Spring 2016 Avian Survey

Brady Wind Energy Center
Stark County, North Dakota

Prepared for:

Brady Wind, LLC

NEXTera ENERGY RESOURCES

September 2016

TETRA TECH

Executive Summary

Tetra Tech, Inc. (Tetra Tech) was contracted by Brady Wind, LLC, to conduct avian use, raptor nest, and grouse lek surveys for the proposed Brady Wind Energy Center (Project Area) in Stark County, North Dakota. The studies were conducted to identify potential avian impacts associated with building and operating a wind energy facility in accordance with voluntary U.S. Fish and Wildlife Service *Land-based Wind Energy Guidelines*. Birds have been identified as a group potentially at risk because of collisions with wind turbines and associated power lines and loss of habitat and/or displacement due to the construction and presence of the associated structures. Weekly avian point-count surveys (fixed 800-meter radius) were performed at 18 points distributed throughout the Project Area from March 18 to June 8, 2016, thereby encompassing the spring migration season. Aerial and ground-based raptor nest surveys were performed on March 29-30 and May 15-16, 2016, respectively. Two rounds of ground-based lek surveys for sharp-tailed grouse were conducted between April 6 and 12, 2016 and between April 25 and 29, 2016.

A total of 4,937 birds from 48 species were observed during spring point-count surveys at the Project. The number of birds observed per survey ranged from 0 to 74 birds/20 minutes, with an overall mean use of 21.10 birds/20 minutes (Table ES-1). All species observed during the spring surveys had low encounter rate, at or below 0.16 birds flying at rotor swept area height/20 minutes. Although there is a potential risk of collisions of these species, any fatalities, should they occur, are not expected to have population-level impacts.

Songbirds had the highest mean use (16.26 birds/20 minutes) among species groups, followed by gamebirds (1.92 birds/20 minutes), and pigeons/doves (1.03 birds/20 minutes. The species most frequently observed in the spring were western meadowlark (71.8 percent of surveys), ringed-necked pheasant (44.4 percent of surveys), horned lark (32.9 percent of surveys), American robin (26.9 percent of surveys), mourning dove (24.8 percent of surveys), and red-winged blackbird (21.4 percent of surveys). Overall, the species with the highest mean use was red-winged blackbird (3.56 birds/20 minutes).

Raptor mean use was relatively low (0.56 birds/20 min). Among raptors, the northern harrier had the highest overall mean use (0.20 birds/20 minutes), and was the raptor species most frequently observed (19.2 percent of surveys). Other raptor species detected included (in order of highest to lowest mean use) Swainson's hawk, turkey vulture, American kestrel, red-tailed hawk and merlin, each with mean use values less than or equal to 0.14 birds/20 minutes, suggesting a low risk for collisions with Project turbines. The red-tailed hawk, Swainson's hawk, ferruginous hawk, and great-horned owl were found to be nesting within or near the Project Area, which may increase the risk for collisions during nesting activities and the time when young begin to fledge

(typically July and August). However, all are expected to have a low collision risk due to low mean use, frequency, and encounter rate.

Four active sharp-tailed grouse leks were observed within the Project Area and two more were found outside of the Project Area but within the 1-mile buffer. Based on the presence of leks and availability of grassland habitat, the likelihood of sharp-tailed grouse occurrence is high. Therefore, there is the potential for Project-related impacts such as displacement of sharp-tailed grouse.

The avian community detected within the Project Area during spring avian surveys was characterized by resident and migrant species typically associated with agricultural lands and grasslands/pastures of North Dakota. Within disturbed habitats such as these, the greatest potential impact of wind facilities to most avian species is collisions with turbines rather than disturbance or displacement. The species with highest mean use and encounter rates are all common in North America and have large populations, suggesting that fatalities observed at the Project, should they occur, are unlikely to have population-level impacts for any of these species. Recent studies suggest that pre-construction avian use rates do not necessarily correlate with post-construction mortality. Thus, the mean-use rates at the Project do not necessarily predict the risk of collision with turbines. Factors such as species' behavioral characteristics and weather events, factors not quantified in these surveys, can also influence collision risk.

Listed and Sensitive Species

No federally-listed threatened, endangered, or candidate species were detected during avian point-count surveys, or incidentally during point-count, raptor nest, or grouse lek surveys. There were no eagle nests within the Project Area. Three occupied golden eagle nests and two occupied bald eagle nests were within 2 to 10-miles from the Project Area (the Eagle Nest Survey Area). Despite the proximity of these eagle nests, no eagles were observed during the point-count surveys, suggesting that the Project Area is not a major flight corridor for local nesting eagles.

Table ES-1. Spring 2016 avian use summary.

Variable	Results	Details
Non-raptors		
Mean use	20.10 birds/20 minutes (90% CI = 19.24 – 22.96 birds/20 minutes)	Section 3
Species detected at Project that are commonly (> 15 records from publically available data) detected as wind farm fatalities	Yes	Section 4.1
Federally listed[1] bird species observed within the Project Area	No	
State-listed[2] bird species within the Project Area	No	
Grouse leks observed within the Project Area	Yes	4 sharp-tailed grouse leks
Grouse leks observed within 1-mile Project Area buffer	Yes	2 sharp-tailed grouse leks
Raptors		
Mean use	0.56 birds/20 minutes (90% CI = 0.47–0.65 birds/20 minutes)	Section 3
Species detected at Project that are commonly (> 15 records) detected as wind farm fatalities	Yes	Section 4.2
Eagles observed within the Project Area	No	
Eagles observed within the RSA	No	
Eagles observed nesting within the Project Area	No	
Eagles observed nesting within 10-mile Project Area buffer	Yes	Two bald and three golden eagle nests
Federally listed[1] species observed within the Project Area	No	
State-listed[2] species within the Project Area	No	
Habitat (within the Project Area)		
Native habitat likely to be affected by development	Yes	Grassland prairie
Lakes (waterfowl and crane attractant)	No	No
Wetlands (attractant for cranes, waterfowl, and other water-based species)	No	No significant wetlands
Cliffs (raptor nesting)	No	No
Rivers (permanent water source, migration corridor)	No	No
Known refuges or habitat features that may funnel migrants	No	

[1]Federally listed species include species listed as endangered, threatened, or candidate under the Endangered Species Act (ESA).

[2]There are no listings as state endangered or threatened species in North Dakota. The North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (Dyke et al. 2015) but these species are not afforded any formal protection by the state of North Dakota and there are no state permitting requirements for them.

Table of Contents

List of Figures

List of Tables

Appendices

1 Introduction

1.1 Wind Energy and Birds

Wind energy provides a clean and renewable energy source; however, birds have been identified as a species group potentially impacted by wind energy development because of collisions with wind turbines and power lines and displacement due to the presence of associated structures (Erickson et al. 2005, Arnett et al. 2007, Loss et al. 2013, Marques et al. 2014). Loss et al. (2013) estimated that 234,000 birds are killed annually at monopole-constructed wind turbines in the United States (excluding older outdated lattice turbine structures), while Erickson et al. (2014) estimated 368,000 birds killed at wind turbines in the United States and Canada.

Among bird species, migratory passerines (e.g., songbirds) are found more often during post-construction mortality monitoring than are other groups (Arnett et al. 2007, Erickson et al. 2014). Although commonly detected as fatalities, turbine-related mortality of passerines does not appear to result in population-level impacts (Stewart et al. 2007). Wind energy projects in the United States and Canada, for example, are estimated to only cause fatality rates ranging from 0.008 to 0.043 percent of population size per year for the most heavily affected passerine species (Erickson et al. 2014). Effects on local or regional populations of birds, nevertheless, may increase in relation to larger footprints of industrial energy projects across a landscape (Manville 2016).

Although most wind farm fatalities are songbirds, raptor mortality historically has received the most attention due to high fatality rates at the Altamont Wind Project in California (Thelander et al. 2003), and more recently as a result of U.S. Fish and Wildlife Service (USFWS) regulations providing a permitting mechanism for incidental take of bald and golden eagles (USFWS 2009). Although to date, only one permit for golden eagle take, and no permits for bald eagle take, have been issued. Raptor mortality at newer wind projects has been low relative to previous generation wind farms, although there is substantial regional variation (Johnson et al. 2002, Erickson et al. 2002, 2004, Kerns and Kerlinger 2004, Jain et al. 2007, Smallwood 2013). Nevertheless, since the Altamont Wind Project, raptors have still remained the avian species group considered most susceptible to collisions with turbines (Strickland et al. 2011), and micro-siting and site evaluation efforts are still necessary to minimize potential project-related impacts to raptors. In addition to direct mortality associated with wind farms, there is the potential for bird species to avoid areas near turbines or experience displacement associated with habitat loss during construction (Pearce-Higgins 2012) or after the wind farm is in operation (Drewitt and Langston 2006, Gillespie 2013, Winder et al. 2015). These effects may result in reduced nesting and breeding densities, loss of local population vigor and overall densities, local habitat and site abandonment, and effects on behavior (e.g., stress, interruption, and modification; Manville 2004, Gillespie 2013, Winder et al. 2015). Pearce-Higgins et al. (2012) detected disturbance-

related effects during construction, indicating that disturbance effects may occur on a short-term basis. To date, post-construction studies of displacement in birds have not demonstrated a distinct pattern of effects. Some studies have found decreased density, abundance, or persistence of birds near turbines (Leddy et al. 1999, Erickson et al. 2004, Gillespie 2013, Winder et al. 2015, Shaffer and Buhl 2016). Gillespie (2013) documented avoidance behavior in some grassland and generalist species, attraction behavior in agricultural species, and no effect of turbine proximity on other species. Other studies have found no evidence of declines near turbines (Devereux et al. 2008, Pearce-Higgins et al. 2012, Shaffer and Buhl 2016). Overall displacement effects are likely to vary extensively among different species and in association with other environmental and project-specific factors.

Agencies and non-governmental groups have raised particular concern over avoidance issues (e.g., habitat displacement) with respect to grouse species (Manville 2004, USFWS 2012). The existing information on avoidance by grouse species is limited to observational studies, with results varying by grouse species and source of disturbance (roads, oil and gas wells, vertical structures, transmission lines). Winder et al. (2015) observed a reduced probability of greater prairie-chicken lek persistence within proximity to turbines (the probability that a lek persisted was about 50 percent when distance between turbines and lek sites is less than 1-kilometer). Other studies of grouse and anthropogenic features have observed that some species of grouse avoid transmission lines, improved roads, buildings, oil and gas wells, and communication towers (Pitman et al. 2005, Pruett et al. 2009, Johnson and Erickson 2011). However, other studies have found no evidence of avoidance of transmission lines or of wind facilities (Johnson et al. 2011, Johnson et al. 2012, Sandercock et al. 2013).

1.2 Protected Species Information

Several federal and state regulations directly or indirectly protect wildlife. The primary federal laws that pertain to wind energy development and impacts to birds include the Endangered Species Act (ESA; 16 U.S.C. 1531- 1544), Bald and Golden Eagle Protection Act (BGEPA; 16 U.S.C. 668-668d), and the Migratory Bird Treaty Act (MBTA; 16 U.S.C. 703-712).

The ESA directs USFWS to identify and protect endangered and threatened species and their critical habitat, and to provide a means to conserve their ecosystems. Among its other provisions, the ESA requires USFWS to assess civil and criminal penalties for violations of the ESA or its regulations. Section 9 of the ESA makes it unlawful to knowingly violate the "take" provisions of the ESA. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" (16 USC 1532). Significant modification or degradation of listed species' habitats where the modification actually kills or injures wildlife by significantly impairing essential behavioral patterns is considered "harm" under ESA regulations. A current list of endangered, threatened, and candidate species for Stark County was obtained

from the USFWS Information for Planning and Conservation (IPaC) interactive webpage at: https://ecos.fws.gov/ipac/gettingStarted/map (Appendix A).

Under authority of the BGEPA (16 USC 668–668d), bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are afforded additional legal protection. The BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof (16 USC 668). The BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb" (16 USC 668c), and includes criminal and civil penalties for violating the statute (16 USC 668). The term "disturb" is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (50 CFR 22.3).

USFWS promulgated regulations in 2009 that provided for a permitting framework for incidental take associated with otherwise lawful activities, including wind energy, under the existing BGEPA (50 CFR 22.26). Applications for incidental take permits under BGEPA are being considered by USFWS for bald eagles throughout the contiguous United States. Incidental take permits for golden eagles are available only to projects located west of the 100th meridian, thus the Project would qualify (USFWS 2013a). However, since 2009, only one incidental take permit for golden eagles has been granted to a wind energy project, and no permits for incidental take of bald eagles at a wind energy facility have been issued. USFWS issued an Advanced Notice of Rulemaking in April 2012, and is currently undergoing a process to revise the permit regulations in response to public comment relative to eagle population management objectives, compensatory mitigation, and programmatic permit issuance. It is unknown at this time what changes will be made or how they may affect the permitting process. The *Draft Eagle Conservation Plan Guidance*, that outlines the recommended steps for permit applicants, was released by USFWS in February 2011 (USFWS 2011a), with revised technical appendices released in August 2012 (USFWS 2012b). USFWS released *Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy: Version 2* (ECP Guidance; USFWS 2013a) in April 2013.

The MBTA implements the Unites States' obligations under four treaties for the protection of migratory birds. The MBTA is administered by the USFWS, which maintains a list of all species protected by the MBTA (50 Code of Federal Regulations [CFR] 10.13). This list includes over 1,000 species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines.

The MBTA makes it unlawful "by any means or in any manner, to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import …transport or cause to be transported… any migratory bird, any part, nest, or eggs of any such bird …" except as otherwise

permitted under the regulations. (16 United States Code [USC] 703). The USFWS has interpreted the MBTA to be a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. Actions resulting in the "take" of a protected species, in the absence of a USFWS permit or regulatory authorization, are a violation.

The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect". (50 CFR 10.12). The MBTA does not have a provision directly prohibiting incidental takes and the definition of "take" does not include the broader terms of "harass" or "harm" that have been found to prohibit incidental takes under the Endangered Species Act. Indeed, in the historic context of the MBTA, and an interpretation supported by the U.S. Court of Appeals for the 8th Circuit, the term "take" refers to conduct directed at birds, such as hunting or poaching, and not on prohibiting lawful, commercial activity which may indirectly cause bird deaths. (See U.S. v. Brigham Oil and Gas, L.P., 840 F.Supp. 2d 1202 (D. N.D. 2012)).

USFWS has established a permitting scheme for a variety of intentional activities, such as hunting and scientific research and has also worked with industries to find ways to minimize impacts to migratory birds. Since the scope of USFWS' legal authority to regulate incidental takes remains unclear, as the 8th Circuit's interpretation is not accepted by all courts, USFWS has not been deterred from attempting to regulate incidental takes under the MBTA. USFWS has historically pursued individual prosecutions for incidental takes and more recently, has proposed an incidental permitting program.

