2014 Spring Avian Survey

Wilton IV Wind Energy Center
Burleigh County, North Dakota

Prepared for

NextEra Energy

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TETRA TECH

EXECUTIVE SUMMARY

Tetra Tech, Inc. (Tetra Tech) was contracted by Wilton Wind IV, LLC, a subsidiary of NextEra Energy Resources, LLC, to undertake spring avian use surveys for the proposed Wilton IV Wind Energy Center (Project) in Burleigh County, North Dakota. The studies were conducted to identify potential avian impacts associated with building and operating a wind energy facility. Birds have been identified as a group potentially at risk because of collisions with wind turbines and power lines, and displacement due to the presence of the associated structures. Weekly surveys were performed at the Project from March 17th through May 31st, 2014, which included the spring migration to early summer breeding seasons. Point-count surveys (Fixed 800-meter [m] radius) were conducted at 5 points distributed throughout the Project area.

A total of 6,040 birds from 50 species and 478 birds that could not be identified to species were observed within the Project area. Overall mean bird use within the Project area was 100.67 birds/20 minute (min) and ranged from 0 to 2,135 birds/20 minute for each survey.

Mean use was highest for waterfowl (61.60 birds/20 min), songbirds (24.07 birds/20 min), and cranes/rails (8.25 bird/20 min). The species with the highest mean use were the snow goose (52.52 birds/20 min), red-winged blackbird (10.17 birds/20 min), and sandhill crane (8.25 birds/20 min). The red-winged blackbird had the highest encounter rate (8.34 birds flying at rotor swept area [RSA] height/20 min), followed by unidentified blackbird, cackling goose and Canada goose at 5.00, 1.25 and 1.13 birds flying at RSA height/20 min respectively.

The avian community detected within the Project area during spring avian surveys was characterized by species typically associated with kettle ponds, agricultural lands and cattle pastures of North Dakota. Within habitats disturbed by agriculture, the greatest potential impact of wind facilities to avian species is risk of collisions with turbines rather than disturbance or displacement. Cackling goose and Canada goose had high encounter rates which, in isolation, may be considered to indicate a high risk for potential Project related fatalities. However, at wind facilities with publicly available fatality data, there have been only 5 fatalities for Canada goose, and no fatalities of cackling goose recorded. The lack of documented fatalities of these waterfowl species at wind facilities within the migratory pathway indicates a low risk of Project-related fatalities. The cackling goose and Canada goose are migratory in this region of North Dakota and therefore would be at the greatest fatality risk during the spring and fall.

Songbirds also had high mean use and encounter rates, which may place them at increased risk of collision. Mean use and encounter rate was highest for red-winged blackbird and unidentified blackbird. Unidentified blackbirds were likely comprised of red-winged blackbirds and common grackles, as well as other black songbird species. Two other species, western meadowlark and horned lark, had a high frequency of detection (observed in 71.7 and 53.3 percent of all surveys respectively) but low mean-use and encounter rates. The red-winged blackbird, western

meadowlark, and horned lark have all been documented as fatalities at other wind energy projects and as a result, risk of turbine-related fatalities exists for each of these species at the Project. However, Project-related fatalities of red-winged blackbird, western meadowlark, and horned lark, should they occur, are unlikely to have population-level impacts because collision-related fatalities appear to have little effect on North American songbird populations and the North Dakota populations for each species are large (8.2, 5.6, and 4.3 million each respectively).

High raptor use (> 2.0 birds/20 min) has been associated with high raptor mortality at wind farms. Conversely, raptor mortality appears to be low when raptor use is low (< 1.0 birds/20 min), which is the case for raptor use at the Project (0.43 birds/20 min). Red-tailed hawks and northern harriers had the highest mean use among raptors (0.23 and 0.12 birds/20 min, respectively). Results from post-construction fatality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities. Whereas risk of turbine-related fatalities at the Project exists for red-tailed hawks, turbine-related fatalities are expected to be low given the low level of use within the Project area. As a result, any fatalities observed at the Project are not expected to have population level impacts. . Risk of collision for northern harriers is believed to be low because the majority of foraging flights observed at other wind facilities occur below typical RSA heights. Therefore, collision risk for northern harriers at the Project is expected to be low.

Three active red-tailed hawk nests and 2 active Swainson's hawk nests were found within the Project area. Seven active red-tailed hawk nests, 1 active great-horned owl nest, and 1 active Swainson's hawk nest were found outside of the Project area within the 2-mile buffer. Additionally, 1 inactive nest was detected within the Project area and 8 inactive nests were detected within the 2-mile buffer. Inactive nests are possibly old red-tailed hawk and Swaisonson's hawk nests, found in previous years, within the Project area. Because raptor activity is typically higher near active nests, nesting raptors may have increased potential for collision if they repeatedly fly within the Project area during nesting activities.

The proximity of the Project area to the Canfield Lake National Wildlife Refuge (NWR) and the Burleigh County Wildlife Production Areas (WPAs) may increase the risk of turbine collision for waterfowl, if use equates to risk, as these areas attract migratory waterfowl. Turbines or any additional power lines sited in close proximity to the WMA or WPAs may also cause avoidance behavior that may be perceived as loss of habitat by a regulatory agency.

Twelve sharp-tailed grouse leks were detected within the Project area and the one-mile buffer. Sharp-tailed grouse and other prairie grouse species may be susceptible to habitat fragmentation and displacement caused by development of wind facilities. North Dakota considers sharp-tailed grouse a Level II Species of Conservation Priority (SCP). State designated SCPs are not afforded any formal protection by the state of North Dakota nor do they require special state designated

take permits. However, most of North Dakota's SCPs are protected by the MBTA and/or the ESA.

PROTECTED SPECIES

No federally listed threatened or endangered species were detected during avian point-count surveys. Two bald eagles were recorded as incidental observations during avian surveys. The bald eagle is protected under the Bald and Golden Eagle Protection Act (BGEPA).

All native birds are protected under the Migratory Bird Treaty Act, and take of even a single individual is prohibited. Currently, there are no permits available for incidental take of migratory birds.

Table ES-1. Spring Avian Use Summary

Variable	Result	Details
Non-raptors		
Mean use	100.23 birds/20 min	(Section 4.1)
Species detected at Wilton IV that are commonly (> 15 records) detected as wind farm fatalities	Yes	red-winged blackbird, western meadowlark, horned lark (Section 4.1)
Federally listed[1] species observed within the Project area	No	
State-listed species[2] within the Project area	N/A	
Raptors		
Mean use	0.42 birds/20 min	(Section 4.2)
Species detected at Wilton IV that are commonly (> 15 records) detected as wind farm fatalities	Yes	red-tailed hawk, northern harrier (Section 4.2)
Eagles observed within the Project area	Yes	bald eagle (Section 4.3)
Federally listed species observed within the Project area	No	
State-listed species[2] within the Project area	N/A	
Habitat		
Native habitat likely to be affected by development	Yes	Native prairie
Lakes (waterfowl and crane attractant)	Yes	Canfield Lake (2 miles from Project area)
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Burleigh County Waterfowl Production Areas (adjacent to Project) and Kettle ponds and intermittent creeks
Cliffs (raptor nesting and traveling)	None	
Rivers (permanent water source, migration corridor)	None	
Known refuges or habitat features that may funnel migrants	Yes	Canfield Lake National Wildlife Refuge and Burleigh County Waterfowl Production Areas

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

[2]North Dakota does maintain a list of Species of Conservation Priority (Hagen et al. 2005), but these species are not afforded any formal protection to by the state and there are no permitting requirements for them

