sections of the Project remain in grassland and are utilized for grazing and other areas have been tilled for cropland. Wetland depressions can be found across the landscape.

The Project boundary used for this survey was received prior to surveys in 2017. Figures in this report show the current Project boundary received by WEST on in July 2018 date. Survey data from 2017 is applicable to the current boundary as all changes were within 0.5-mile buffer.

METHODS

The objective of the sharp-tailed grouse lek aerial survey was to determine the location of sharp-tailed grouse leks and provide a general sense of sharp-tailed grouse use within and immediately adjacent to the Project during peak lekking activity (late March through early May). Survey methodology was similar to that used at other wind sites in North and South Dakota and followed methods outlined in Martin and Knopf (1981). Historical lek data was requested from North Dakota Game and Fish Department (NDGFD) prior to the start of surveys.

Confirmed leks were locations where birds were observed, generally in courtship behavior, during more than one survey period. Possible leks were locations where birds were observed engaging in courtship behavior during only one survey period. Birds were considered: 1) male, when observed in courtship behavior, 2) female, when observed along the edges of a lek with males engaging in courtship behavior, or 3) unknown, when in flight or when no courtship was observed.

North/south transects were created throughout the study area. Transects started 0.5 miles (mi; 800 meters [m]) outside the east/west Project boundary and were placed at approximately 0.25 mi (400 m) intervals covering the study area (Figure 1). The length of each transect varied

based on the study area. Each transect was flown by fixed-wing aircraft (e.g. Cessna 172) at approximately 30 to 46 m (100 – 150 feet) during three separate survey periods.

Surveys were conducted approximately two weeks apart and occurred during the normal sharp-tailed grouse lekking period in North Dakota. Surveys were conducted approximately 30 minutes before sunrise, depending on cloud cover, until 2 hours after sunrise. When three or more sharp-tailed grouse observed together, the location was recorded with a global positioning system (GPS) unit along with the number of birds, activity, and lek status. Precipitation, temperature, wind speed, and cloud cover (%) were also recorded for each flight. Survey flights occurred during calm weather (wind <20 mph) with no rain.

RESULTS

Approximately 679 km (1093 mi) of transects were surveyed during each survey period: (April 3-6, April 17, 19-20, 22, and April 27, 30, May 1-3) encompassing nearly 48 flight hours. Two survey days were canceled due to poor weather conditions and one day was shortened due to ground-level fog, but surveys were completed the next day with calm weather. No historical lek data was received from NDGFD.

One confirmed lek (Lek 1) and two possible leks (Lek 2 and 3) were observed during the three survey periods (Table 1; Figure 1). One confirmed lek (Lek 1) and one possible lek (Lek 2) were within the Project boundary. Birds were observed at Lek 1 during all three survey periods, but no courting behavior was observed from the airplane. A ground survey was conducted by a field biologist on May 6 confirming courtship behavior at Lek 1 (Figure 1). No leks were observed within the 230 kV Transmission Line corridor.

With one confirmed lek within the Project, Emmons-Logan yields an approximate density of one lek per 131 mi². The average number of sharp-tailed grouse observed on a lek was 10.67 birds. While the maximum number of birds recorded on a lek during aerial was 11 birds (Lek 1; Table 1), a total of 17 birds were observed during the ground check on May 6. All leks were recorded within grassland/hay habitat.

Table 1. Summary of aerial sharp-tailed grouse lek surveys conducted during April and May 2017 at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line.

Lek ID	Date First Observed	Other Dates Observed	Highest Total	Lek
1	4/5	4/20, 5/1	11	Confirmed
2	4/30	n/a	10	Possible
3	5/3	n/a	11	Possible

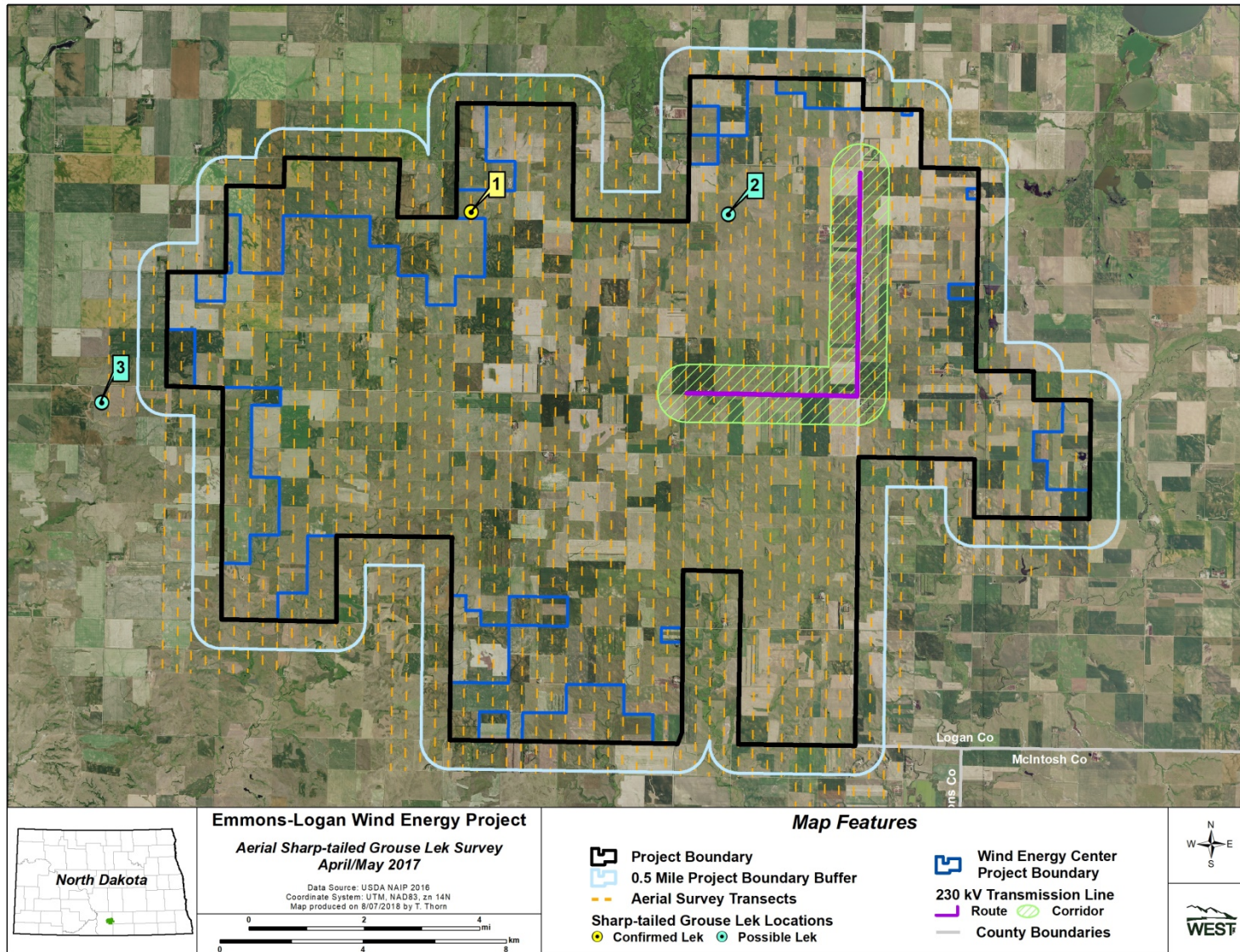


Figure 1. Sharp-tailed grouse leks observed during aerial surveys at the Emmons-Logan Wind Energy Center and 230 kV Transmission Line conducted in April and May 2017.

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