In addition to federal listing, some states also list species at the state level that are declining and in danger of becoming extinct within the state's border. The North Dakota Game and Fish Department (NDGF) does not have a state endangered or threatened species list. Only those species listed by the ESA are considered threatened or endangered in North Dakota. The state of North Dakota does maintain a list of Species of Conservation Priority (Dyke et al. 2015) but these species are not afforded any formal protection by the state and there are no state permitting requirements for them. State-level regulations are similar to federal law. North Dakota has a statute that specifically prohibits taking, killing, hunting, possessing, selling, purchasing, pursuing, shooting at, disturbing, capturing, or destroying any golden eagle, bald eagle, or any nest or egg thereof (North Dakota Century Code, Chapter 20.1-04-05). State collection permits, which are processed through the NDGF, are only issued for scientific purposes.

1.3 Study Description

Brady Wind, LLC (Brady Wind) is planning to develop the Brady Wind Energy Center (Project) on approximately 29,983 acres of privately owned land in Stark County, North Dakota (Figure 1). The Project will have a name-plate generating capacity of up to 150 megawatts (MW). The Project

will consist of up to 87 turbines. Brady Wind expects to use both General Electric (GE) 1.715 MW Xle and 1.79 MW Xle wind turbine generators. The Project also includes a planned approximately 19-mile, 230-kilovolt (kV) overhead transmission interconnect line. For the purpose of assessing risk to birds flying through the Project Area, the larger turbine was used which has a hub height of 80 meters and rotor diameter of 103 meters. With these specifications, the anticipated Rotor Swept Area (RSA) is estimated to be between approximately 28 and 132 meters above ground.

The Project Area is located in the Missouri Plateau subregion of the Northwestern Great Plains Ecoregion (Bryce et al. 1998). The area is unglaciated and topography includes rolling plains with isolated sandstone buttes. Elevation ranges from 533 to 1006 meters. The area receives 38 to 43 centimeters of precipitation annually and average daily temperatures range from -6°C in January to 28°C in July. Dryland farming and cattle grazing are the primary land uses in the area. Crops grown in the ecoregion include spring wheat, barley, oats, and sunflowers. According to the National Land Cover Database (NLCD) the majority of the proposed Project Area is cultivated crops (55 percent) and grassland/herbaceous (25 percent). Although the Project Area contains numerous small streams and wetlands, there are no major rivers or lakes within the Project Area. The closest river is the Cannonball River, located approximately 5 miles to the southwest of the Project (Figure 1). Trees and forested areas are sparsely scattered throughout the Project Area and are restricted mainly to riparian areas and to windbreaks around fields and farmsteads. The topography within the Project Area primarily consists of rolling plains, and lacks prominent landscape features (e.g., hills, valleys).

North Dakota has 362 documented bird species (Nature Worldwide 2015) and is situated within the Central Flyway, one of the main bird migratory routes in North America (USFWS 2016). During spring and fall migration, most birds that move along the Central Flyway travel between wintering grounds as far away as South America via the Gulf of Mexico through the central states, and breeding grounds as far away as Alaska and northern Canada (USFWS 2016).

2 Methods

Brady Wind is committed to environmental due diligence and has contracted Tetra Tech, Inc. (Tetra Tech) to conduct avian surveys in the Project Area, including point-count surveys, raptor nest surveys, and grouse lek surveys. The objectives of these surveys were to quantify local bird use in the area and to evaluate the potential impacts of the Project to birds likely to occur in the Project Area. These study objectives and the standardized protocols utilized for avian surveys presented in this report are consistent with recommendations from the *National Wind Coordinating Committee's Comprehensive Guide to Studying Wind Energy/Wildlife Interactions* (Strickland et al. 2011), Tier 3 of the voluntary *USFWS Land-Based Wind Energy Guidelines*

(USFWS 2012), and the *Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy: Version 2* (ECP Guidance; USFWS 2013).

2.1 Avian Surveys

2.1.1 Point-count Surveys

To evaluate avian risk at wind energy facilities, standardized protocols for pre-construction point-counts have been established and were used in this study (Strickland et al. 2011, USFWS 2012). Data collected from point-counts are used to identify species or species groups that may be at risk from Project development, and may provide additional information for micro-siting wind turbines to minimize impacts to birds.

Tetra Tech distributed 18 point-count locations along publicly accessible roads throughout the Project Area, choosing locations that maximized a 360-degree sight distance for the observer and that covered a diversity of habitats (Figure 2). Due to changes to the original Project boundary, several of the point-count locations established for the fall avian surveys were modified for the spring avian survey to increase coverage of the Project Area; as a result, 5 new point-count locations were established and three of the fall point-count locations were relocated prior to the spring avian surveys. To evaluate spring avian use, behavior, and species composition, an experienced field biologist (biologist) conducted 13 weekly surveys from March 18 through June 8, 2016 (Table 1), thereby encompassing the spring migration season.

For each survey, the biologist collected data on all birds detected within an 800-meter radius of each of the point-count locations (Point-count Survey Area). Surveys at each point-count location lasted for 20 minutes, during which time the biologist continuously recorded all visual and auditory observations of birds. For each observation, the biologist recorded data that included species, number of individuals, time of observation, height above ground, and behavior. The biologist estimated flight heights and distances using existing reference points such as meteorological towers and local transmission lines, as well as landscape contours shown on topographic maps. Flight directions were recorded for individuals traversing the Point-count Survey Area, but not for individuals making local movements.

The survey protocol used in this study was designed to collect data on all bird species and to provide results that are comparable with studies at other wind farms, rather than to target specific taxa. The benefit of using this protocol is that it estimates avian use throughout the day and captures activity by a variety of bird species. During the breeding season, and to a lesser extent in the spring, fall and winter, songbirds are most active in the morning and can be difficult to detect during the afternoon. In contrast, diurnal raptors are more readily detected several hours after sunrise, as the sunlight heats the air and creates thermals, which facilitate soaring

behavior (Ballam 1984). Therefore, this protocol is appropriate for characterizing the entire avian community using the Project Area. The starting points and/or order of points visited were varied among each weekly survey to ensure different times of day were sampled at each point. This survey protocol, however, can only detect nocturnal migrants that are local breeders or that utilize the Project Area during the day as migratory stopover habitat.

Tetra Tech chose 20-minute survey periods because they provide adequate time to detect both raptors and non-raptors (Strickland et al. 2011, USFWS 2012). However, time periods of 20 minutes may lead to double-counting (i.e., counting the same individual more than once), because individuals may appear and disappear from view or may not be tracked by the observer while scanning for other birds. Double-counting of birds generally is not problematic for this type of survey, however, because the objective is to document use in terms of number of birds noted per 20-minute survey, not the number of distinct individuals.

Detectability varies among species and habitats, and potentially not all individuals within the 800-meter radius were counted. This variation in detectability could result in an overestimate of mean use for conspicuous species and an underestimate of mean use for reclusive species (Thompson 2002). Birds not easily identifiable, such as those seen under low light conditions or small birds seen at a distance were identified to the lowest taxonomic level possible and included as unidentified birds in the results.

2.1.2 Raptor Nest Surveys

Tetra Tech conducted raptor and eagle nest surveys within the Project Area and out to 10-miles from the Project Area. The raptor and eagle nest surveys consisted of an aerial survey in early March and a follow-up survey conducted from the ground in May. The objective of the aerial raptor nest survey was to document the presence of bald and golden eagle nests within a 10-mile buffer of the Project Area (the Eagle Nest Survey Area) and other raptor nests within a 2-mile buffer of the Project Area (the Raptor Nest Survey Area). The objective of the follow-up ground survey was to check on the status of raptor nests detected during the aerial surveys and search for additional nests within the Raptor Nest Survey Area. This report details raptor nest surveys conducted in spring 2016 (March and May). Information regarding previous raptor nest surveys conducted in summer and fall 2015 (June and November) and winter 2016 (January and February) are included in the Raptor Nest Survey Report (Tetra Tech 2016a). These surveys were intended to provide an inventory of raptor nests within the above mentioned buffers to inform Project risk and facilitate planning for the avoidance of nest disturbance during construction.

Tetra Tech requested locations of documented eagle nests within a 10-mile radius of the Project Area in May 2015 and April 2016 from NDGF. In May 2015, NDGF reported six historical golden eagle nest structures, all located on sandstone buttes approximately 8 to 9 miles northwest of

the Project Area. Tetra Tech notified NDGF in April of 2016 that a new golden eagle nest was located during our spring 2016 aerial nest survey. NDGF also confirmed in April 2016 that they had been notified by the landowner of this nest and had no new information on other eagle nests within 10 miles of the Project Area.

An aerial helicopter survey was conducted on March 29-30, 2016, before the trees leafed out. The survey was conducted from a Bell-206 Jet Ranger helicopter (Double M Helicopters, Mandan, North Dakota) that was flown approximately 200 feet above ground level at an approximate speed of 60 miles per hour. The crew consisted of a Tetra Tech biologist, a local field biologist, and pilot. The aerial survey covered the Raptor Nest Survey Area (Project Area and 2-mile buffer) and Eagle Nest Survey Area (an additional 10-mile buffer area beyond the Project Area boundary). The aerial survey consisted of searches for all raptors stick nests within the Raptor Nest Survey Area and for eagles only within the Eagle Nest Survey Area. Within the Raptor Nest Survey Area, transects spaced 1-mile apart were flown to provide systematic coverage. Within the Eagle Nest Survey Area, surveyors primarily focused on potentially suitable nesting habitat on the ledges of buttes and along riparian corridors and other areas with large trees sufficient to support nesting by eagles. Biologists recorded the location of any eagles observed incidentally during the raptor nest surveys.

The follow-up ground-based survey was conducted May 15-16, 2016. The survey was conducted from public roadways by a biologist equipped with a spotting scope. The biologist searched for any raptor nests not located during the aerial survey within the Raptor Nest Survey Area and checked on the status of raptor nests located during the aerial survey.

2.1.2.1 Data Collection

To aid in navigation and data recording, topographic maps and electronic tablets with a built in global positioning system (GPS) were used during the surveys. An optically stabilized camera was used to photograph nests. If a nest was found, the following data were collected:

- **Nest Identification Number:** corresponding with GPS waypoint number.
- **Raptor Species:** using 4-letter American Ornithologists' Union codes (e.g., RTHA = red-tailed hawk, GHOW = great-horned owl).
- **Proximity of Adult:** On= bird sitting on nest, NEAR = bird near the nest, UNK = Unknown.
- **Eggs or Young:** number of eggs or young observed.
- **Nest Substrate:** structure in which nest was located (e.g., broadleaf tree, cut bank, transmission pole, etc.).
- **Nest Height:** Height relative to the structure it is on (e.g., on top of transmission pole, ¾ of height of tree).

To assess nest activity, the following criteria were used (Postupalsky 1974, USFWS 2013):

- **Occupied:** a territory containing a nest at which observers detected either recent repairs (i.e., addition of greenery) to a nest, two adults perched near a nest, copulating adults, an incubating adult on a nest, eggs in a nest, or young in or near a nest.
- **Unoccupied:** a territory lacking any of the indications of breeding listed above.
- **No Longer Present (NLP):** A nest that was located during a previous survey, but has subsequently been found to be destroyed and no longer exists. No evidence remains.

To assess nest condition, the following criteria were used (Postupalsky 1974, USFWS 2013):

- **Excellent:** defined cup or nest bowl with a well-maintained rim. Adult or young present.
- **Good:** nest bowl intact and rim defined; minor repair needed for nest to be used; margins of nest in loose configuration, minor slumping occurring.
- **Fair:** nest bowl intact and nest not dilapidated, but needs significant repair in order to be used; material is slumping or sliding.
- **Poor:** loose structure of nest bowl still present; nest walls and side falling out; nest is in need of major repair to be used.
- **Remnant:** nest bowl not defined; scant material remaining and not usable unless fully rebuilt.

2.1.3 Grouse Lek Surveys

Surveys were conducted to identify areas of use by breeding sharp-tailed grouse within a 1-mile buffer of the Project Area. Two separate rounds of lek surveys were conducted on the ground between mid-March and early May. Peak lek activity typically occurs in mid-April; however, weather conditions can cause annual variation.

Prior to the field surveys, Tetra Tech prepared a preliminary desktop habitat assessment using the NLCD and aerial imagery to delineate suitable lek habitat within 1-mile of the Project Area. Open areas with grassland habitat were classified as suitable grouse lek habitat. Preliminary listening stations were delineated along public roads within suitable grouse lek habitat within 1 mile of the Project Area. A Tetra Tech biologist then field-verified that each preliminary listening station had suitable habitat and accessibility during the site visit to set up the 2015 fall avian point-count surveys. The initial survey route was developed with listening stations mapped 1 mile apart along accessible public roads adjacent to suitable habitat; however, per the request of NDGF, the spacing of the listening stations was reduced to 0.5 miles apart shortly before the surveys began, (A. Robinson per com), resulting in 44 additional listening stations. The habitat suitability and access to the additional listening stations was verified by the field biologist during spring raptor nest surveys and during the first day of the lek surveys.

Ground surveys were conducted along public access roads in suitable habitat within 1-mile of the Project Area. Surveys were conducted from one-half hour before sunrise to two hours after sunrise to coincide with peak lekking activity. During the surveys, biologists stopped at listening stations located 0.5-mile apart for a minimum of 3 minutes during which time the observer systematically scanned and listened for displaying sharp-tailed grouse. Observed leks were mapped and numbers of males and females were counted if possible. The lek surveys were not conducted on any days when winds exceeded 25 mph or if there was any type of precipitation event.

2.1.3 Incidental Observations

Incidental observations included observations that occurred 1) during transit between point-count locations, 2) before or after the official 20-minutes survey period, 3) outside of the 800-m radius circular plot, and 4) during the raptor nest and grouse lek surveys. The biologist recorded these observations on separate data sheets, and these data were not used in the formal analyses; however, a summary of incidentally observed species is presented to provide additional information about species found in the local area.

2.2 Data Quality Assurance/Quality Control

Tetra Tech implemented quality assurance and quality control measures during all stages of data collection, analysis, and report preparation. To ensure legibility and completeness of data sheets, each biologist reviewed all data sheets, providing clarification as needed, before data entry into FileMaker Pro, a relational database for data storage and analysis. Prior to analysis, an independent reviewer conducted a 100-percent quality review of the data entries. Any questions that arose at this time were directed toward and answered by the biologist. Tetra Tech reports undergo an internal double-review process, including at least one senior-level reviewer, to maximize the integrity and quality of the reports.

2.3 Avian Point-count Analysis

2.3.1 Species Groupings

Tetra Tech considered two primary groups of interest: raptors and non-raptors. Raptors included vultures, hawks, eagles, falcons, kestrels, kites, harriers, and owls. All other species groups were defined as non-raptors. Non-raptors were further subdivided into species groups including cranes/rails, gamebirds, gulls/terns, pigeons/doves, songbirds, waterbirds, waterfowl, and woodpeckers.

2.3.2 Avian Use

Tetra Tech tabulated summaries of species detected during point-count surveys and also derived two metrics (mean use and frequency of occurrence) that describe avian use of the Project. Mean use was calculated as the average number of birds observed per 20-minute survey at each point-count location. Tetra Tech also calculated a measure of variability (90 percent confidence intervals) for all mean use values. The frequency of occurrence was measured as the percentage of surveys in which a species was detected. The number of observations, defined as an individual bird or a discrete flock of birds, is also presented. This information, along with the frequency of occurrence, help evaluate the extent to which Project mean use values are representative of sustained use of the area by a species or result from rare events (e.g., a single large flock of birds) or pulsed activity throughout a season.