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1.0 INTRODUCTION

1.1 WIND ENERGY AND BIRDS

Wind energy provides a clean, renewable energy source. As wind power has become more common, the need to address potential environmental impacts has increased. Birds have been identified as a group potentially at risk because of collisions with wind turbines and power lines, and displacement due to the presence of the associated structures (Erickson et al. 2005, Drewitt and Langston 2006, Arnett et al. 2007). Specifically, migrant passerines (e.g., songbirds) are found more often in post-construction mortality monitoring compared to other groups of birds (Arnett et al. 2007). In fact, at newer generation wind energy facilities outside of California, approximately 80 percent of documented fatalities have been songbirds, of which 50 percent are often nocturnal migrants (Erickson et al. 2001, Johnson et al. 2002, Drewitt and Langston 2006, Strickland and Morrison 2008). Although nocturnal migrants comprise the majority of songbird fatalities, the proportion of migrating songbirds killed at any given wind project during migration is reported to be low (Strickland et al. 2011). Locally breeding songbirds may experience lower mortality rates than migrants because many of these species tend not to fly at turbine heights during the breeding season. However, some breeding songbird species have behaviors that increase the risk of collisions with turbines. For example, horned larks have been commonly found (> 15 records) as fatalities at wind farms and mortality may be partially attributed to the breeding flight displays within the rotor swept area (Pickwell 1931, Johnson and Erickson 2011).

Despite the observation that 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). Raptor mortality at newer generation 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). Although raptor mortality is reduced at newer generation facilities, raptors remain the avian species group considered most susceptible to collisions with turbines (Strickland et al. 2011). Therefore local micro-siting and site evaluation efforts are still necessary to minimize potential project-related impacts to raptors.

In addition to mortality associated with wind farms, there is potential for bird species to avoid areas near turbines or experience habitat displacement after the wind farm is in operation (Drewitt and Langston 2006). To date, evidence of this potential impact to birds does not demonstrate a distinct trend; some studies have found decreased density or abundance of birds near turbines (e.g., grassland songbirds, Leddy et al. 1999, Erickson et al. 2004, Shaffer and Johnson 2009), while others have found no evidence of declines near turbines (Devereux et al. 2008, Shaffer and Johnson 2009, Pearce-Higgins et al. 2012). However, Pearce-Higgins et al.

(2012) detected disturbance-related effects during construction, indicating that disturbance effects may occur on a short-term basis.

Particular concern over avoidance issues has been raised by agencies and non-governmental groups with respect to grouse species (Manville 2004, USFWS 2012). However, 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). 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 et al. 2011). But other studies have found no evidence of avoidance of transmission lines or of wind facilities (Johnson et al. 2011, Johnson et al. 2012). The effect of tall structures on birds is not well understood, and focused studies that examine before and after effects and specific causal mechanisms are needed to support effective project siting and conservation planning (Walters et al. 2014). The only published research on operational wind facilities and grouse suggest long-term data sets are needed to adequately assess impacts (Johnson et al. 2012).

Finally, most native, migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918. Under the MBTA it is unlawful to take (i.e., kill) any migratory bird, including nests and nest contents. Currently, there are no permits for incidental take of migratory birds (Beveridge 2005).

1.2 STUDY DESCRIPTION

Wilton Wind IV, LLC, a subsidiary of NextEra Energy Resources, LLC, is planning to develop the Wilton IV Wind Energy Center (Project) in Burleigh County, North Dakota (Figure 1), located entirely on private lands. Wilton IV is committed to environmental due diligence and has contracted Tetra Tech, Inc. (Tetra Tech) to conduct spring avian surveys at the Project to quantify local avian use in the area and to evaluate the potential impacts of the Project to birds detected during the survey. These study objectives meet the requirements recommended under Tier 3 of the voluntary *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* (USFWS 2012).

The Project area covers approximately 24,375 acres and is mostly located in the Northwestern Glaciated Plains Ecoregion (Bryce et al. 1996). This semi-arid region of North Dakota includes level to rolling plains topography with isolated sandstone buttes or badland formations. Historically, much of the landscape was a mix of western mixed-grass prairie and shortgrass prairie with associated wetlands (Bryce et al. 1996). Today, most native grasslands have been largely replaced by agriculture in level areas. Remnant native grasslands may still persist in areas of steep or broken topography. Agriculture in the area consists predominantly of dry-land farming of alfalfa, sunflowers, corn, and soybeans and is interspersed with cattle grazing pastures

of shortgrass prairie. The area has numerous open water sources consisting mostly of kettle ponds in lowland areas. The Canfield Lake National Wildlife Refuge (NWR) and Burleigh County Waterfowl Production Areas (WPAs) are located northwest of the Project area (Figures 1 and 2).

North Dakota has 365 documented bird species (Faanes and Stewart 1982) and is situated within the Central Flyway, one of the main bird migratory routes in North America (USFWS 2011a). The Central Flyway runs through the central portion of the U.S. and, as a consequence, the Project area. During spring migration, most birds that move along the Central Flyway travel from wintering grounds as far away as South America via the Gulf of Mexico through the central states eventually reaching breeding grounds as far away as Alaska and northern Canada (USFWS 2011a).

2.0 METHODS

To evaluate avian risk at wind energy facilities, standardized protocols for pre-construction point counts have been established and were used in this study. This protocol is designed to be responsive to the level of effort recommended in the *National Wind Coordinating Committee's Comprehensive Guide to Studying Wind Energy/Wildlife Interactions* (Strickland et al. 2011) and the voluntary *U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines* (USFWS 2012). Data collected from these 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 facilities to minimize impacts to birds. Results in this report are presented in terms of species groups, and highlight any federal and state-listed species and eagles.

2.1 AVIAN SURVEYS

2.1.1 Point-count Surveys

An experienced field biologist (biologist) conducted 20-minute (min) point-count surveys at 5 locations within the Project area to evaluate avian use, behavior, and species (Figure 2). Although data were initially collected at 7 point-count locations, after a reduction of the Project area, 2 point-count locations fell outside of the updated Project boundary and were removed from analysis. The same point-locations were surveyed in Fall 2013. The biologist conducted 12 weekly surveys from March 17th through May 31st, 2014 (Table 1), thereby encompassing the spring migration to early breeding seasons. Tetra Tech distributed the survey locations throughout the Project area and chose locations that maximized the 360-degree sight distance for the observer and covered a diversity of habitats (Figure 2).

The biologist collected data on all birds detected within an 800-meter (m) radius of the point-count location. Surveys at each point-count location lasted for 20 minutes, during which time the

biologist continuously recorded any visual or auditory observations. The biologist recorded data including: 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 direction was recorded for individuals making directional flights, but was not recorded for individuals making localized movements.

The survey protocol used in this study is designed to collect data on all bird species and to provide results that are comparable with other studies at 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 fall and winter, songbirds are most active in the morning and can be difficult to detect during the afternoon. In contrast, raptors become active as the sunlight heats the air and creates thermals, which individual raptors use for soaring (Ballam 1984). Thus, raptors are more readily detected several hours after sunrise. Therefore, this protocol is appropriate for characterizing the entire bird community using the Project area. It should be noted, however, that this survey protocol can only detect nocturnal migrants should they be local breeders within the Project area or if they utilize the Project area as stopover habitat.

Tetra Tech chose 20-minute survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 minutes may lead to double-counting of songbirds (i.e., counting the same individual more than once) because individuals may appear and disappear from view. For example, if a horned lark is detected perched on a fence then disappears from view and, 6 minutes later, a horned lark is seen flying, these birds are recorded as separate observations because it is not possible to distinguish individuals. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-min survey, not number of distinct individual birds.