Because individual birds are not uniquely marked or otherwise distinguishable, individuals may be counted multiple times during one or more survey periods, and actual population sizes or abundance cannot be determined. Mean use of a species therefore provides an index that is assumed to be proportional to abundance and activity within the Project Area and that is comparable across species with similar detectability.

2.3.3 Flight Behavior

Tetra Tech evaluated flight behavior by calculating the proportion of flying birds observed below, within, or above the height of the anticipated turbine RSA. Tetra Tech considered a bird to have flown within the height range of the anticipated RSA if any of its recorded heights fell within the upper or lower limits of the anticipated RSA.

2.3.4 Encounter Rate

To estimate the rate at which a given species flew at the height of the anticipated RSA, Tetra Tech applied the following equation to every species observed in the Project Area:

$$\boldsymbol{Encounter\ Rate = A \times P_f \times P_t}$$

$\boldsymbol{A}$ is the mean number of birds/20 minutes for a given species, $\boldsymbol{P_f}$ is the proportion of all activity observations for a given species that were flying; and $\boldsymbol{P_t}$ is the proportion of flying observations that were within the height range of a turbine RSA for a given species. The encounter rate provides information on the rate at which a species may move at a height that is consistent with the RSA of the proposed turbines. This information is an important component in evaluating risk of collisions; however, this number alone does not indicate potential project-related impact to a species. Species with a high encounter rate are considered potentially at a higher risk of collision than species with a low encounter rate, but other factors such as turbine location or a species

ability to detect and avoid turbine blades, flight maneuverability, and habitat selection also influence mortality (Orloff and Flannery 1992, Drewitt and Langston 2008, Martin 2011, Garvin et al. 2011, May et al. 2015).

2.3.5 Mortality Risk

The regional nature of avian mean use across North America, combined with other risk factors such as individual species behavior and weather, contribute to uncertainty in predicting fatality rates (Arnett et al. 2007, Stewart et al. 2007, Strickland et al. 2011, Marques et al. 2014). A meta-analysis suggests that pre-construction studies provide poor indicators of post-construction mortality (Ferrer et al. 2012). WEST (2011) suggests that the most accurate predictors of mortality at a wind project are records of species-specific fatalities detected at nearby wind projects. Tetra Tech therefore did not attempt to derive mortality estimates from mean use data, but instead highlights those species or species groups with relatively high use values that may experience Project-related mortality or whose regional population could be impacted by the Project development. Additionally, Tetra Tech identifies species with high frequencies (greater than 50 percent) of observation, high encounter rates (greater than 0.99 birds flying at RSA height/20 minutes), and those with records of turbine-related fatality at other wind projects, as these variables may also indicate potential collision risk at the Project.

3 Results

3.1 Point-count Surveys

3.1.1 Mean Use and Frequency of Occurrence

The biologist surveyed 8,928 acres of the Project Area during point-count surveys, covering 29.8 percent of the total Project Area. The 18 point-count locations were surveyed 13 times in the spring for a total of 234, 20-minute surveys.

A total of 4,937 birds from 48 species were observed during spring point-count surveys at the Project (Table 2). Species were observed from nine species groups: songbirds, gamebirds, pigeons/doves, waterfowl, raptors, waterbirds, gulls/terns, woodpeckers, and cranes/rails. The number of birds observed per survey ranged from 0 to 74 birds/20 minutes, with an overall mean use of 21.10 birds/20 minutes (Table 2). Spring mean use by non-raptors was 20.54 birds/20 minutes. Songbirds had the highest mean use (16.26 birds/20 minutes) among species groups, followed by gamebirds (1.92 birds/20 minutes), and pigeons/doves (1.03 birds/20 minutes), and gamebirds (1.57 birds/20 minutes; Table 2). The remaining non-raptor species groups (waterfowl, waterbirds, gulls/terns, woodpeckers, and cranes/rails) each had mean use values of 0.75 birds/20 minutes or less (Table 2). The species most frequently observed in the spring were

western meadowlark (71.8 percent of surveys), ringed-necked pheasant (44.4 percent of surveys), horned lark (32.9 percent of surveys), American robin (26.9 percent of surveys), mourning dove (24.8 percent of surveys), and red-winged blackbird (21.4 percent of surveys; Table 2). Overall, the species with the highest mean use was red-winged blackbird (3.56 birds/20 minutes; Table 2). Among raptors, the northern harrier had the highest overall mean use (0.20 birds/20 minutes), and was the raptor species most frequently observed (17.5 percent of surveys).

Songbirds were the most frequently observed species group during the spring survey (77.1 percent of all birds observed; Table 2). The songbird species with the highest mean use were the red-winged blackbird (3.56 birds/20 minutes), followed by American robin (2.90 birds/20 minutes), horned lark (2.13 birds/20 minutes), brown-headed cowbird (2.12 birds/20 minutes), and western meadowlark (1.49 birds/20 minutes; Table 2). These five species accounted for 57.8 percent of all bird observations during the spring survey. The remaining songbird species observed had mean use values of 0.98 birds/20 minutes or less.

Gamebirds had the second highest mean use among species groups (1.92 birds/20 minutes) and represented 9.1 percent of all birds observed during the spring survey (Table 2). The ring-necked pheasant was the most common gamebird, accounting for 98 percent of the gamebirds observed during the spring survey (Table 2). Pigeon/doves and waterfowl were the taxonomic groups with the third and fourth highest mean use, respectively (1.03 birds/20 minutes and 0.75 birds/20 minutes, respectively) during the spring. These two groups composed 4.9 percent and 3.5 percent of all birds observed, respectively (Table 2). For both pigeon/doves and waterfowl, a single species was the primary contributor to the group's mean use value: mourning dove for pigeon/doves (0.76 birds/20 minutes) and mallard for waterfowl (0.38 birds/20 minutes; Table 2). The remaining non-raptor species groups (waterbirds, gulls/terns, woodpeckers, and cranes/rails) had mean use values of 0.29 birds/20 minutes or less for the spring survey period.

There was a general increase in the number of non-raptors observed as the spring season progressed. Non-raptor mean use was highest on June 6-7, the last round of the spring surveys (36.78 birds/20 minutes; Figure 3). The primary contributors to the high mean use on June 6-7 was brown-headed cowbird (279 individuals, 26 percent of observations) and red-winged blackbird (152 individuals, 14 percent of observations). Spring mean use for non-raptors was highest at point-count locations 20, 2 and 22 (42.31, 31.00, and 27.54 birds/20 minutes respectively; Figure 4), where red-winged black birds (459 individuals), American robins (192 individuals), and brown-headed cowbirds (139 individuals) were the species primarily contributing to the high mean use at these point-count locations; Table 3).

For raptors, spring mean use was 0.56 birds/20 minutes, the fifth highest value among the nine species groups (Table 2). The raptor species with the highest mean use was northern harrier (0.20

birds/20 minutes; observed in 19.2 percent of all surveys) and Swainson's hawk (0.14 birds/20 minutes; observed in 13.7 percent of all surveys; Table 2). Other raptor species detected included turkey vulture, American kestrel, red-tailed hawk, and merlin, each with mean use values less than or equal to 0.10 birds/20 minutes and observed in less than 2.7 percent of all surveys (Table 2).

Mean use by raptors was relatively low until mid-April, after which time mean use increased with some fluctuation throughout the remainder of the spring season. Raptor mean use was highest on May 24-25 (1.28 birds/20 minutes; Figure 5). Raptor species observed on these dates included turkey vulture (12 individuals), red-tailed hawk (2 individuals observed), northern harrier (9 individuals), Swainson's hawk (7 individual), and American kestrel (2 individuals). Mean use for raptors was 0.83 birds/20 minutes or less for all other survey dates (Figure 5). Mean use for raptors was highest at point-count locations 23, 2, and 22 (1.15, 1.08, and 0.92 birds/20 minutes respectively; Figure 6). Raptor species observed at these point-count locations included northern harrier (11 individuals), Swainson's hawk (8 individuals), turkey vulture (8 individuals), American kestrel (9 individuals), red-tailed hawk (4 individuals), and merlin (1 individual; Table 3). Raptor mean use was less than or equal to 0.85 birds/20 minutes at all other point-count locations. The habitat at point-count locations 23, 2, and 22 was primarily row crop agriculture (wheat) and grasslands which may provide foraging opportunities for raptors; however, the majority of the raptor observations at these points were of individuals flying through the count circle and not utilizing the habitat.

3.1.2 Encounter Rate and Flight Height

During the spring avian surveys, the biologist collected behavioral data for 100 percent of birds observed during point-count surveys, of which 92.6 percent were observed flying. The biologist collected flight height data for 100 percent and flight direction for 45.6 percent of the individuals observed flying. Of non-raptor individuals observed flying, 98.3 percent flew below the anticipated RSA height and 1.7 percent flew at the height of the anticipated RSA (Table 4). Of raptor individuals observed flying, 71.2 percent flew below the height of the anticipated RSA and 28.8 percent flew at the height of the anticipated RSA (Table 4). None of the non-raptors or raptors were observed flying above the anticipated RSA height. During the spring survey, the majority of birds flew in a northerly direction (NE, N, NW; 57.8 percent; Appendix B).

All species had encounter rates less than 1.00 birds flying at RSA height/20 minutes (Table 5). Canada goose had the highest encounter rate (0.16 birds flying at RSA height/20 minutes) in the spring (Table 5).

3.2 Raptor Nest Surveys

3.2.1 March Aerial Survey

3.2.1.1 Raptor Nest Survey Area

Surveyors located six occupied great horned owl nests, one occupied red-tailed hawk nest, nine unoccupied small stick nests, and two unoccupied large stick nests (nests 2015_10 and 2015_38) within the Raptor Nest Survey Area during the March 2016 aerial raptor nest surveys (Table 6, Figure 7). Six of the unoccupied small stick nests were located within the Project Area. There were two large unoccupied stick nests located within the Raptor Nest Survey Area, but outside the Project Area. Nest 2015_10 is large, but appears to be a ferruginous hawk nest based on the height and size of the nest tree. All of the nests within the Raptor Nest Survey Area were located in trees. No occupied eagle nests were located within the Project Area or within the Raptor Nest Survey Area.

3.2.1.2 Eagle Nest Survey Area

Surveyors located three occupied golden eagle nests and two occupied bald eagle nests within the Eagle Nest Survey Area (Figure 7). The nearest eagle nest is golden eagle Nest 2015_39, located 2.2 miles to the south of the Project Area (Figure 7). This nest was relatively undersized and located near the top of the tree. The nest size and location were more typical of a hawk nest than a golden eagle nest. None of the historical golden eagle nest structures located on sandstone buttes approximately 8 to 9 miles northwest of the Project Area were occupied by golden eagles (Figure 7).

Surveyors located three occupied ferruginous hawk nests within the Eagle Nest Survey Area (2015_25, 2016_07, and 2016_17). Nest 2015_25 was located in a historical golden eagle nest and 2016_07 was located on a sandstone pillar in close proximity to the historical golden eagle nest locations. The other ferruginous hawk nest, 2016_17, was located in a tree to the south of the Project Area.

Two of the six large stick nests located on buttes between 2.1 and 5.9 miles from the Project Area (Nest 2015_13 and Nest 2015_15) were determined to be occupied based on fresh lining material added to the nests between the February and March surveys. However, no raptors were present and the species could not be determined.

There were several large unoccupied stick nests located in trees within the Eagle Nest Survey Area. Based on their proximity, Nests 2016_12 and 2016_13 appear to be alternate nests within the golden eagle territory of Nest_2016_08 and Nest 2016_10 appears to be an alternate nest within the bald eagle territory of nest 2016_20 (Figure 7). Nests 2016_15, 2016_16, 2016_21, and

2016_02 were all located in large trees near drainages, and these nest structures appeared large enough to potentially support eagles.

3.2.2 May Ground-based Survey

3.2.2.1 Raptor Nest Survey Area

The surveyor located eight raptor nests not detected during the March aerial surveys (two occupied Swainson's hawk nests, two occupied red-tailed hawk nests, one occupied great horned owl nest, and three unoccupied small stick nests; Table 6). Within the Project Area, the surveyor located one occupied Swainson's hawk nest and one occupied red-tailed hawk nest (Table 6, Figure 7). The surveyor was unable to relocate four of the previously documented unoccupied small stick nests located within the Project Area. No occupied eagle nests or additional unoccupied large stick nests were located within the Project Area or within the Raptor Nest Survey Area.

3.2.2.2 Eagle Nest Survey Area

All of the occupied eagle nests located during the March aerial survey were relocated during the May ground-based follow-up survey. Golden eagle nest 2016-08 and 2016_09 were occupied but golden eagle nest 2015_39 had failed by the time of the follow-up survey. Both of the bald eagle nests (2015_19 and 2015_20) were occupied.

The surveyor was able to relocate two of the four historical golden eagle nest structures located on sandstone buttes approximately 8 to 9 miles northwest of the Project Area (Table 6). Nest 2015_24 was unoccupied and nest 2015_25 continued to be occupied by a ferruginous hawk (Table 6).

The surveyor was able to relocate three of the six large unoccupied stick nests located in trees within Eagle Nest Survey Area and confirm that the nests remained unoccupied (Table 6). No occupied eagle nests or additional unoccupied large stick nests were located within the Eagle Nest Survey Area.

3.3 Grouse Lek Surveys

Ground surveys were conducted along public access roads in suitable habitat within one-mile of the Project Area. Two rounds of surveys were conducted between April 6 and 12, 2016 and between April 25 and 29, 2016. Of the 131 listening stations identified during the desktop analysis, 106 were accessible by public roads, occurred in suitable habitat, and were surveyed. Each of these listening stations surveyed twice (once per survey round). Six sharp-tailed grouse leks were documented during the surveys; four of the leks within the Project Area and two leks were outside the Project Area but within 1-mile; Figure 8). The number of grouse observed at each lek ranged from 5 to 26 individuals (Table 7). A total of 147 birds (93 males, 29 females, 23

unknown) were recorded at these leks (Table 7), although this is a minimum count as not all birds were visible from the road.

3.4 Incidental Observations

During spring surveys, biologists documented incidental observations of 6 species, including the sandhill crane, sharp-tailed grouse, northern harrier, red-tailed hawk, ferruginous hawk, and Swainson's hawk (Table 8). The ferruginous hawk was the only species observed incidentally in the spring, not detected during spring point-count surveys.

3.5 Protected Species

No federally or state threatened, endangered, or candidate species were observed during avian point-count surveys, raptor nest surveys, lek surveys or as an incidental observation. The following species observed during the surveys have been designated as species of conservation priority: bald eagle, golden eagle, Swainson's hawk, ferruginous hawk, northern harrier, boblink, western meadowlark, Brewer's sparrow, lark bunting, marbled godwit, and sharp-tailed grouse (Dyke et al. 2015). Additionally, the grasshopper sparrow, marbled godwit, and upland sandpiper are USFWS Bird of Conservation Concern (BCC; USFWS 2008).