Detectability varies among species and potentially not all individuals within the 800-m 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. Hence, unidentified birds are included in the results.

2.1.2 Raptor Nest Surveys

The purpose of raptor nest surveys is to estimate the number of active and inactive raptor nests in the Project area. The biologist conducted the raptor nest survey of the Project area and 2-mile buffer before trees began to leaf out to increase visibility of raptor nests. In order to address USFWS concern for nesting bald eagle potential within the Project area and vicinity (T.

Ellsworth, personal communication, December 11, 2013), initial raptor nest surveys were performed in February, timed to coincide with pair formation and nest decorating for this species. A second round of surveys began in April and was timed to coincide with nest building of other raptor species. Once a nest was located, the biologist returned during the raptor breeding season to collect data on species, location, and activity status. Nests were classified as active if they had presence of an adult or young, active territory defense by an individual, or the presence of feathers, egg shells or droppings underneath the nest; otherwise a nest was classified as inactive. In addition, the biologist determined the nest condition and substrate. The biologist visited each nest a minimum of two times, once to determine the location of the nest and at least once to determine activity. The subsequent checks also allowed the biologist to detect later-nesting species such as Swainson's hawks. This raptor nest survey provides an estimate of the number and species of raptors that use stick nests in the immediate area. Ground-nesting raptor species, such as northern harriers, were not surveyed.

2.1.3 Grouse Lek Surveys

The USFWS along with the North Dakota Game and Fish Department (NDGF) have expressed concern regarding residential sharp-tailed grouse as a species of habitat fragmentation concern as outlined in the USFWS published Land-Based Wind Energy Guidelines (USFWS 2012). The biologist conducted grouse lek surveys to identify areas of use by breeding prairie grouse within the Project area and surrounding one-mile buffer. Surveys were conducted on April 12th, 22nd, and 25th with an additional survey and recheck of existing leks found on April 26th and May 9th. Survey duration was ½ hour before sunrise to two hours after sunrise. Surveys were conducted throughout the Project area and 1-mile buffer by driving county roads through areas identified as potential lek habitat. Typical grouse lek habitat in North Dakota is classified as open shortgrass vegetation that may contain scattered patches of small trees and shrubs with minimal amounts of agriculture crops. When conducting lek surveys, the biologist stopped every half-mile and listened for a minimum of five minutes for vocalizations of displaying males. The biologist did not conduct listening stops when winds exceeded 10 mph or if there was any type of precipitation. If a lek was located and visible, the biologist observed the lek for 10 minutes to count the number of males and females present.

2.2 INCIDENTAL OBSERVATIONS

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

2.3 PROTECTED SPECIES INFORMATION

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the take of any bald or golden eagle, alive or dead, including any part, nest, or egg. "Take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" a bald or golden eagle. "Disturb" means to agitate or bother an eagle to a degree that causes, or is likely to cause, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Applications for incidental take permits under BGEPA are being considered by USFWS for bald eagles throughout the contiguous U.S. and for golden eagles west of 100 degrees west longitude, which includes this Project (USFWS 2013).

The Endangered Species Act (ESA), as administered by the USFWS, mandates protection of species federally listed as threatened or endangered and their associated habitats. The ESA makes it unlawful to "take" a listed species. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect or attempt to engage in any such conduct" (USFWS 2011b). A list of endangered, threatened and candidate species for Burleigh County can be found at: http://www.fws.gov/northdakotafieldoffice/SEtable.pdf. Permits for incidental take of ESA protected species are available from USFWS.

The State of North Dakota 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.

2.4 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 a FileMaker Pro™ 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.

2.5 ANALYSIS

2.5.1 Species Groupings

Tetra Tech considered two primary groups of interest: raptors and non-raptors. Tetra Tech defined raptors as vultures, hawks, eagles, falcons, kestrels, kites, harriers, and owls. All other species groups are defined as non-raptors.

2.5.2 Avian Use

Tetra Tech derived avian use (mean use) of the Project by calculating the average number of birds observed per 20-minutes (birds/20 min) survey at each point-count location. To evaluate the diversity and composition of avian species using the Project area, Tetra Tech summarized the number of individuals and frequency (percentage of surveys where a species was detected) for species observed. Tetra Tech also calculated a measure of variability (90 percent confidence intervals) for all mean use values. In addition, the number of observations is also presented, where an observation can be either an individual bird or a discrete flock of birds. This information helps evaluate whether Project relative high mean use values are driven by a single event (e.g., a large flock of birds moving through the Project area on migration) or the result of more sustained use of the area by species. Because individual birds are not uniquely marked and easy to distinguish from one another, actual population size or abundance cannot be determined. One individual may be counted multiple times during a survey period or across survey periods. Although mean use of a given species does not equate to abundance, it does provide an index that is likely proportional to abundance and activity within the Project for species with similar detectability.

2.5.3 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 rotor swept area (RSA). NextEra plans to develop the Project using GE (General Electric) 1.715 MW (Megawatt) *Xle* turbines. These turbines have a hub height of 80 meters and a rotor diameter of 103 meters. With these specifications, the anticipated RSA is estimated to be between approximately 28 and 131.5 m above ground. 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.

2.5.4 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 min 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 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 project-related impact to a species.

Species with a high encounter rate are considered at a higher risk of collision than species with a low encounter rate, but it does not mean that turbine-related mortality is certain. Other factors such as turbine location or a species ability to detect turbine blades, flight maneuverability, and habitat selection also influence mortality (Orloff and Flannery 1992, Drewitt and Langston 2008, Martin 2011). Encounter values are sensitive to large flocks of birds flying within the RSA height; that is, a species will have a high encounter rate even if only observed once as a large flock in flight.

2.5.5 Mortality Risk

The highly regional nature of avian mean use across North America and the scarcity of publicly available data on avian mortality at wind farms in many parts of the continent, combined with other risk influences such as individual species behavior and weather, contribute to uncertainty in predicting fatality rates (Arnett et al. 2007, Strickland et al. 2011). A recent 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 predictor of mortality at a wind project is records of species-specific fatalities detected at nearby wind projects. As a result of uncertainty in predicting fatality rates, Tetra Tech did not attempt to derive mortality estimates from mean use data, but instead highlights those species or groups with high use values that may experience Project-related mortality or whose regional population could be impacted by development. Additionally, in this report, Tetra Tech highlights species with high frequencies of observation, high encounter rates, and those with records of turbine-related fatality at other wind projects, as these variables may also indicate potential collision risk at the Project.

3.0 RESULTS

3.1 AVIAN USE AND FREQUENCY OF OCCURRENCE

The biologist surveyed 2,483 acres during point-count surveys, covering 10 percent of the total Project area (24,375 acres). The 5 point-count locations were surveyed 12 times each, resulting in 60 total 20-minute surveys. A total of 6,040 birds from 50 species and 478 birds that could not be identified to species were recorded within the Project area during the point-count surveys (Table 2). Overall mean bird use for the Project area was 100.67 birds/20 min (Table 2). Mean use ranged from 0 to 2,135 birds/20 min over all point-count surveys conducted in Spring 2014.

Overall mean use by non-raptors was 100.23 birds/20 min. Waterfowl had the highest mean use (61.60 birds/20 min) among non-raptor species groups. Waterfowl comprised 61.2 percent of all birds observed, and were primarily detected at Point-Count location 3 (Table 3 and 4a). The waterfowl species with the highest mean use was the snow goose (52.52 birds/20 min, observed in 8.3 percent of all surveys; Tables 2 and 3). Overall, snow goose accounted for 52.2 percent of all birds observed in the Project area in Spring 2014 (Table 4a).