4 Discussion

4.1 Point-count Surveys

The avian community detected within the Project Area during spring avian surveys was characterized by resident and migrant species typically associated with agricultural lands and grasslands/pastures of North Dakota. Much of the Project Area and vicinity have been developed for cattle grazing and agricultural use, specifically crops such as wheat and sunflower. Within disturbed habitats such as these, the greatest potential impact of wind facilities to most avian species is collisions with turbines rather than disturbance or displacement. Publicly available mean annual avian fatality rates estimated from wind facilities in the Midwest (Iowa, Minnesota, Nebraska, and Wisconsin) range from 0.76 to 11.83 birds/turbine/year (0.84 – 7.17 birds/MW/year; Johnson et al. 2000, Howe et al. 2002, Jain 2005, Derby et al. 2007, Gruver et al. 2009, Grodsky and Drake 2011, Jain et al. 2011). Annual avian fatality rates at the Project, should fatalities occur, are expected to fall within this range.

4.1.1 Non-Raptor Use and Collision Risk

During spring surveys, songbirds were identified as the most abundant of the species groups. Mean use was highest for the red-winged blackbird, American robin, horned lark, and brown-headed cowbird, but all of these species had an encounter rate of zero. The red-winged blackbird,

American robin, horned lark, and brown-headed cowbird have been identified as fatalities at other wind farms in the U.S. (Erickson et al. 2014). Should fatalities of red-winged blackbird, American robin, horned lark or brown-headed cowbird occur, they are unlikely to have population-level impacts because these species are widely distributed with large North Dakota populations (8.2 million, 1.9 million, 4.3 million, and 12 million, respectively; PIFSC 2013). Additionally, these species all have stable or increasing population trends in North Dakota (Sauer et al. 2014). The remaining non-raptor species detected during spring surveys have low risk for turbine collisions at the Project due to a combination of relatively low mean-use rates and/or low encounter rates. Furthermore, collision mortality appears to have little effect on population trends of songbirds (Arnold and Zink 2011).

4.1.2 Raptor Use and Collision Risk

A meta-analysis published in 2012 suggests that pre-construction studies provide poor indicators of post-construction mortality (Ferrer et al. 2012). Prior to this 2012 analysis, high raptor use (> 2.0 birds/20 min) had been thought to be associated with high raptor mortality at wind farms (Strickland et al. 2011). Conversely, raptor mortality often appeared to be low when raptor use was low (< 1.0 birds/20 minutes; Strickland et al. 2011), which is the case for raptor use at the Project. As more wind energy facilities complete both pre- and post-construction studies, a better understanding of the relationship between bird use and fatality rates could be gained should the results of the studies become publicly available.

Northern harrier was the raptor species with the highest mean use and was also the most frequently detected raptor species at the Project. The species is commonly associated with agricultural and grassland habitats which provide opportunities for foraging, an activity associated with susceptibility to turbine-collisions (Thelander et al. 2003). However, in a study of raptor response to wind farms, northern harriers were identified as having a low risk flight behavior for collisions (Garvin et al. 2011). Risks of collision for northern harriers are believed to be low because the majority of foraging flights occur below typical RSA heights (Whitfield and Madders 2006). This is consistent with the results of the spring avian point count surveys, where northern harriers had an encounter rate of zero (no individuals flying within the anticipated RSA). Thus, risks of turbine-related fatalities at the Project are expected to be low given the low level of use and encounter rate. As a result, project-related fatalities of northern harrier, should they occur, are likely to be minimal, and unlikely to have population-level impacts because northern harriers have a widespread distribution with large populations (Sauer et al. 2014).

Other raptor species detected included (in order of highest to lowest mean use) Swainson's hawk, turkey vulture, American kestrel, red-tailed hawk and merlin. All are expected to have a low collision risk due to low mean use, frequency, and encounter rate.

4.2 Raptor Nest Surveys

Surveyors located three occupied golden eagle nests and two occupied bald eagle nests between the 2-mile and 10-mile buffers around the Project Area during aerial raptor nest surveys conducted in March 2016 (Tetra Tech 2016a). The nearest golden eagle nests is located approximately 2.2 miles to the south of the eastern portion of the Project Area and the nearest bald eagle nest is located approximately 3 miles to the east of the Project Area. Despite the proximity of these eagle nests, no eagles were observed during the point-count surveys, suggesting that the Project Area is not a major flight corridor for local nesting eagles.

All of the eagle nests that were occupied in March were occupied during the May ground survey, except for golden eagle nest 2015_39 which was recorded as unoccupied. Biologists monitoring Nest 2015_39 on a daily basis determined that this nest had failed (Tetra Tech 2016b) around May 10. Nest 2015_39 had fallen apart, presumably because the nest was too small to support eagles (Tetra Tech 2016b). Surveyors located one occupied-active red-tailed hawk nest, one occupied-active Swainson's hawk nest, and four unoccupied small stick nests within the Project Area. Drewitt and Langston (2008) summarized that bird activity in general is typically higher near active nests than areas without active nests; as a result, these species may have increased potential for collision as they repeatedly fly within the Project Area during nesting activities and during the time when young begin to fledge from the nests. However, turbine-related fatalities are expected to be low given the low level of raptor use, low encounter rates of raptors observed during the avian surveys, and the low number of raptor nests within the Project Area.

4.3 Grouse Lek Surveys

The sharp-tailed grouse is considered a gamebird by the NDGF and is afforded no special protection by the state. However, this species has experienced population declines linked to landscape-level land use changes, primarily due to habitat loss through the conversion of grasslands to cropland. Habitat loss, fragmentation, and degradation were the primary factors behind historic declines of federally-listed grouse species, and are considered the primary threats to existing prairie grouse populations, including sharp-tailed grouse (Hoffman and Thomas 2007). State and federal wildlife agencies have regularly expressed concern about the locations of wind turbines with respect to prairie grouse leks. Although generally considered at low risk of collision with turbines because of their low flight heights, sharp-tailed grouse species may be susceptible to habitat fragmentation and displacement caused by development of wind facilities. Winder et al. (2015) observed a reduced probability of greater prairie-chicken lek persistence within proximity to turbines (0.5 probability of lek persistence when distance between turbines and lek sites is less than 0.62 miles). Sharp-tailed grouse often exhibit strong site fidelity (Connelly et al. 1998) and use traditional leks year after year. Six active sharp-tailed grouse leks were observed

within the Project Area and one-mile buffer. Based on the presence of leks and availability of grassland habitat, the likelihood of sharp-tailed grouse occurrence is high. Therefore, there is the potential for Project-related impacts such as displacement of sharp-tailed grouse.

4.4 Protected Species

No federally-listed threatened or endangered species were detected during avian point-count surveys.

Although no eagles were observed during the point-count surveys, the presence of eagle nests in the vicinity of the Project suggests potential for collision risk. Eagle fatalities resulting from collisions with wind turbines have been documented at wind energy projects and, in general, eagle use prior to construction was higher at projects with eagle fatalities compared to projects with no eagle fatalities (Allison 2012, USFWS 2012). To date, 85 eagle mortalities (six bald eagles and 79 golden eagles) associated with wind energy facilities within the United States have been reported from 1997 through June 2012, excluding the Altamont Pass Wind Resource Area in California (Pagel et al. 2013); however, only one bald eagle mortality has been reported at a wind energy facility in North Dakota (Public Prairie Broadcasting 2015). Golden eagles are believed to be more at risk of turbine collision because they hunt on the wing for land-based prey along topographic contours where turbines are often located, whereas bald eagles tend to focus their hunting efforts from perches and target fish or carrion near lakes and rivers (Buehler 2000, Kochert et al. 2002). Based on observations of bald eagles interacting with a wind farm in Alaska (Sharp et al. 2011), avoidance behavior may be significantly greater in bald eagles than in golden eagles.

5 Brady Wind Energy Center Conclusions

Results of the spring 2016 avian surveys at the Brady Wind Energy Center suggest an overall low impact of the Project development on the local avian community. Although there is potential for greater risk of Project-related fatalities of certain songbird species (e.g., red-winged-black bird, American robin, horned lark, and brown-headed cowbird), fatalities of these species are not expected to have population-level impacts. Collision mortality for songbirds is likely to be comparable with other anthropomorphic sources of mortality for bird populations. Additionally, the potential for turbine-related fatalities exists for nocturnal migrant species not identifiable by the methods of this study. If avian fatality rates are similar to other wind facilities within the region, we would expect the rates to fall between 0.38 and 11.83 birds/turbine/year (0.42 - 7.17 birds/MW/year). Proper siting of Project facilities away from wetland habitats, which attract songbird and waterfowl species, may help to further reduce the risk of fatalities.

No federally listed threatened or endangered species were detected during avian point-count surveys. Although eagles were not detected during the point-count surveys, the presence of occupied bald eagle and golden eagles nests in the vicinity of the Project suggests there is degree of potential risk of collision with Project turbines for this species.

6 References

Allison, T.D. 2012. Eagles and Wind Energy: Identifying Research Priorities. A white paper of the American Wind Wildlife Institute, Washington, DC.

Arnett, E.B., D.B. Inkley, D.H. Johnson, R.P. Larkin, S. Manes, A.M. Manville, J.R. Mason, M.L. Morrison, M.D. Strickland, and R. Thresher. 2007. Impacts of wind energy facilities on wildlife and wildlife habitat. Wildlife Society Technical Review 07-2. The Wildlife Society, Bethesda, MD.

Arnold, T.W., and R.M. Zink. 2011. Collision mortality has no discernable effect on population trends of North American Birds. PLoS ONE 6: e24708. doi:10.1371/journal.pone.0024708.

Ballam, J.M. 1984. The use of soaring by the red-tailed hawk (*Buteo jamaicensis*). Auk 3:519-524.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In: The Birds of North America Online, A. Poole (ed.). Cornell Lab of Ornithology: Ithaca, NY. Available online at: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/506.

Connelly, J. W., M. W. Gratson and K. P. Reese. 1998. Sharp-tailed Grouse (*Tympanuchus phasianellus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/354

Derby, C., A. Dahl, W. Erickson, K. Bay, and J. Hoban. 2007. Post-Construction Monitoring Report for Avian and Bat Mortality at the NPPD Ainsworth Wind Farm. Unpublished report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for the Nebraska Public Power District.

Devereux, C.L., Denny, M.J. and M.J. Whittingham. 2008. Minimal effects of wind turbines on the distribution of wintering farmland birds. Journal of Applied Ecology, 45(6), pp.1689-1694.

Drewitt, A.L. and R.H.W. Langston. 2008. Collision effects of wind-power generators and other obstacles on birds. Pages 233-266 *in* R. S. Ostfeld and W. H. Schlesinger, editors. Year in Ecology and Conservation Biology 2008. Blackwell Publishing, Oxford.

Drewitt, A.L. and R.H.W. Langston. 2006. Assessing the impacts of wind farms on birds. Ibis 148:29-42.

Dyke, S.R., S.K. Johnson, and P.T. Isakson. 2015. North Dakota State Wildlife Action Plan. North Dakota Game and Fish Department. Bismarck ND.

Erickson, W.P., M. Wolf, K. Bay., D. Johnson, and J. Gehring. 2014. A Comprehensive Analysis of Small-Passerine Fatalities from Collision with Turbines at Wind Energy Facilities. Plos One (9:9): e107491, pp.1-17.

Erickson, W.P., G.D. Johnson and D.P. Young Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collision. USDA Forest Service Gen. Tech. Rep PSWGTR(191): 1029-1042.

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Annual Report. July 2001 - December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee. Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 2004.

Erickson, W.P., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. Technical report prepared by WEST, Inc., for Bonneville Power Administration, Portland, OR.

Ferrer, M., M. de Lucas, G.F.E. Janss, E. Casado, A.R. Muñoz, M.J. Bechard, and C.P. Calabuig. 2012. Weak relationship between risk assessment studies and recorded mortality in wind farms. Journal of Applied Ecology. 49(1): 38-46. Available online at http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2664.2011.02054.x/pdf.

Garvin, J.C., Jennelle, C.S., Drake, D. and Grodsky, S. M. 2011. Response of raptors to a windfarm. Journal of Applied Ecology, 48: 199–209.

Gillespie, M.K. 2013. Bird and bat responses to wind energy development in Iowa. MS Thesis. Iowa State University, Ames, Iowa. 82 pp.

Grodsky, S.M. and D. Drake. 2011. Assessing Bird and Bat Mortality at the Forward Energy Center. Final Report. Public Service Commission (PSC) of Wisconsin. PSC REF#:152052. Prepared for Forward Energy LLC. Prepared by Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin. August 2011.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 - October 31, 2008 and March 15 - June 4, 2009. Unpublished report

prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Hoffman, R. and A. Thomas. 2007. Columbian Sharp-tailed Grouse (*Tympanuchus phasianellus columbianus*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: http://www.fs.fed.us/r2/projects/scp/assessments/columbiansharptailedgrouse.pdf.

Howe, R.W., W. Evans, and A.T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Prepared by University of Wisconsin-Green Bay, for Wisconsin Public Service Corporation and Madison Gas and Electric Company, Madison, Wisconsin. November 21, 2002. 104 pp.

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. M.S. Thesis. Iowa State University, Ames, Iowa.

Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual report for the Maple Ridge wind power project post-construction bird and bat fatality study—2006. Prepared by Curry and Kerlinger, LLC for PPM Energy, Horizon Energy, and Technical Advisory Committee for the Maple Ridge Project.

Jain, A.A., R.R. Koford, A.W. Hancock, and G.G. Zenner. 2011. Bat Mortality and Activity at a Northern Iowa Wind Resource Area. Am. Mid. Natur. 165: 185-200.

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

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30:879-887.

Johnson, G.D. and W.P. Erickson. 2011. Avian, Bat and Habitat Cumulative Impacts Associated with Wind Energy Development in the Columbia Plateau Ecoregion of Eastern Washington and Oregon. Prepared by West, Inc. for Klickitat County, Washington

Johnson, G.D., C. LeBeau, R. Neilsen, T. Rintz and J. Eddy. 2012. Greater Sage-Grouse Habitat Use and Population Demographics at the Simpson Ridge Wind Resource Area, Carbon County, Wyoming. Final Report prepared for EBP Renewables, Houston, Texas.

Kerns, J. and P. Kerlinger. 2004. A study of bird and bat collision fatalities at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual report for 2003. Technical

report prepared by Curry and Kerlinger, LLC for FPL Energy and Mountaineer Wind Energy Center Technical Review Committee.

Kochert, M.N., K. Steenhof, C.L. Mcintyre and E.H. Craig. 2002. Golden Eagle (Aquila chrysaetos), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/684http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/684doi:10.2173/bna.684doi:10.2173/bna.684.

Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of wind turbines on upland nesting birds in CRP grasslands. Wilson Bulletin 111:100-104.

Loss, S.R., T. Will, P.P. Marra. 2013. Estimates of bird collision mortality at wind facilities in the contiguous United States. Biological Conservation 168:201–209.

Manville II, A.M. 2016. Impacts to Birds and Bats Due to Collisions and Electrocutions from Some Tall Structures in the United States: Wires, Towers, Turbines, and Solar Arrays—State of the Art in Addressing the Problems. In Problematic Wildlife (pp. 415-442). Springer International Publishing.

Manville II, A.M. 2004. Prairie grouse leks and wind turbines: U.S. Fish and Wildlife Service justification for a 5-mile buffer from leks; additional grassland songbird recommendations. Division of Migratory Bird Management, USFWS, Arlington, VA, peer-reviewed briefing paper.