Songbirds had the second highest mean use (24.07 birds/20 min) and comprised 23.9 percent of all birds observed and were distributed throughout the Project area (Tables 2 and 3). The songbird species with the highest mean use was the red-winged blackbird (10.17 birds/20 min, observed in 28.3 percent of all surveys; Tables 2 and 3). Additionally, unidentified blackbird had a high mean use among songbirds (5.58 birds/20 min, observed in 3.3 percent of all surveys; Tables 2 and 3). Songbirds with a high frequency of observation but low mean use included western meadowlark (71.7 percent of all surveys) horned lark (53.3 percent of all surveys).

Cranes/rails were the group with the third highest mean use among non-raptor species groups (8.25 bird/20 min; Tables 2 and 3). Sandhill crane was the only species observed in this group during Spring 2014 surveys. Sandhill cranes were observed in 5.0 percent of all surveys and comprised 8.2 percent of all birds observed (Tables 2 and 3). Sandhill cranes were detected at point-count locations 4 and 5, 6 (Tables 3 and 4a).

Non-raptor mean use was highest on March 29th (752.80 birds/20 min; Figure 3). The primary contributors to the high mean use on March 29th were observations of migratory snow goose (3,140 individuals in 5 flocks of 120 to 2,000 individuals displaying directional flight). Mean use for non-raptors was highest at point-count locations 3 and 4 (216.92 and 103.25 birds/20 min, respectively; Figure 4). The high mean use at points 3 and 4 was caused mostly by high numbers of snow geese (2,120 and 720 individuals respectively; Table 4a). The habitat at Point-count Location 3 consists is shortgrass prairie and the habitat at Point-count Location 4 is shortgrass prairie and agriculture (cereal grains and corn). The habitat at these points is not unique within the Project area.

Overall mean use for raptors was 0.43 birds/20 min (Table 2); which places the group sixth among the nine species groups observed during spring 2014 point-count surveys. The raptor species with the highest mean use were the red-tailed hawk (0.23 birds/20 min; observed in 20.0 percent of all surveys) and northern harrier (0.12 birds/20 min; observed in 11.7 percent of all surveys; Tables 2 and 3). Other raptor species detected included the turkey vulture, Swainson's hawk, American kestrel and unidentified *Buteo* each with mean use values equal to or less than 0.03 birds/20 min and observed in less than 1.7 percent of all surveys (Tables 2 and 3).

Mean use by raptors was highest on April 19th and May 16th (1.20 birds/20 min and 1.00 birds/20 min, respectively; Figure 5). Raptor species observed on April 19th included red-tailed hawk (4 individuals) northern harrier (1 individual) and unidentified *Buteo* (1 individual). Raptors observed on May 16th included red-tailed hawk (4 individuals) and northern harrier (1 individual). Mean use for raptors was 0.80 birds/20 min or less for all other survey dates (Figure 5). Mean use for raptors was highest at Point-count Location 3 (0.83 birds/20 min; Figure 6). The species contributing the most to the mean use at Point-count Location 3 included the red-tailed hawk (6 individuals), northern harrier (2 individuals), and turkey vulture (2 individuals; Table

4b). Raptor mean use was equal to or less than 0.42 birds/20 min at all other points. The habitat at Point-count Location 3 is shortgrass prairie, which may provide foraging opportunities for raptors. These features are not unique to this point-count location or within the Project area.

3.2 FLIGHT HEIGHT AND ENCOUNTER RATE

During spring avian use surveys, the biologist collected behavioral data for 99.4 percent of all birds observed during point-count surveys of which 95.4 percent were observed flying. The biologist collected flight height data for 99.8 percent and flight direction for 91.2 percent of observations. Of non-raptor individuals observed flying, 12.6 percent flew below the height of the anticipated RSA, 18.1 percent flew at the height of the anticipated RSA and 69.3 percent flew above the height of the anticipated RSA (Table 6). Of raptor individuals observed flying, 95.5 percent flew below the height of the anticipated RSA, 0.0 percent flew at the height of the anticipated RSA, and 4.5 percent flew above the height of the anticipated RSA. Data on flight direction are located in Appendix 1a. Generally, 84.0 percent birds observed in flight were moving in a northerly direction (north, northeast, or northwest).

The red-winged blackbird had the highest encounter rate (8.34 birds flying at RSA height/20 min; Table 7b), followed by unidentified blackbird, cackling goose and Canada goose (5.00, 1.25, and 1.13 birds flying at RSA height/20 min respectively; Table 6a). All other species had an encounter rate at or below 0.85 birds flying at RSA height/20 min.

3.3 RAPTOR NEST SURVEYS

Raptor nest surveys occurred on February 7, April 4th, 10th, 14th, 19th, and May 7th. Raptor nests detected within the Project area included 3 active red-tailed hawks, 2 active Swainson's hawks, and 1 inactive nest (Figure 7 Appendix 2). Seven active red-tailed hawks, 8 inactive, 1 active Swainson's hawk and 1 active great-horned owl nest were found outside of the Project area within the 2-mile buffer (Figure 7; Appendix 2). Inactive nests are possibly old red-tailed hawk and Swainson's hawk nests, found in previous years. No eagle nests were located during the raptor nest surveys.

3.4 LEK SURVEYS

Grouse lek surveys were conducted within the Project area and a surrounding 1-mile buffer on April 12th, 22nd, and 25th with an additional recheck on April 26th and May 9th of leks previously detected. A total of 12 sharp-tailed grouse leks were found within the Project area and 1-mile buffer (Figure 7). Four of the leks were within the Project area (Figure 7). The smallest lek (Lek 8) had a maximum of only four individual grouse observed while the largest leks (leks 6 and 12) had a maximum of 11 individual grouse observed.

3.5 INCIDENTAL OBSERVATIONS

The biologist documented 18 species as incidental observations (Table 7). Of these species, 4 non-raptor species were not detected during spring point-count surveys: canvasback, green-winged teal, northern flicker and eastern bluebird (Table 7). One raptor species, rough-legged hawk, was detected incidentally but not during point-count surveys. Five raptor species, the American kestrel, northern harrier, red-tailed hawk, Swainson's hawk, and turkey vulture were detected both incidentally and during the point-count surveys.

3.6 PROTECTED SPECIES

No federally designated threatened or endangered species were observed during avian point-count surveys or as incidental observations. Two adult bald eagles were recorded incidentally; 1 on March 29th and another on April 4th. The March 29th observation was of an adult in flight 400-500 m above ground level near Point-count Location 3. The April 4th observation was of an adult perched in a tree near Point-count Location 4. No other observations of eagles were made during the spring 2014 point-count surveys.

4.0 DISCUSSION

The avian community detected within the Project area during spring surveys was characterized by species typically associated with agricultural lands and shortgrass prairie vegetation of North Dakota. Open, flat lands suitable for development within the Project area and vicinity have been developed for agricultural use, specifically crops such as wheat, sunflower, alfalfa, and corn. Additional lands that are not suitable to agricultural development are fenced parcels devoted to tame pastureland, with remnants of native shortgrass prairie that are used for cattle grazing or harvested hayfields. Within disturbed habitats such as these, the greatest potential impact of wind facilities to avian species is risk of collisions with turbines rather than disturbance or displacement. The close proximity of the Canfield Lake NWR and the WPAs may serve as an attractant to migratory bird species, especially waterfowl, crane/rails, and waterbird species groups, which pass through the area during the spring and fall migration. Publicly available mean avian fatality rates estimated from wind facilities in the Midwest (NE, WI, MN, and IA) range from 0.44 to 11.83 birds/turbine/year (0.49 – 7.17 birds/MW/year; Tetra Tech unpublished data). Any Project-related bird fatalities, should they occur, are expected to fall within this range.