Marques, A.T., H Batalha, S. Rodrigues, H. Costa, M.J. Ramos Pereira, C. Fonseca, M. Mascarenhas, and J. Bernardino. 2014. Understanding bird collisions at wind farms: an updated review on the causes and possible mitigation strategies. Biological Conservation 179:40-52.

Martin, G.R. 2011. Understanding bird collisions with man-made objects: a sensory ecology approach. Ibis 153(2):239-254.

May, R., O. Reitan, K. Bevanger, S.H. Lorentsen, and T. Nygård. 2015. Mitigating wind-turbine induced avian mortality: sensory, aerodynamic and cognitive constraints and options. Renewable and Sustainable Energy Reviews 42:170-181.

Nature Worldwide. 2015. Birds: World Institute for Conservation and Environment, WICE. Birds of North Dakota. Available online at http://www.birdlist.org/checklists_of_the_birds_of_the_united_states/birds_of_north_dakota.htm.

Orloff, S. and A. Flannery. 1992. Wind turbine effects on avian activity, habitat use, and mortality in Altamont Pass and Solano County Wind Resource Areas, 1989-1991. Final

report prepared by Biosystems Analysis, Inc. for Alameda, Contra Costa, and Solano Counties and the California Energy Commission.

Pagel, J.E, K.J. Kritz, B.A. Millsap and R.K. Murphy, E.L. Kershner and S. Covington. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. J. of Raptor Research, 47(3):311-315.

Pearce-Higgins, J.W., L. Stephen, A. Douse, and R.H.W. Langston. 2012. Greater impacts of wind farms on bird populations during construction than subsequent operation: results of a multi-site and multi-species analysis. Journal of Applied Ecology 49: 386-394.

PIFSC (Partners in Flight Science Committee) 2013. Population Estimates Database, version 2013. Available at http://rmbo.org/pifpopestimates.

Pitman, J.C., C.A. Hagen, R.J. Robel, T.M. Loughin, and R.D. Applegate. 2005. Location and success of lesser prairie-chicken nests in relation to vegetation and human disturbance. Journal of Wildlife Management 69:1259-1269.

Postupalsky, S. 1974. Raptor reproductive success: some problems with methods, criteria and terminology. Raptor Research Report No. 2:21-31.

Public Prairie Broadcasting. 2015. Bald eagle death could mean a new look at wind turbine siting rules. Reported by Dave Thompson on Oct 6, 2015. Available at: http://news.prairiepublic.org/post/bald-eagle-death-could-mean-new-look-wind-turbine-siting-rules

Pruett, C.L., M.A. Patten and D.H. Wolfe. 2009. Avoidance Behavior by Prairie Grouse: Implications for Development of Wind Energy. Conservation Biology 23:1253-1259.

Sandercock, B., S. Wisely, L. McNew, A. Gregary, V. Winder, L. Hunt. 2013. Environmental Impacts of Wind Power Development on the Population Biology of Greater Prairie-Chickens. Final Technical Report for Department of Energy: DE-EE0000526.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2014. The North American Breeding Bird Survey, Results and Analysis 1966 - 2013. Version 01.30.2015 USGS Patuxent Wildlife Research Center, Laurel, MD.

Shaffer, J. A., and D. A. Buhl. 2016. Effects of wind-energy facilities on breeding grassland bird distributions. Conservation Biology 30:59–71.

Sharp, L., R. Friedel, K. Kosciuch, C. Herrmann, T. Allison, and R. MacIntosh. 2011. Pre- and post-construction monitoring of bald eagle use at the Pillar Mountain Wind Project, Kodiak, Alaska, 2007–2011. Oral presentation at NWCC Research Webinar, 31 October 2011.

Smallwood, K.S. 2013. Comparing bird and bat fatality-rate estimates among North American wind energy projects. Wildlife Society Bulletin 37:19–33.

Stewart, G.B., A.S. Pullin, and C.F. Coles. 2007. Poor evidence-base for assessment of windfarm impacts on birds. Environmental Conservation 34:1-11.

Strickland, M.D., E.B. Arnett, W.P. Erickson, D.H. Johnson, G.D. Johnson, M.L. Morrison, J.A. Shaffer, and W. Warren-Hicks. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative, Washington, D.C. http://www.nationalwind.org/assets/publications/Comprehensive_Guide_to_Studying_Wind_Energy_Wildlife_Interactions_2011_Updated.pdf.

Tetra Tech. 2016a. Brady Wind Energy Center Raptor Nest Survey Report. Submitted to NextEra, April 15, 2016.

Tetra Tech. 2016b. Brady II Wind Energy Center Golden Eagle Nest 2015_39 Report. Submitted to NextEra, June 9, 2016.

Thelander, C.G., K.S. Smallwood, and L. Rugge. 2003. Bird Risk Behaviors and Fatalities at the Altamont Pass Wind Resource Area: Period of Performance: March 1998-December 2000.

Thompson, W.L. 2002. Towards reliable bird surveys: accounting for individuals present but not detected. Auk 119:18-25.

USFWS (United States Fish and Wildlife Service). 2008. Birds of Conservation Concern 2008. United States Department of Interior, Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. 85 pp. [Online version available at <http://www.fws.gov/migratorybirds/>]

USFWS. 2009. Eagle permits; take necessary to protect interests in particular localities; final rules, 50 CFR Parts 13 and 22.

USFWS. 2012. U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines. Available from: http://www.fws.gov/windenergy/docs/WEG_final.pdf

USFWS. 2013. Eagle Conservation Plan Guidance. Module 1 – Land-based Wind Energy. Version 2. USFWS Division of Migratory Bird Management. April 2013.

USFWS. 2016. Flyways. Retrieved from: http://flyways.us/flyways/info.

WEST (Western EcoSystems Technology, Inc.). 2011. Presentation at the Northwest Wind Energy and Wildlife Workshop. June 7-8, 2011, Portland, Oregon.

Whitfield, D.P. and M. Madders. 2006. Flight height in the hen harrier *Circus cyaneus* and its incorporation in wind turbine collision risk modeling. Natural Research Information Note 2. Natural Research Ltd, Banchory, UK.

Winder, V., A. Gregory, L. McNew, B. Sandercock. 2015. Responses of male Greater Prairie-Chickens to wind energy development. DOI: 10.1650/Condor: 14-98.1.

Tetra Tech staff who contributed to this report

Rich Young	August 1, 2016
Report Author	**Date**
Jim Kowalsky	August 4, 2016
Peer Review #1	**Date**
Mark Martel	August 15, 2016
Peer Review #2	**Date**
Shaun Brooks	August 16, 2016
Project Manager	**Date**
Kristina Dick	August 15, 2016
GIS	**Date**

FIGURES

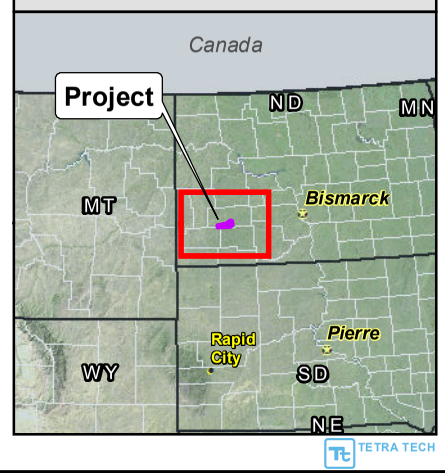
Figure 1

Vicinity map

Brady Wind Energy Center

Stark County, ND

- Proposed Project Area (10-21-2015)
- Proposed Transmission Line (02-02-2016)
- County Boundary
- Urban area
- Interstate Highway
- Secondary Highway
- Secondary Road
- River/Stream
- Lake/Pond



TETRA TECH

1:500,000 WGS84 UTM Zone 13N

0 5 10 20 30 40 50 Miles

P:\GIS_PROJECTS\NextEra\BradyWindEnergyCenter\MXDs\Avian2016\Report_Spring2016\NEE_Brady_AvianSurvey_Figure1_Vicinity_17i1fi_20160815.mxd - Last Saved 8/15/2016

Figure 2

Point-count location map (Spring 2016)

Brady Wind Energy Center

Stark County, ND
Last modified: 08-15-2016

- Avian Survey Point
- Avian Survey Point 800-m Radius

PC# Point count number

- Proposed Project Area (10-21-2015)
- Proposed Transmission Line (02-02-2016)
- Secondary Road

PC 01
PC 02
PC 03
PC 05
PC 06
PC 08
PC 09
PC 10
PC 11
PC 12
PC 16
PC 17
PC 18
PC 19
PC 20
PC 21
PC 22
PC 23

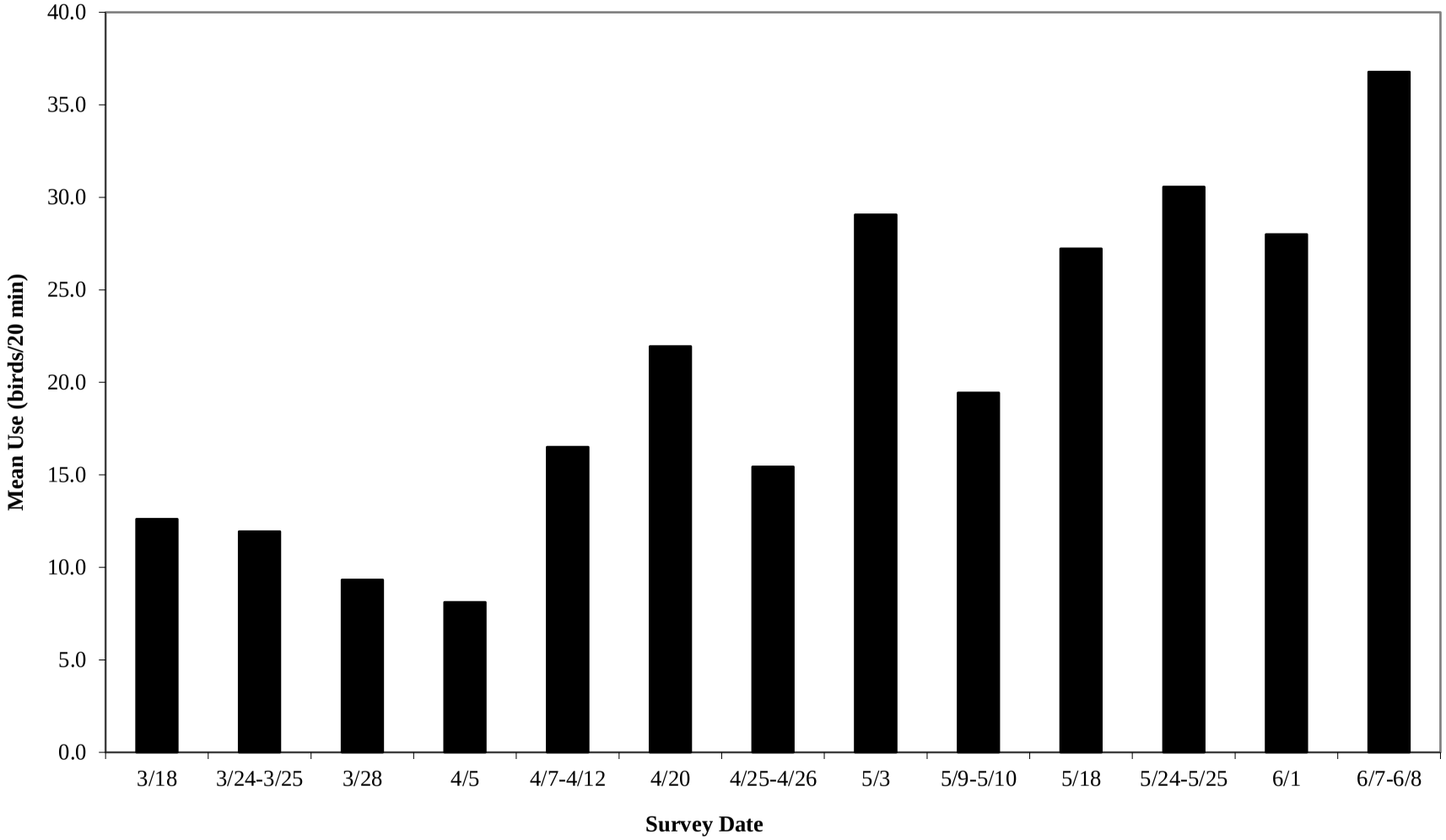
1:114,292 WGS84 UTM Zone 13N

0 0.5 1 2 3 4 5 Miles

TETRA TECH

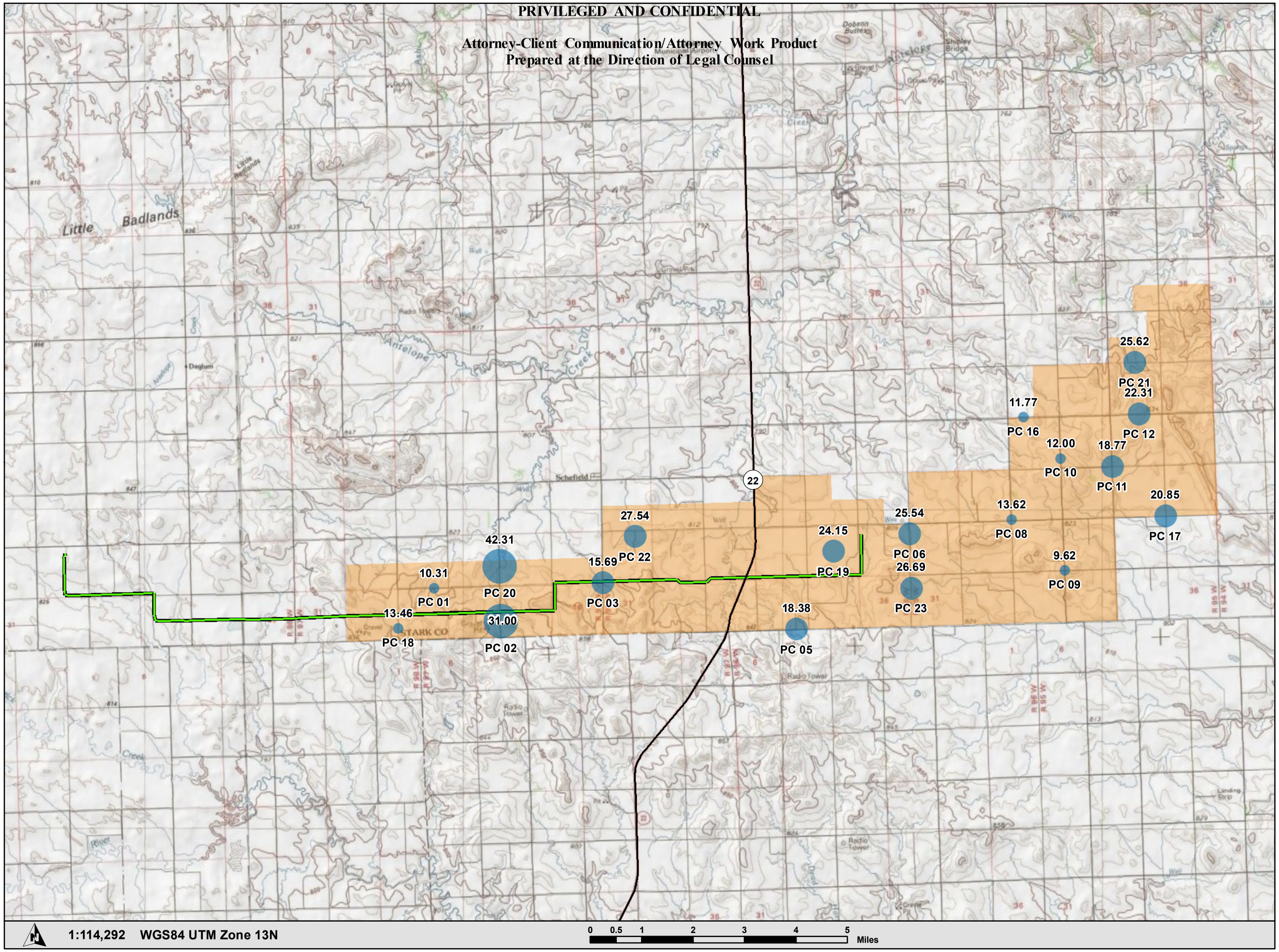
P:\GIS_PROJECTS\NextEraBradyWindEnergyCenter\MXDs\Avian\2016\Report_Spring2016\NEE_Brady_AvianSurvey_Figure2_PClocation_17\11_20160815.mxd - Last Saved 8/8/2016

Figure 3. Non-raptor mean use by survey date in Spring 2016 at the Brady Wind Energy Center.



PRIVILEGED AND CONFIDENTIAL

Attorney-Client Communication/Attorney Work Product
Prepared at the Direction of Legal Counsel



1:114,292 WGS84 UTM Zone 13N

0 0.5 1 2 3 4 5 Miles

Figure 4

Non-raptor mean use by point-count location (Spring 2016)

NEXTera ENERGY RESOURCES

Brady Wind Energy Center

Stark County, ND
Last modified: 08-08-2016

Non-raptors Per 20 Minutes

- 0.01 - 15.00
- 15.01 - 30.00
- 30.01 - 45.00

Mean use value
PC# Point count number

- Proposed Project Area (10-21-2015)
- Proposed Transmission Line (02-02-2016)
- Secondary Road

TETRA TECH

P:\GIS_PROJECTS\NextEra\BradyWindEnergyCenter\MXDs\Avian\2016\Report_Spring2016\NEE_Brady_AvianSurvey_Figure4_NonRapMU_17\1\1_20160815.mxd - Last Saved 8/15/2016

Figure 5. Raptor mean use by survey date in Spring 2016 at the Brady Wind Energy Center.

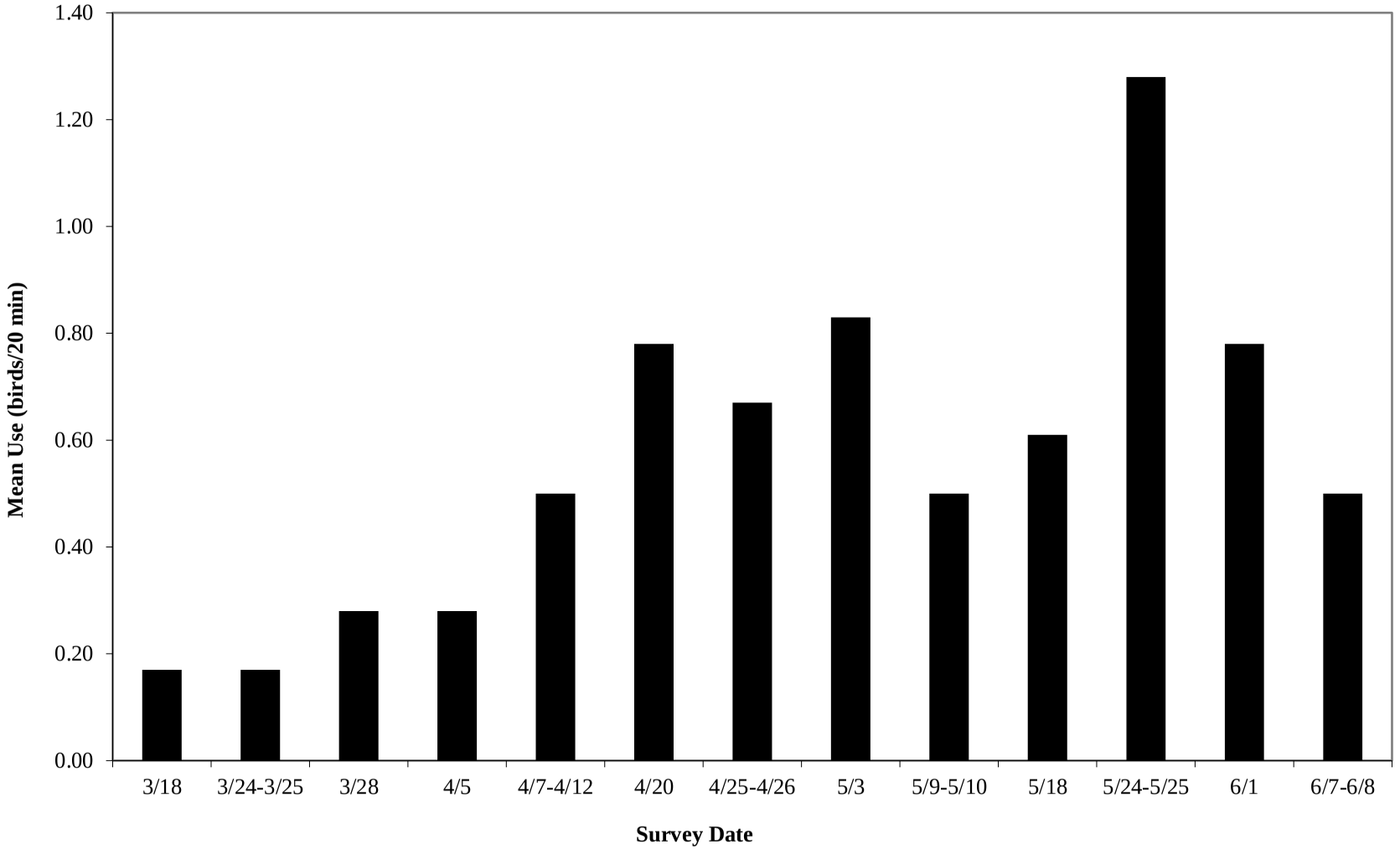


Figure 6

Raptor mean use by point-count location (Spring 2016)

Brady Wind Energy Center

Stark County, ND
Last modified: 08-08-2016

Raptors Per 20 Minutes

- 0.01 - 0.30
- 0.31 - 0.60
- 0.61 - 0.90
- 0.91 - 1.20

Mean use value
PC# Point count number

- Proposed Project Area (10-21-2015)
- Proposed Transmission Line (02-02-2016)
- Secondary Road

PC 18 0.77
PC 01 0.31
PC 20 0.38
PC 02 1.08
PC 22 0.92
PC 03 0.38
PC 19 0.31
PC 05 0.31
PC 06 0.46
PC 23 1.15
PC 08 0.77
PC 09 0.38
PC 17 0.46
PC 11 0.46
PC 10 0.08
PC 16 0.85
PC 12 0.46
PC 21 0.62

1:114,292 WGS84 UTM Zone 13N

0 0.5 1 2 3 4 5 Miles

TETRA TECH

P:\GIS_PROJECTS\NextEra\Brady\WindEnergyCenter\MXDs\Avian\2016\Report_Spring2016\NEE_Brady_AvianSurvey_Figure6_RapMU_17i1l_20160815.mxd - Last Saved 8/15/2016

2016_21
2015_19
2016_15
2016_16
2015_24
2016_11
2015_25
2015_23
2015_21
2016_07
2015_18
2016_23
2016_38
2015_05
2016_22
2015_04
2016_06
2015_03
2015_20
2016_10
2015_38
2015_15
2015_14
2015_11
2015_13
2015_12
2015_10
2016_20
2016_39
2016_30
2016_03
2016_05
2015_02
2016_01
2016_31
2015_16
2016_04
2015_17
2016_32
2016_24
2015_09
2016_18
2015_07
2016_37
2016_36
2015_06
2016_29
2015_39
2016_26
2016_17
2016_08
2016_12
2016_13

1:190,000 WGS84 UTM Zone 13N

0 0.5 1 2 3 4 5 Miles

Figure 7

Raptor nest location map (Spring 2016)

Brady Wind Energy Center

Stark County, ND
Last modified: 08-08-2016

- Occupied golden eagle nest
- Occupied bald eagle nest
- Occupied ferruginous hawk nest
- Occupied large stick nest, species undetermined
- Occupied Swainson's hawk nest
- Occupied great horned owl nest
- Occupied red-tailed hawk nest
- Unoccupied small stick nest
- Unoccupied large stick nest
- Proposed Project Area (10-21-2015)
- Proposed Transmission Line (02-02-2016)
- Eagle Survey Area (10-mile Buffer Around Project Boundary)
- Raptor Survey Area (2-mile Buffer Around Project Boundary)

TETRA TECH

Figure 8

Lek location map (Spring 2016)

Brady Wind Energy Center

Stark County, ND
Last modified: 08-08-2016

- Lek Location
- Proposed Project Area (10-21-2015)
- Proposed Transmission Line (02-02-2016)
- Grouse Lek Survey Area (1-mile Buffer)

2016_05
2016_04
2016_03
2016_01
2016_02
2016_07

1:119,379 WGS84 UTM Zone 13N

0 0.5 1 2 3 4 5 Miles

TETRA TECH

P:\GIS_PROJECTS\NextEraBradyWindEnergyCenter\MXDs\Avian\2016\Report_Spring2016\NEE_Brady_AvianSurvey_Figure8_Lek_17111_20160815.mxd - Last Saved 8/15/2016

TABLES

Table 1. Spring 2016 point-count survey dates at the Brady Wind Energy Center.

Survey number	Date(s)	Year
1	3/18	2016
2	3/24-3/25	2016
3	3/28	2016
4	4/5	2016
5	4/7-4/12	2016
6	4/20	2016
7	4/25-4/26	2016
8	5/3	2016
9	5/9-5/10	2016
10	5/18	2016
11	5/24-5/25	2016
12	6/1	2016
13	6/7-6/8	2016

Table 2. Avian species, by species grouping, observed during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
Songbirds							
red-winged blackbird	1	832	50	3.56 (2.75-4.37)	21.4	21.9%	16.9%
American robin	2	679	63	2.90 (2.26-3.54)	26.9	17.8%	13.8%
horned lark	3	499	81	2.13 (1.48-2.78)	32.9	13.1%	10.1%
brown-headed cowbird	4	495	43	2.12 (1.53-2.71)	17.5	13.0%	10.0%
western meadowlark	6	349	180	1.49 (1.34-1.64)	71.8	9.2%	7.1%
common grackle	7	230	27	0.98 (0.61-1.35)	11.5	6.0%	4.7%
barn swallow	8	179	21	0.76 (0.46-1.06)	8.5	4.7%	3.6%
American crow	10	172	29	0.74 (0.39-1.09)	12.4	4.5%	3.5%
lark bunting	11	119	27	0.51 (0.32-0.70)	10.7	3.1%	2.4%
European starling	13	66	11	0.28 (0.12-0.44)	4.7	1.7%	1.3%
bobolink	20	31	13	0.13 (0.06-0.20)	5.6	0.8%	0.6%
savannah sparrow	22	27	7	0.12 (0.03-0.21)	3.0	0.7%	0.5%
western kingbird	23	23	21	0.10 (0.06-0.14)	9.0	0.6%	0.5%
vesper sparrow	25	19	10	0.08 (0.03-0.13)	4.3	0.5%	0.4%
house sparrow	26	17	1	0.07 (0.00-0.19)	0.4	0.4%	0.3%
dark-eyed junco	26	17	1	0.07 (0.00-0.19)	0.4	0.4%	0.3%
snow bunting	29	13	1	0.06 (0.00-0.15)	0.4	0.3%	0.3%
clay-colored sparrow	29	13	2	0.06 (0.00-0.13)	0.9	0.3%	0.3%
eastern kingbird	32	11	11	0.05 (0.03-0.07)	4.7	0.3%	0.2%
tree swallow	37	5	2	0.02 (0.00-0.05)	0.9	0.1%	0.1%
grasshopper sparrow	37	5	5	0.02 (0.00-0.04)	2.1	0.1%	0.1%
white-crowned sparrow	42	1	1	0.00 (0.00-0.01)	0.4	0.0%	0.0%
northern shrike	42	1	1	0.00 (0.00-0.01)	0.4	0.0%	0.0%
Brewer's sparrow	42	1	1	0.00 (0.00-0.01)	0.4	0.0%	0.0%
black-billed magpie	42	1	1	0.00 (0.00-0.01)	0.4	0.0%	0.0%
Group Total		**3805**	**610**	**16.26** (14.61-17.91)	**91.5**		**77.1%**
Gamebirds							
ring-necked pheasant	5	440	106	1.88 (1.47-2.29)	44.4	98.0%	8.9%

Table 2. Avian species, by species grouping, observed during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
gray partridge	35	7	3	0.03 (0.00-0.06)	1.3	1.6%	0.1%
sharp-tailed grouse	39	2	1	0.01 (0.00-0.02)	0.4	0.4%	0.0%
Group Total		**449**	**110**	**1.92** (1.50-2.34)	**44.9**		**9.1%**
Pigeons/Doves							
mourning dove	8	178	58	0.76 (0.60-0.92)	24.8	74.2%	3.6%
rock pigeon	14	62	10	0.26 (0.10-0.42)	4.3	25.8%	1.3%
Group Total		**240**	**68**	**1.03** (0.80-1.26)	**27.8**		**4.9%**
Waterfowl							
mallard	12	88	27	0.38 (0.24-0.52)	11.5	50.3%	1.8%
Canada goose	15	55	11	0.24 (0.05-0.43)	4.7	31.4%	1.1%
blue-winged teal	20	31	8	0.13 (0.05-0.21)	3.4	17.7%	0.6%
northern pintail	42	1	1	0.00 (0.00-0.01)	0.4	0.6%	0.0%
Group Total		**175**	**47**	**0.75** (0.50-1.00)	**17.1**		**3.5%**
Raptors							
northern harrier	18	47	45	0.20 (0.15-0.25)	19.2	35.6%	1.0%
Swainson's hawk	19	32	32	0.14 (0.10-0.18)	13.7	24.2%	0.6%
turkey vulture	23	23	6	0.10 (0.03-0.17)	2.6	17.4%	0.5%
American kestrel	26	16	16	0.07 (0.04-0.10)	6.8	12.1%	0.3%
red-tailed hawk	29	13	13	0.06 (0.04-0.08)	5.6	9.8%	0.3%
merlin	42	1	1	0.00 (0.00-0.01)	0.4	0.8%	0.0%
Group Total		**132**	**113**	**0.56** (0.47-0.65)	**44.0**		**2.7%**
Waterbirds							
killdeer	16	52	41	0.22 (0.16-0.28)	17.5	77.6%	1.1%
upland sandpiper	33	10	10	0.04 (0.02-0.06)	4.3	14.9%	0.2%
Wilson's snipe	39	2	2	0.01 (0.00-0.02)	0.9	3.0%	0.0%
marbled godwit	39	2	2	0.01 (0.00-0.02)	0.9	3.0%	0.0%
great blue heron	42	1	1	0.00 (0.00-0.01)	0.4	1.5%	0.0%
Group Total		**67**	**56**	**0.29** (0.23-0.35)	**22.2**		**1.4%**
Gulls/Terns							
ring-billed gull	16	52	5	0.22 (0.03-0.41)	2.1	100.0%	1.1%