4.1 NON-RAPTOR USE AND COLLISION RISK

Waterfowl may be at risk of collision due to the relatively high encounter rates and/or relatively high mean use rates recorded for some waterfowl species. Waterfowl species with high encounter rates included the cackling goose and the Canada goose. Fewer than 5 fatalities of Canada goose (Jain et al 2007), and no cackling goose fatalities have been documented at wind facilities with publically available data. The lack of documented fatalities of these species at

wind facilities within the migratory pathway (Jain 2005) indicates a low risk of Project-related fatalities. Both cackling goose and Canada goose are migratory in this region of North Dakota and therefore would be at the greatest fatality risk during the spring and fall.

Some songbird species may also be at risk of collision. Mean use was highest for red-winged blackbird and unidentified blackbird. Both had relatively high encounter rates (8.34 and 5.00 birds flying at RSA height/20 min respectively). The unidentified blackbirds were likely made up of red-winged blackbirds and common grackles, as well as other black songbird species. Two species, western meadowlark and horned lark, had a high frequency of detection (observed in 71.7 and 53.3 percent of all surveys respectively) but low mean use rate (1.42 and 1.37 birds/20 min respectively) and low encounter rates of 0.00 and 0.02 birds flying at RSA height/20 min respectively. These three songbird species, red-winged blackbird, western meadowlark, and horned lark, are local resident and migratory species commonly associated with the open pastureland, shortgrass prairie, and row-crop agriculture habitats found throughout the Project area and are widely distributed across North America. The red-winged blackbird, western meadowlark, and horned lark have all been documented as fatalities at other wind energy projects (Johnson et al. 2000, Derby et al. 2007, Jain et al. 2011), particularly horned larks which exhibit breeding flight displays that may bring them into the height of the RSA (Johnson and Erickson 2011). Thus, risk of turbine-related fatalities exists for each of these species at the Project. However, Project-related fatalities of red-winged blackbird, western meadowlark, and horned lark, should they occur, are unlikely to have population-level impacts because North Dakota populations for each species are large (8.2, 5.6, and 4.3 million each respectively; PIFSC 2013). Additionally, research suggests that avian collisions with manmade structures may have no discernable effect on populations (Arnold and Zink 2011).

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, infrequent flight within the height of the RSA, and/or few to no records of fatalities at other wind facilities with publically available results of mortality studies. Nonetheless, most avian species are protected by the MBTA.

4.2 RAPTOR USE AND COLLISION RISK

High raptor use (> 2.0 birds/20 min) has been associated with high raptor mortality at wind farms (Strickland et al. 2011). Conversely, raptor mortality appears to be low when raptor use is low (< 1.0 birds/20 min; Strickland et al. 2011), which is the case for raptor use at the Project area.

Red-tailed hawks and northern harriers were the raptor species with the highest mean use (0.23 and 0.12 birds/20 min, respectively) for the raptor species group and were also among the most frequently detected raptor species at the Project. Both species are commonly associated with agricultural and grassland habitats which provide opportunities for foraging, an activity

associated with susceptibility to turbine-collisions (Thelander et al. 2003). In a recent study of raptor response to wind farms, red-tailed hawks were observed engaging in high-risk flight behaviors at operational wind facilities whereas northern harriers were identified as having a low risk flight behavior for collisions (Garvin et al. 2011). Results from post-construction mortality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities (214 records of red-tailed hawk fatalities; e.g., Jain 2005, Grodsky and Drake 2011, Johnson and Erickson 2011). A total of 10 active red-tailed hawk nests were found in the Project area and within a 2-mile buffer. Because raptor activity is typically higher near active nests, red-tailed hawks may have increased potential for collision if they repeatedly fly within the Project area during nesting activities. Any Project-related fatalities are unlikely to have population-level impacts because red-tailed hawks are common nationwide (Sauer et al. 2012). Risk of collision by northern harriers is believed to be low because the majority of foraging flights occur below typical RSA heights (Whitfield and Madders 2006). Thus, risk of turbine-related fatalities of northern harriers at the Project is expected to be low given the typical flight behavior exhibited by the species, a low encounter rate of 0.01 birds flying at the RSA height/20 min, and the low level of use within the Project area. Project-related fatalities of northern harrier, should they occur, are unlikely to have population-level impacts because northern harriers are common nationwide (Sauer et al. 2012).

Other raptor species detected during spring surveys included the turkey vulture, Swainson's hawk and American kestrel. Three active Swainson's hawk nests were found within 2-miles and in the Project area that may increase the risk for collisions if adults repeatedly fly within the Project area during nesting activities and during the time when young begin to fledge. Swainson's hawk fatalities have been recorded at other wind energy facilities with publicly available data (Erickson et al. 2004, Gritski et al. 2010, Johnson and Erickson 2011). Given the low mean use of Swainson's hawks within the Project area, turbine-related fatalities are likely to be low. Both turkey vultures and American kestrels are commonly found as fatalities at wind facilities (Erickson et al. 2002, Stantec 2010). However, only one American kestrel and 2 turkey vultures were observed during surveys, suggesting a low risk for turbine collisions at the Project.

4.3 PROTECTED SPECIES

No federally listed threatened or endangered species were detected during avian point-count surveys. Two bald eagles were recorded incidentally during the point-count surveys and are protected under the BGEPA and MBTA (Section 2.1.3). Historically, permits were not available under the BGEPA for incidental takes from otherwise lawful activities; however, USFWS-promulgated regulations in 2009 provided for permits for incidental take associated with otherwise lawful activities, including wind energy (50 Code of Federal Regulations § 22.26).

Bald eagles are ubiquitous in areas of the North America with large water bodies, and the detection of two bald eagles incidentally during a season of point counts probably indicates a low risk of impacts to this increasingly common species.

4.4 COMAPRISON OF THE FALL 2013 AND SPRING 2014 AVIAN SURVEYS

The five point-count locations were surveyed 10 times during fall 2013 and 12 times during spring 2014. Numbers of detections and species richness were greater in the spring (6,040 birds from 50 species, and 478 unidentified birds) compared to fall (4,381 birds from 29 species including 226 unidentified birds; Table 2). Overall, snow goose, red-winged blackbird, common grackle, American coot, and sandhill crane were the most commonly observed species during the spring and fall avian surveys (Table 2) There were 32 species detected in the spring that were not detected in the fall, and 10 species detected in the fall that were not detected in the spring, suggesting a slight variation in the community of migrants using the area between the two seasons. Overall mean use in the spring was higher at 100.67 birds/20 min compared to the 87.62 birds/20 min in the fall (Table 2). Songbirds had the highest mean use in the fall with red-winged blackbird and common grackle the most commonly observed species in the songbird group. The Waterfowl group had the highest mean use in the spring survey with snow goose the most commonly observed species within the waterfowl group. The Cranes/rails species group, which includes sandhill crane, had the third highest mean use among species groups in both spring and fall. Raptors had the seventh and sixth highest mean use among species groups (out of nine) in the spring and fall seasons respectively (Table 2). Red-tailed hawks and northern harriers had the highest mean use among raptors in both seasons.

Flight behavior varied among seasons with both non-raptors and raptors flying more frequently at RSA height in the fall than in spring (Table 5). Snow goose had the highest encounter rate in the fall, but its encounter rate was lower than those of red-winged blackbird and unidentified blackbird in the spring (Tables 6a and 6b). The overall combined results of the fall and spring surveys show that red-winged blackbird, unidentified blackbird, snow goose and greater white-fronted goose had the highest encounter rates (Table 6c). Note that most of the greater white-fronted goose observations were during the fall 2013 surveys and mean use by this species was not as high as that of other goose species in spring. Snow goose and red-winged blackbird were two species that were observed with directional flights generally northward in spring and southward in fall as would be expected during the respective migration periods (Appendix 1a and 1b).

Spatial patterns in use were relatively consistent among seasons. During the fall, point-count location 4 had the highest number of individual non-raptors, whereas point-count location 3 had the highest number of non-raptor individuals in the spring (Tables 4a and Tables 4b). Point-count locations 3 and 4 are directly south of the Burleigh County WPAs and Canfield Lake NWR.

Both the wildlife refuge and waterfowl production areas provide an attractant to waterfowl, waterbird, and shorebird species migrating through the area during the spring and fall surveys. For raptors, point-count locations 2 and 5 during the fall survey and Point-count Location 3 during the spring survey had the highest number of individual raptors (Table 4a and 4b). The habitat at these points is not unique to the Project area but may provide desirable foraging habitat as open grassland/agriculture habitats. There are no habitat features in the Project area that would concentrate raptors during migration. The majority of the raptors observed were red-tailed hawks and northern harriers which are common breeding and migratory raptors to North Dakota and the Project area.

4.5 WILTON IV WIND ENERGY CENTER CONCLUSIONS FOR SPRING 2014

Results of the spring 2014 avian surveys at the Project area suggest an overall low impact of the Project development on the local avian community. The mean-use rate at the Project by non-raptors is primarily driven by a few common residents and migratory species. Based on encounter rates, frequency of occurrence and fatalities detected at regional wind farms, there is potential for turbine-related fatalities of cackling goose, Canada goose, red-winged blackbird, western meadowlark, horned lark, red-tailed hawk, and northern harrier in the Project area. However, fatalities are not expected to have population-level impacts. If avian fatality rates are similar to other wind facilities within the region, we would expect them to fall between 0.44 – 11.83 birds/turbine/year (0.49 – 7.17 birds/MW/year). Additionally, the potential for turbine-related fatalities exists for nocturnal migrant species not identifiable by the methods of this study.

The proximity of the Project area to the Canfield Lake NWR and the Burleigh County WPAs may increase the risk to waterfowl of turbine collisions if use equates to risk, as these areas attract migratory waterfowl. Turbines or any additional power lines sited in close proximity to the NWR or the WPAs may also cause displacement from suitable habitat.

No federally listed threatened or endangered species were detected incidentally during avian point-count surveys. Two bald eagles were recorded as incidental observations during avian surveys. Both bald and golden eagles are protected under the BGEPA and MBTA, but the low use by eagles suggests low risk to these species. Twelve sharp-tailed grouse leks, a state Level II SCP, were located within the Project area and 1-mile buffer. SCP receives no regulatory protection under state law. All native migratory avian species are protected by the MBTA.

5.0 REFERENCES

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 (9): e24708.

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

Beveridge, L. J. 2005. The Migratory Bird Treaty Act and wind development. North American Wind Power September: 36-38.

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

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

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.

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. Prepared for Nebraska Public Power District, Columbus, NE. 24 pgs.

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.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young Jr., K.J. Sernka, and R E. Good. 2001. Avian collisions with wind turbines: a summary of existing studies and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, Washington, DC. Accessed at http://www.nationalwind.org/assets/archive/Avian_Collisions_with_Wind_Turbines_-

_A_Summary_of_Existing_Studies_and_Comparisons_to_Other_Sources_of_Avian_Collision_Mortality_in_the_United_States__2001_.pdf

Faanes, C.A., and R.E. Stewart. 1982. Revised checklist of North Dakota birds. Version 16JUL97. The Prairie Naturalist 14(3):81-92. Jamestown, ND: Northern Prairie Wildlife Research Center Online. Available online at: http://www.npwrc.usgs.gov/resource/birds/chndbird/index.htm. Accessed June 2014.

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.

Gritski, B., S. Downes, and K. Kronner. 2010. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring Study October 2007–October 2009. Prepared for Iberdrola Renewables, Klondike Wind Power III, LLC, Portland, OR. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendeleton, Oregon. April 21, 2010.

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.

Hagen, S.K., P.T. Isakson, and S.R. Dyke. 2005. North Dakota Comprehensive Wildlife Conservation Strategy. North Dakota Game and Fish Department. Bismarck, ND.

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.

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. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. Thesis submitted to Iowa State University, Ames, IA. 113 pgs.

Johnson, D.H., M.J. Holloran, J.W. Connelly, S.E. Hanser, C.L. Amundson, and S.T. Knick. 2011. Influences of Environmental and Anthropogenic Features on Greater Sage-grouse Populations, 1997-2007. Pages 407-450 in S.T. Knick and J.W. Connelly. Greater Sage-Grouse: ecology and conservation of a landscape species and its habitat. Studies in Avian Biology 38. University of California Press, Berkeley, CA.

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.

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., 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.

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.

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.

Manville, A.M., II. 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.

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

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.

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.

Pickwell, B. 1931. The prairie horned lark. St. Louis Academy of Sciences Transactions 27:1-153.

PIFSC (Partners in Flight Science Committee) 2013. Population Estimates Database, version 2013. Available at http://rmbo.org/pifpopestimates. Accessed on June 2014.

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.

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.

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2012. The North American Breeding Bird Survey, Results and Analysis 1966 - 2011. Version - 07.03.2013 USGS Patuxent Wildlife Research Center, Laurel, MD

Shaffer, J.A. and D.H. Johnson. 2009. Displacement effects of wind developments on grassland birds in the northern Great Plains. NWCC Wind Wildlife Conference [Presentation],

October 2008. Milwaukee, WI. Prepared for NWCC by S.S Schwartz and Published 2009. Available online at: https://www.nationalwind.org/assets/research_meetings/Research_Meeting_VII_Shaffer.pdf. Accessed June 2014.

Stantec Consulting, Inc. (Stantec). 2010. Cohocton and Dutch Hill Wind Farms Year 1 Post-Construction Monitoring Report, 2009, for the Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Prepared for Canandaigua Power Partners, LLC and Canandaigua Power Partners II, LLC, Portland, Maine. Prepared by Stantec, Topsham, Maine. January 2010.

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. Accessed June 2014.

Strickland, D. and M.L. Morrison. 2008. A summary of avian/wind facility interactions in the U.S. Federal Guidelines Committee for Wind Siting Guidelines, February 26, 2008, Washington, DC.

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 (U.S. Fish and Wildlife Service). 2013. Eagle Conservation Plan Guidance. Module 1 – Land-based Wind Energy. Version 2. USFWS Division of Migratory Bird Management. April 2013.

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. 2011a. Flyways. Retrieved from: http://flyways.us/flyways/info Accessed June 2014.

USFWS. 2011b. ESA Basics: More Than 30 Years of Conserving Endangered Species. Retrieved from: http://www.fws.gov/endangered/esa-library/pdf/ESA_basics.pdf.

Walters, K., K. Kosciuch, and J. Jones. 2014. Can the effect of tall structures on birds be isolated from other aspects of development? Wildlife Society Bulletin: 10.1002/wsb.394.