Table 2. Avian species, by species grouping, observed during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
Group Total		**52**	**5**	**0.22** (0.03-0.41)	**2.1**		**1.1%**
Woodpeckers							
northern flicker	33	10	10	0.04 (0.02-0.06)	4.3	100.0%	0.2%
Group Total		**10**	**10**	**0.04** (0.02-0.06)	**4.3**		**0.2%**
Cranes/Rails							
sandhill crane	35	7	1	0.03 (0.00-0.08)	0.4	100.0%	0.1%
Group Total		**7**	**1**	**0.03** (0.00-0.08)	**0.4**		**0.1%**
Grand Total		**4937**	**1020**	**21.10** (19.24-22.96)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Spring 2016 point count-surveys at the Brady Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points																
			1	2	3	5	6	8	9	10	11	12	16	17	18	19	20	21	22	23
red-winged blackbird	832	50	26	156	42	61	33	16	20	7	13	26	22	0	0	26	177	68	126	13
American robin	679	63	5	81	0	10	56	7	0	22	63	63	11	82	3	28	104	43	7	94
horned lark	499	81	12	14	24	7	10	12	18	38	43	8	21	6	65	84	7	77	26	27
brown-headed cowbird	495	43	23	22	16	29	66	9	26	10	18	10	7	58	17	20	88	15	29	32
ring-necked pheasant	440	106	6	14	29	79	15	6	7	2	25	52	9	16	15	20	42	15	21	67
western meadowlark	349	180	16	11	19	19	24	24	14	17	24	21	28	23	24	24	14	14	13	20
common grackle	230	27	7	0	5	6	19	48	5	17	13	27	6	39	0	6	6	16	0	10
barn swallow	179	21	8	29	4	0	33	8	0	0	5	4	0	9	0	29	0	10	35	5
mourning dove	178	58	4	12	19	13	9	11	0	8	7	20	9	9	6	9	12	4	14	12
American crow	172	29	11	4	9	0	54	8	12	0	0	15	0	0	3	15	17	13	0	11
lark bunting	119	27	0	11	8	6	1	13	3	6	6	11	12	10	4	0	6	11	0	11
mallard	88	27	4	13	0	0	0	2	0	3	0	2	0	0	0	3	22	8	31	0
European starling	66	11	0	7	0	0	6	0	0	0	9	0	8	11	3	15	0	5	0	2
rock pigeon	62	10	0	3	16	0	0	0	15	0	0	0	10	0	6	6	6	0	0	0
Canada goose	55	11	0	0	2	0	2	0	0	0	0	0	7	0	0	8	6	2	4	24
killdeer	52	41	0	9	0	2	2	3	1	3	5	3	0	1	9	3	5	1	3	2
ring-billed gull	52	5	0	4	0	0	0	0	0	0	0	0	0	0	0	0	16	13	19	0
northern harrier	47	45	2	5	3	1	2	2	3	0	2	3	5	5	3	1	1	3	4	2
Swainson's hawk	32	32	1	3	1	3	3	2	2	1	3	0	4	1	0	2	1	0	2	3
blue-winged teal	31	8	0	6	3	0	0	0	0	0	0	0	0	0	0	0	9	0	13	0
bobolink	31	13	9	1	5	4	1	1	0	2	0	0	0	0	2	0	2	0	4	0
savannah sparrow	27	7	0	0	0	1	0	0	0	0	9	6	0	0	0	0	6	5	0	0
turkey vulture	23	6	0	3	0	0	0	5	0	0	0	0	0	0	7	0	3	0	5	0
western kingbird	23	21	3	0	3	1	1	1	1	0	1	1	1	0	1	1	2	0	3	3
vesper sparrow	19	10	0	0	0	0	0	4	0	0	0	1	1	0	4	1	2	4	1	1
dark-eyed junco	17	1	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0
house sparrow	17	1	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0
American kestrel	16	16	0	2	1	0	0	1	0	0	1	1	2	0	0	0	0	1	1	6
clay-colored sparrow	13	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	3	0
red-tailed hawk	13	13	1	1	0	0	1	0	0	0	0	2	0	0	0	1	0	4	0	3
snow bunting	13	1	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0
eastern kingbird	11	11	0	2	0	1	0	0	2	0	1	1	0	0	0	0	0	2	0	2
northern flicker	10	10	0	3	0	0	0	1	0	1	0	0	0	0	0	0	0	2	0	3
upland sandpiper	10	10	0	1	0	0	0	0	0	0	1	1	0	0	0	2	1	0	3	1
gray partridge	7	3	0	0	0	0	0	0	0	2	0	0	0	0	0	4	0	1	0	0
sandhill crane	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
grasshopper sparrow	5	5	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	1	1	0
tree swallow	5	2	0	0	0	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0

Table 3. Avian species observed by point during Spring 2016 point count surveys at the Brady Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points																	
			1	2	3	5	6	8	9	10	11	12	16	17	18	19	20	21	22	23
marbled godwit	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
sharp-tailed grouse	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Wilson's snipe	2	2	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
black-billed magpie	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Brewer's sparrow	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
great blue heron	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
merlin	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
northern pintail	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
northern shrike	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
white-crowned sparrow	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Grand Total	**4937**	**1020**	**138**	**417**	**209**	**243**	**338**	**187**	**130**	**157**	**250**	**296**	**164**	**277**	**185**	**318**	**555**	**341**	**370**	**362**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during Spring 2016 point-count surveys at the Brady Wind Energy Center.

		Birds	
		Number	**Percentage**
Non-raptors			
	At RSA height (28.5m–131.5m)	75	1.7%
	Below RSA height (<28.5m)	4364	98.3%
Raptors			
	At RSA height (28.5m–131.5m)	38	28.8%
	Below RSA height (<28.5m)	94	71.2%

[1]Includes only flying birds with flight height data

[2]These values assume a rotor diameter of 103 meters and a hub height of 80 meters

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
Canada goose	0.16	0.24 (0.05 - 0.43)	96.4	0.0	67.9	32.1
American crow	0.14	0.74 (0.39 - 1.09)	100.0	0.0	18.6	81.4
turkey vulture	0.10	0.10 (0.03 - 0.17)	100.0	0.0	100.0	0.0
Swainson's hawk	0.05	0.14 (0.10 - 0.18)	100.0	0.0	37.5	62.5
sandhill crane	0.03	0.03 (0.00 - 0.08)	100.0	0.0	100.0	0.0
red-tailed hawk	0.01	0.06 (0.04 - 0.08)	100.0	0.0	23.1	76.9
American kestrel	0.00	0.07 (0.04 - 0.10)	100.0	0.0	0.0	100.0
American robin	0.00	2.90 (2.26 - 3.54)	98.7	0.0	0.0	100.0
barn swallow	0.00	0.76 (0.46 - 1.06)	100.0	0.0	0.0	100.0
black-billed magpie	0.00	0.00 (0.00 - 0.01)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	2.12 (1.53 - 2.71)	100.0	0.0	0.0	100.0
bobolink	0.00	0.13 (0.06 - 0.20)	100.0	0.0	0.0	100.0
Brewer's sparrow	0.00	0.00 (0.00 - 0.01)	0.0	0.0	0.0	0.0
blue-winged teal	0.00	0.13 (0.05 - 0.21)	90.3	0.0	0.0	100.0
clay-colored sparrow	0.00	0.06 (0.00 - 0.13)	100.0	0.0	0.0	100.0
common grackle	0.00	0.98 (0.61 - 1.35)	100.0	0.0	0.0	100.0
dark-eyed junco	0.00	0.07 (0.00 - 0.19)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.05 (0.03 - 0.07)	100.0	0.0	0.0	100.0
European starling	0.00	0.28 (0.12 - 0.44)	97.0	0.0	0.0	100.0
great blue heron	0.00	0.00 (0.00 - 0.01)	100.0	0.0	0.0	100.0
gray partridge	0.00	0.03 (0.00 - 0.06)	100.0	0.0	0.0	100.0
grasshopper sparrow	0.00	0.02 (0.00 - 0.04)	20.0	0.0	0.0	100.0
horned lark	0.00	2.13 (1.48 - 2.78)	98.2	0.0	0.0	100.0
house sparrow	0.00	0.07 (0.00 - 0.19)	100.0	0.0	0.0	100.0
killdeer	0.00	0.22 (0.16 - 0.28)	73.1	0.0	0.0	100.0
lark bunting	0.00	0.51 (0.32 - 0.70)	100.0	0.0	0.0	100.0
marbled godwit	0.00	0.01 (0.00 - 0.02)	100.0	0.0	0.0	100.0
mallard	0.00	0.38 (0.24 - 0.52)	95.5	0.0	0.0	100.0
merlin	0.00	0.00 (0.00 - 0.01)	100.0	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species	Encounter Rate	Mean Use # birds/ 20 min. (90% confidence interval)	Percent Flying	Percent Above RSA Height	Percent At RSA Height	Percent Below RSA Height
mourning dove	0.00	0.76 (0.60 - 0.92)	95.5	0.0	0.0	100.0
northern flicker	0.00	0.04 (0.02 - 0.06)	100.0	0.0	0.0	100.0
northern harrier	0.00	0.20 (0.15 - 0.25)	100.0	0.0	0.0	100.0
northern pintail	0.00	0.00 (0.00 - 0.01)	100.0	0.0	0.0	100.0
northern shrike	0.00	0.00 (0.00 - 0.01)	100.0	0.0	0.0	100.0
ring-billed gull	0.00	0.22 (0.03 - 0.41)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	1.88 (1.47 - 2.29)	55.5	0.0	0.0	100.0
rock pigeon	0.00	0.26 (0.10 - 0.42)	100.0	0.0	0.0	100.0
red-winged blackbird	0.00	3.56 (2.75 - 4.37)	99.6	0.0	0.0	100.0
savannah sparrow	0.00	0.12 (0.03 - 0.21)	88.9	0.0	0.0	100.0
snow bunting	0.00	0.06 (0.00 - 0.15)	100.0	0.0	0.0	100.0
sharp-tailed grouse	0.00	0.01 (0.00 - 0.02)	100.0	0.0	0.0	100.0
tree swallow	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
upland sandpiper	0.00	0.04 (0.02 - 0.06)	0.0	0.0	0.0	0.0
vesper sparrow	0.00	0.08 (0.03 - 0.13)	78.9	0.0	0.0	100.0
white-crowned sparrow	0.00	0.00 (0.00 - 0.01)	0.0	0.0	0.0	0.0
western kingbird	0.00	0.10 (0.06 - 0.14)	95.7	0.0	0.0	100.0
western meadowlark	0.00	1.49 (1.34 - 1.64)	73.6	0.0	0.0	100.0
Wilson's snipe	0.00	0.01 (0.00 - 0.02)	100.0	0.0	0.0	100.0

[1]These values assume a rotor diameter of 103 (meters) and a hub height of 80 (meters)

Table 6. Raptor Nests at Brady Wind Energy Center, March-May 2016.

Nest ID Number	Species	Substrate	Size Category	Location[1]	Status[2] on March 29-31, 2016	Status[2] on May 15-16, 2016	Comments
2015_11	Unknown	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	
2015_12	Unknown	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	
2015_13	Unknown	Cliff	Large	Eagle Nest Survey Area	Occupied	Occupied	Fresh lining material in the nest, but species undetermined
2015_14	Unknown	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	
2015_15	Unknown	Cliff	Large	Eagle Nest Survey Area	Occupied	Occupied	Fresh lining material in the nest, but species undetermined
2015_18	Unknown	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	
2015_19	bald eagle	Tree	Large	Eagle Nest Survey Area	Occupied	Occupied	
2015_20	bald eagle	Tree	Large	Eagle Nest Survey Area	Occupied	Occupied	
2015_21	golden eagle	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Not Found	NDGF Nest GE099
2015_22	golden eagle	Cliff	Large	Eagle Nest Survey Area	No Longer Present	No Longer Present	NDGF Nest GE100 reported as destroyed by NDGF
2015_23	golden eagle	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Not Found	NDGF Nest GE098
2015_24	golden eagle	Cliff	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	NDGF Nest GE101
2015_25	ferruginous hawk	Cliff	Large	Eagle Nest Survey Area	Occupied	Occupied	NDGF Nest GE576: extremely tall nest visible from several miles away
2015_26	golden eagle	Cliff	Large	Eagle Nest Survey Area	No Longer Present	No Longer Present	NDGF Nest GE097 reported as destroyed by NDGF
2015_39	golden eagle	Tree	Small	Eagle Nest Survey Area	Occupied	Unoccupied	A relatively small nest located near the top of the tree; not a typical eagle nest resembles a hawk nest. Nest was occupied in March but unoccupied (failed) and nest dilapidated in May, presumably because the nest was too small to support eagles
2016_07	ferruginous hawk	Cliff	Large	Eagle Nest Survey Area	Occupied	Not Found	Nest on a sandstone pillar
2016_08	golden eagle	Tree	Large	Eagle Nest Survey Area	Occupied	Occupied	Two chicks observed in the nest in May
2016_10	Unknown	Tree	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	Based on size and proximity, appears to be an alternate nest to bald eagle occupying nest 2015_20
2016_12	Unknown	Tree	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	Based on size and proximity, appears to be an alternate nest to golden eagle occupying nest 2016_08
2016_13	Unknown	Tree	Large	Eagle Nest Survey Area	Unoccupied	Unoccupied	Based on size and proximity, appears to be an alternate nest to golden eagle occupying nest 2016_08
2016_15	Unknown	Tree	Large	Eagle Nest Survey Area	Unoccupied	Not Found	
2016_16	Unknown	Tree	Large	Eagle Nest Survey Area	Unoccupied	Not Found	
2016_17	ferruginous hawk	Tree	Large	Eagle Nest Survey Area	Occupied	Occupied	

Table 6. Raptor Nests at Brady Wind Energy Center, March-May 2016.

Nest ID Number	Species	Substrate	Size Category	Location[1]	Status[2] on March 29-31, 2016	Status[2] on May 15-16, 2016	Comments
2016_21	Unknown	Tree	Large	Eagle Nest Survey Area	Unoccupied	Not Found	
2015_02	red-tailed hawk	Tree	Small	Project Area	Unoccupied	Occupied	
2015_03	Unknown	Tree	Small	Project Area	Unoccupied	Not Found	
2015_04	Unknown	Tree	Small	Project Area	Unoccupied	Not Found	
2015_16	Unknown	Tree	Small	Project Area	Unoccupied	Not Found	
2016_03	Unknown	Tree	Small	Project Area	Unoccupied	Not Found	
2016_05	Swainson's hawk	Tree	Small	Project Area	Unoccupied	Occupied	
2015_05	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Occupied	
2015_06	Unknown	Tree	Small	Raptor Nest Survey Area	Unoccupied	Unoccupied	
2015_07	great horned owl	Tree	Small	Raptor Nest Survey Area	Unoccupied	Occupied	
2015_09	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Unoccupied	
2015_10	red-tailed hawk	Tree	Large	Raptor Nest Survey Area	Unoccupied	Occupied	
2015_17	Unknown	Tree	Small	Raptor Nest Survey Area	Unoccupied	Unoccupied	
2015_38	Unknown	Tree	Large	Raptor Nest Survey Area	Unoccupied	Not Found	
2016_01	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Not Found	
2016_04	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Occupied	
2016_06	Unknown	Tree	Small	Raptor Nest Survey Area	Unoccupied	Unoccupied	
2016_18	red-tailed hawk	Tree	Small	Raptor Nest Survey Area	Occupied	Occupied	
2016_20	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Occupied	
2016_22	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Not Found	
2016_23	great horned owl	Tree	Small	Raptor Nest Survey Area	Occupied	Not Found	
2016_24	red-tailed hawk	Tree	Small	Raptor Nest Survey Area	Unknown	Occupied	

Table 6. Raptor Nests at Brady Wind Energy Center, March-May 2016.