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.

FIGURES

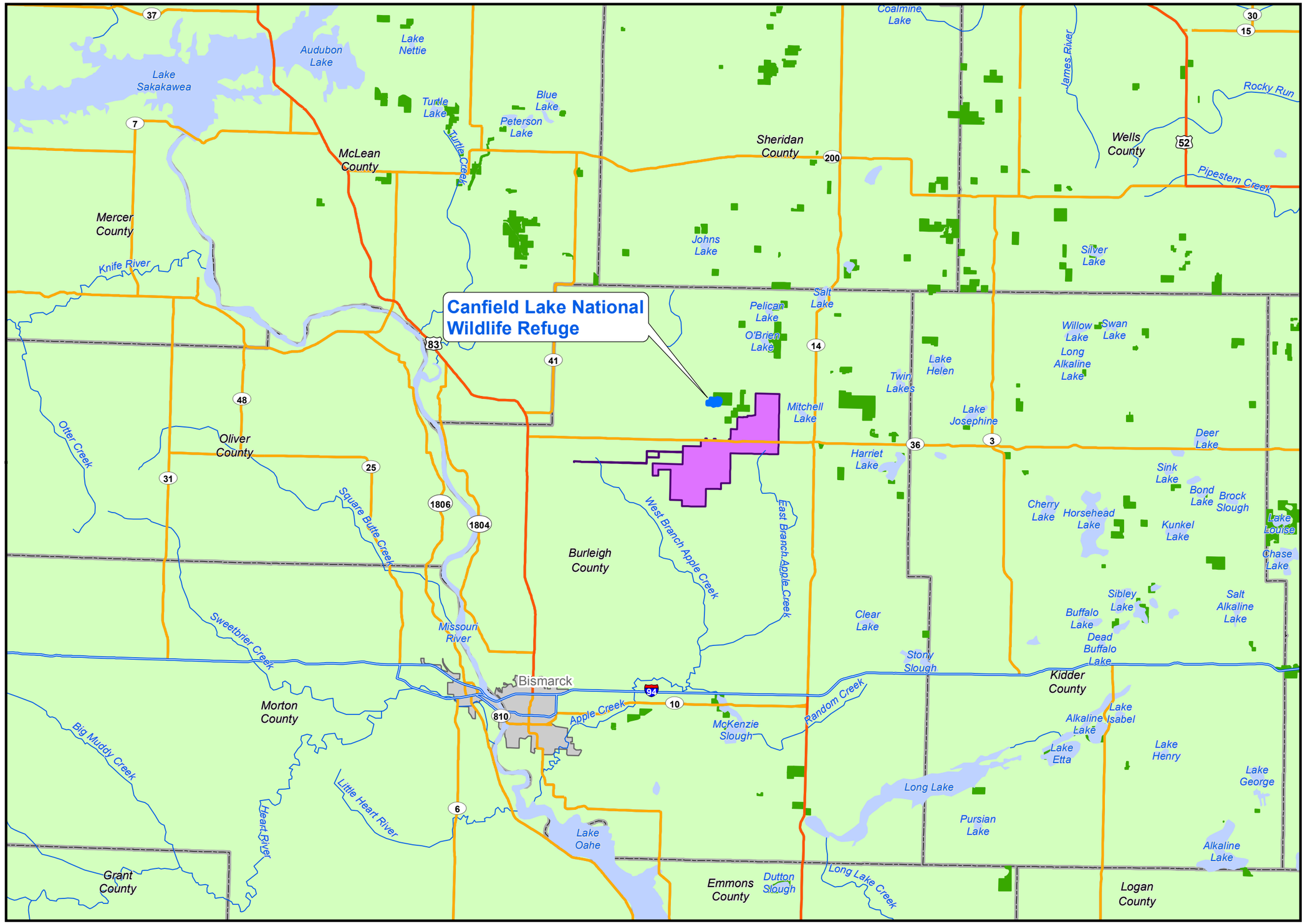
Figure 1

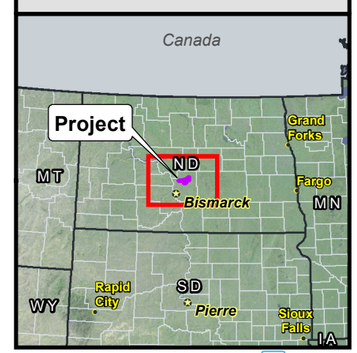
Vicinity map

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014





- Project area
- County Boundary
- Urban area
- Canfield Lake National Wildlife Refuge
- Waterfowl Production Area
- Interstate Highway
- Federal Highway
- State Highway
- River/Stream
- Lake/Pond

TETRA TECH

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Figure 2

Point-count location map (Spring 2014)

NextEra ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

Canfield Lake National Wildlife Refuge

PC 02
PC 03
PC-04
PC 05
PC 06

Regan
Wing
Old Hwy 36
Main St S
Hill St
Canfield Lake
Mirage Lake
Lonetree Lake
Carmel Slough
Burleigh County Waterfowl Production Area

357Th Ave NE
344Th Ave NE
331St Ave NE
318Th Ave NE
292Nd Ave NE
279Th Ave NE
266th Ave Ne
253Rd Ave NE
240th Ave Ne
227Th Ave NE

145Th St NE
158Th St NE
119Th St NE
132Nd St NE
171St St NE
184Th St NE
197Th St NE
210Th St NE
223Rd St NE
236Th St NE
249Th St NE
262Nd St NE
275Th St NE
288Th St NE
301St St NE
327Th St NE
158th St Ne
171st St Ne
249th St Ne
275th St Ne
288Th St NE

CR 1804

Avian Survey Point

Avian Survey Point 800-m Radius

PC# Point count number

Project area

Canfield Lake National Wildlife Refuge

Burleigh County Waterfowl Production Area

State Highway

Local Road

1:75,000 WGS 1984 UTM 14

0 0.5 1 2 3 4 5 6 7 8 9 10 Miles

TETRA TECH

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Figure 3. Non-raptor mean use by survey date during Spring 2014 point-count surveys at the Wilton IV Wind Energy Center.