Nest ID Number	Species	Substrate	Size Category	Location[1]	Status[2] on March 29-31, 2016	Status[2] on May 15-16, 2016	Comments
2016_29	Unknown	Tree	Small	Raptor Nest Survey Area	Unknown	Unoccupied	
2016_30	Unknown	Tree	Small	Raptor Nest Survey Area	Unknown	Unoccupied	
2016_31	Swainson's hawk	Tree	Small	Raptor Nest Survey Area	Unknown	Occupied	
2016_32	Unknown	Tree	Small	Raptor Nest Survey Area	Unknown	Unoccupied	
2016_36	Swainson's hawk	Tree	Small	Raptor Nest Survey Area	Unknown	Occupied	
2016_37	great horned owl	Tree	Small	Raptor Nest Survey Area	Unknown	Occupied	
2016_39	red-tailed hawk	Tree	Small	Raptor Nest Survey Area	Unknown	Occupied	

1-Eagle Nest Survey Area = 2 to 10-miles from the Project Area, Raptor Nest Survey Area = out to 2-miles from the Project Area. Project Area = within the current Project Area.
2-Nests classified as no longer present are not included in Figure 7.

Table 7. Sharp-tailed grouse leks observed at the Brady Wind Energy Center in Spring 2016.

Lek ID	Survey Date	Number of Males	Number of Females	Number of Unknown Grouse	Total
2016_01	4/11/2016	3	4	0	7
	4/26/2016	3	2	0	5
2016_02	4/11/2016	6	4	0	10
	4/28/2016	0	0	8	8
2016_03	4/8/2016	2	0	7	9
	4/29/2016	7	0	0	7
2016_04	4/12/2016	10	16	0	26
	4/28/2016	24	0	0	24
2016_05	4/6/2016	0	0	9	9
	4/28/2016	8	0	0	8
2016_06	4/8/2016	Unknown	Unknown	Unknown	Unknown
	4/29/2016	6	1	0	8
2016_07	4/8/2016	Unknown	Unknown	Unknown	Unknown
	4/29/2016	24	2	0	26

Table 8. Incidental observations of birds during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species	Number of individuals
sandhill crane	31
sharp-tailed grouse	19
northern harrier	4
red-tailed hawk	4
ferruginous hawk	1
Swainson's hawk	1
Grand Total	**60**

APPENDICES

Appendix A. IPaC report for Stark County, North Dakota

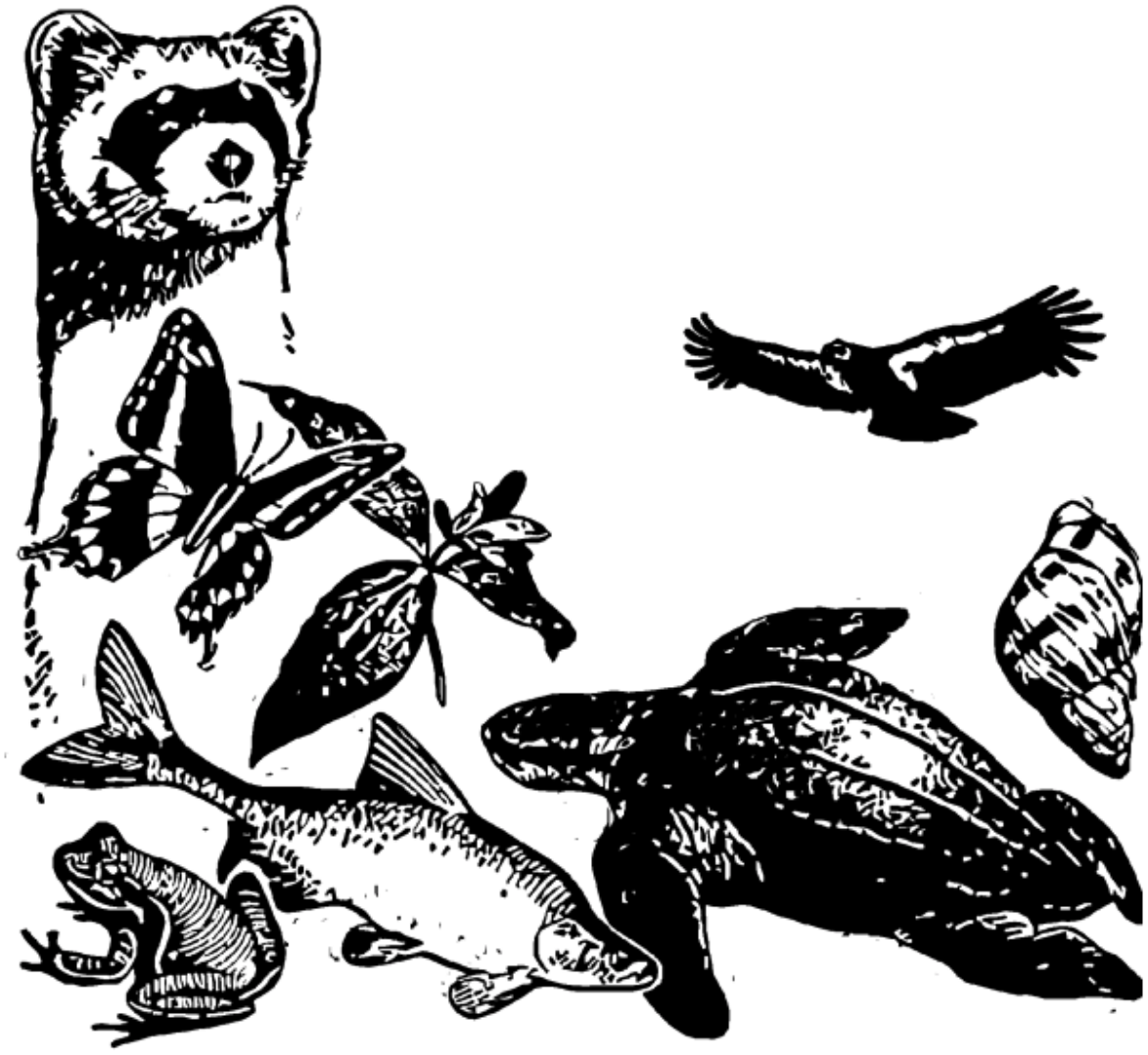
U.S. Fish & Wildlife Service

Brady Wind Energy Center

IPaC Trust Resources Report

Generated July 25, 2016 05:53 PM MDT, IPaC v3.0.8

This report is for informational purposes only and should not be used for planning or analyzing project level impacts. For project reviews that require U.S. Fish & Wildlife Service review or concurrence, please return to the IPaC website and request an official species list from the Regulatory Documents page.



IPaC - Information for Planning and Conservation (https://ecos.fws.gov/ipac/): A project planning tool to help streamline the U.S. Fish & Wildlife Service environmental review process.

Table of Contents

U.S. Fish & Wildlife Service

IPaC Trust Resources Report

NAME

Brady Wind Energy Center

LOCATION

Stark County, North Dakota

IPAC LINK

https://ecos.fws.gov/ipac/project/XMNRK-6KIOF-BKNHA-OVYPX-ATH4CE

U.S. Fish & Wildlife Service Contact Information

Trust resources in this location are managed by:

North Dakota Ecological Services Field Office
3425 Miriam Avenue
Bismarck, ND 58501-7926
(701) 250-4481

Endangered Species

Proposed, candidate, threatened, and endangered species are managed by the Endangered Species Program of the U.S. Fish & Wildlife Service.

This USFWS trust resource report is for informational purposes only and should not be used for planning or analyzing project level impacts.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list from the Regulatory Documents section.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Documents section in IPaC or from the local field office directly.

The list of species below are those that may occur or could potentially be affected by activities in this location:

Birds

Whooping Crane Grus americana — Endangered

CRITICAL HABITAT
There is **final** critical habitat designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B003

Mammals

Gray Wolf Canis lupus — Endangered

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A00D

Northern Long-eared Bat Myotis septentrionalis — Threatened

CRITICAL HABITAT
No critical habitat has been designated for this species.

http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=A0JE

Critical Habitats

There are no critical habitats in this location

Migratory Birds

Birds are protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act.

Any activity that results in the take of migratory birds or eagles is prohibited unless authorized by the U.S. Fish & Wildlife Service.[1] There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

---

1. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern
  http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds
  http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data
  http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The following species of migratory birds could potentially be affected by activities in this location:

American Bittern Botaurus lentiginosus — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F3

Baird's Sparrow Ammodramus bairdii — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B09B

Bald Eagle Haliaeetus leucocephalus — Bird of conservation concern
Season: Wintering
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B008

Black-billed Cuckoo Coccyzus erythropthalmus — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HI

Brewer's Sparrow Spizella breweri — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HA

Burrowing Owl Athene cunicularia — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0NC

Common Tern Sterna hirundo — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B09G

Dickcissel Spiza americana — Bird of conservation concern
Season: Breeding

Ferruginous Hawk Buteo regalis — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06X

Golden Eagle Aquila chrysaetos — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DV

Grasshopper Sparrow Ammodramus savannarum — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0G0

Greater Sage-grouse Centrocercus urophasianus — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06W

Hudsonian Godwit Limosa haemastica — Bird of conservation concern
Season: Migrating

Loggerhead Shrike Lanius ludovicianus — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0FY

Long-billed Curlew Numenius americanus — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B06S

Marbled Godwit Limosa fedoa — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JL

Prairie Falcon Falco mexicanus — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0ER

Red-headed Woodpecker Melanerpes erythrocephalus — Bird of conservation concern
Season: Breeding

Short-eared Owl Asio flammeus — Bird of conservation concern
Season: Year-round
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HD

Sprague's Pipit Anthus spragueii — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0GD

Swainson's Hawk Buteo swainsoni — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B070

Upland Sandpiper Bartramia longicauda — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0HC

Western Grebe aechmophorus occidentalis — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0EA

Willow Flycatcher Empidonax traillii — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0F6

Yellow Rail Coturnicops noveboracensis — Bird of conservation concern
Season: Breeding
http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0JG

Wildlife refuges and fish hatcheries

There are no refuges or fish hatcheries in this location

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

DATA LIMITATIONS

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

DATA EXCLUSIONS

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

DATA PRECAUTIONS

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

This location overlaps all or part of the following wetlands:

The area of this project is too large for IPaC to load all NWI wetlands in the area. The list below may be incomplete. Please contact the local U.S. Fish & Wildlife Service office or visit the NWI map for a full list.

Freshwater Pond

PABF

PABFh

Lake

L1UBGh
L1UBHh
L2ABF
L2ABFh
L2ABKx

A full description for each wetland code can be found at the National Wetlands Inventory website: http://107.20.228.18/decoders/wetlands.aspx

Appendix B. Flight directions of birds observed during Spring 2016 point-count surveys at the Brady Wind Energy Center

Appendix 2. Flight directions of birds observed during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
red-winged blackbird	232	16	62.5	1.3	0.0	0.0	5.2	10.3	5.6	12.1	3.0
brown-headed cowbird	223	26	39.9	9.0	0.0	3.1	21.1	0.0	9.4	17.5	0.0
horned lark	193	27	38.3	0.0	0.0	1.0	30.6	0.0	28.0	0.0	2.1
barn swallow	179	21	34.1	7.3	0.0	0.0	25.1	0.0	15.1	18.4	0.0
American crow	163	27	71.8	9.8	0.6	1.2	4.3	0.6	9.2	2.5	0.0
mourning dove	152	52	44.7	3.3	2.0	0.0	5.3	2.6	40.1	0.0	2.0
common grackle	150	19	46.7	0.0	2.0	0.0	2.7	0.7	14.0	16.0	18.0
ring-necked pheasant	86	12	19.8	0.0	14.0	15.1	14.0	0.0	31.4	5.8	0.0
American robin	78	12	28.2	0.0	0.0	3.8	19.2	0.0	42.3	0.0	6.4
mallard	74	23	45.9	2.7	8.1	4.1	8.1	0.0	18.9	12.2	0.0
European starling	64	10	20.3	25.0	0.0	14.1	17.2	0.0	4.7	18.8	0.0
rock pigeon	57	9	38.6	5.3	0.0	0.0	17.5	0.0	10.5	28.1	0.0
Canada goose	53	10	60.4	0.0	3.8	0.0	28.3	0.0	7.5	0.0	0.0
ring-billed gull	52	5	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern harrier	47	45	27.7	6.4	2.1	21.3	25.5	0.0	10.6	4.3	2.1
lark bunting	39	9	30.8	15.4	0.0	0.0	15.4	0.0	23.1	15.4	0.0
Swainson's hawk	31	31	22.6	12.9	6.5	0.0	35.5	9.7	9.7	3.2	0.0
western meadowlark	30	20	23.3	0.0	6.7	0.0	23.3	0.0	43.3	0.0	3.3
blue-winged teal	28	7	32.1	21.4	10.7	14.3	0.0	10.7	10.7	0.0	0.0
turkey vulture	23	6	47.8	0.0	0.0	0.0	17.4	13.0	0.0	21.7	0.0
house sparrow	17	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
dark-eyed junco	17	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
bobolink	15	6	46.7	0.0	0.0	0.0	0.0	0.0	53.3	0.0	0.0
American kestrel	14	14	21.4	0.0	7.1	0.0	35.7	0.0	21.4	14.3	0.0
snow bunting	13	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
red-tailed hawk	11	11	18.2	9.1	0.0	18.2	27.3	27.3	0.0	0.0	0.0
sandhill crane	7	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern flicker	6	6	16.7	0.0	33.3	0.0	0.0	0.0	50.0	0.0	0.0

Appendix 2. Flight directions of birds observed during Spring 2016 point-count surveys at the Brady Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
tree swallow	5	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
killdeer	5	4	0.0	20.0	60.0	0.0	0.0	0.0	20.0	0.0	0.0
gray partridge	4	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
clay-colored sparrow	3	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wilson's snipe	2	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
sharp-tailed grouse	2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
marbled godwit	2	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
western kingbird	1	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
northern shrike	1	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern pintail	1	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
merlin	1	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
great blue heron	1	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
eastern kingbird	1	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
black-billed magpie	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Grand Total	**2084**	**448**	**43.2**	**5.6**	**2.0**	**2.7**	**14.6**	**2.0**	**18.1**	**9.0**	**2.7**

[1] Includes only flying birds with flight directions