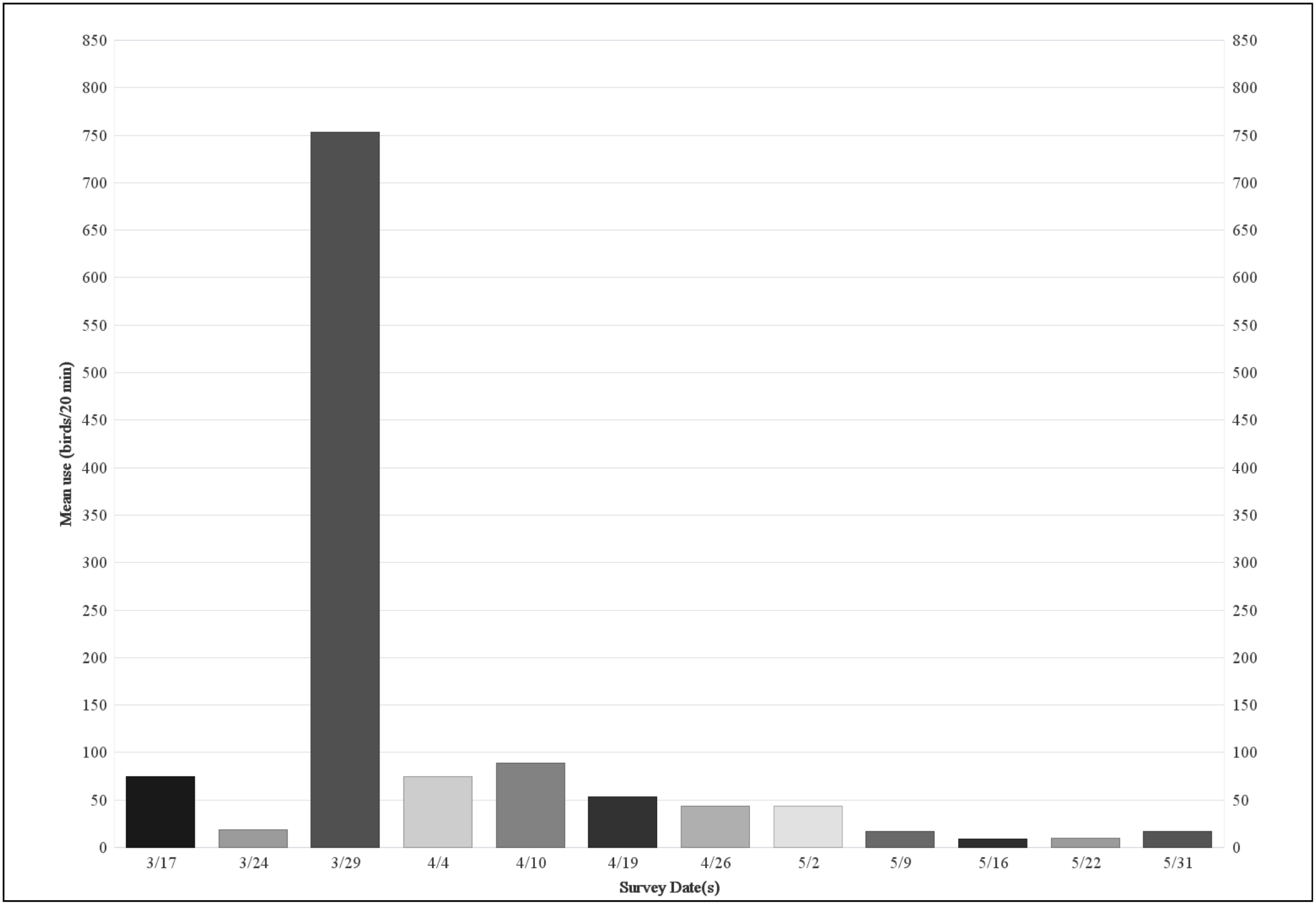

Figure 4

Non-raptor mean use by point-count location (Spring 2014)

NextEra ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

Canfield Lake National Wildlife Refuge

32.00
PC 02

103.25
PC 04

216.92
PC 03

91.25
PC 05

57.75
PC 06

Non-raptors Per 20 Minutes

- 25.90 - 50.00
- 50.01 - 100.00
- 100.01 - 150.00
- 150.01 - 200.00
- 200.01 - 250.00

 # Mean use value
PC# Point count number

- Project area
- Canfield Lake National Wildlife Refuge
- Burleigh County Waterfowl Production Area
- State Highway
- Local Road

1:75,000 WGS 1984 UTM 14

0 0.5 1 2 3 4 5 6 7 8 9 10 Miles

TETRA TECH

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Figure 5. Raptor mean use by survey date during Spring 2014 point-count surveys at the Wilton IV Wind Energy Center.

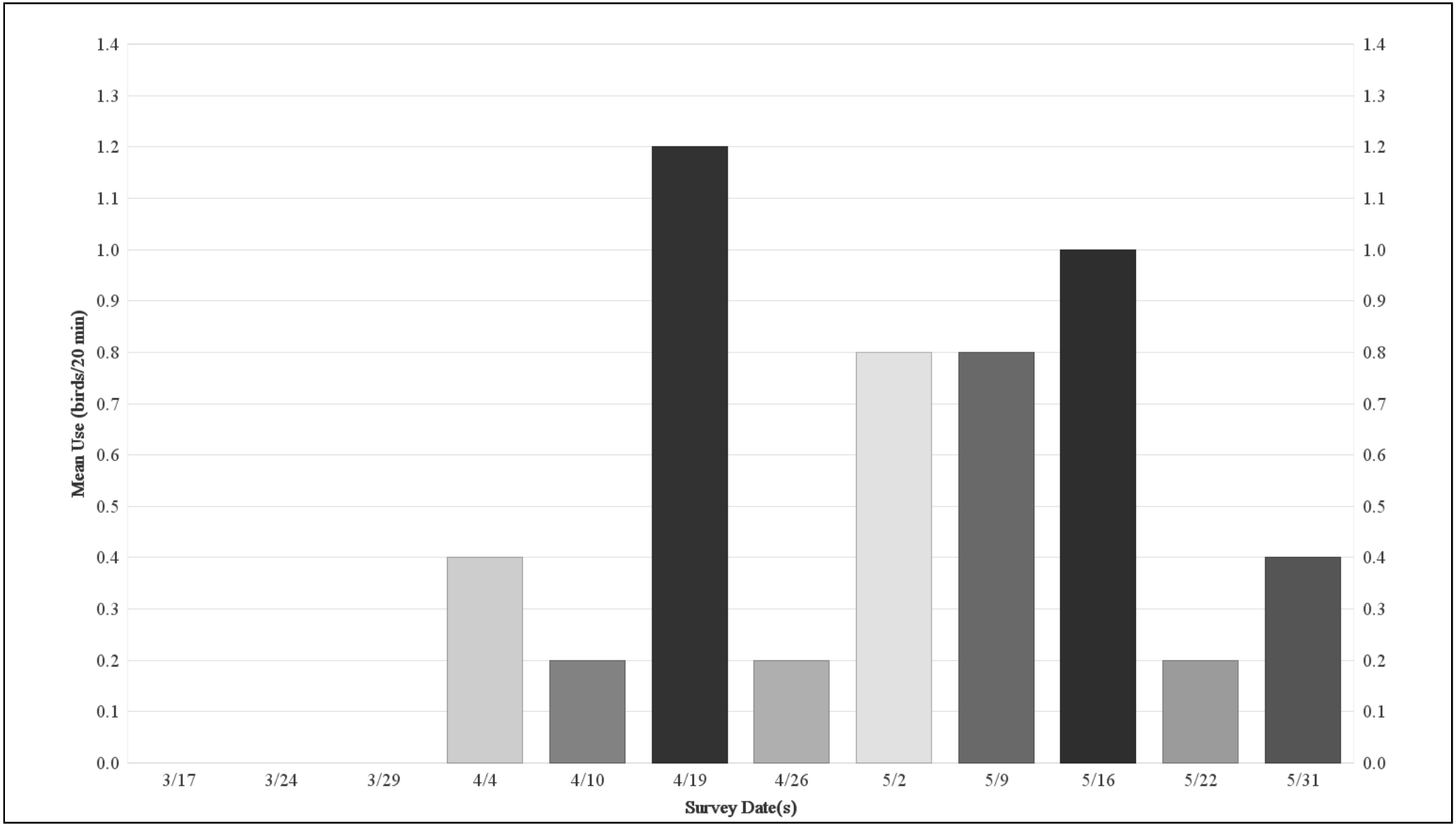

Figure 6

Raptor mean use by point-count location (Spring 2014)

NextEra ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

Raptors Per 20 Minutes

- 0.01 - 0.25
- 0.26 - 0.50
- 0.51 - 0.75
- 0.76 - 1.00

 # Mean use value
PC# Point count number

- Project area
- Canfield Lake National Wildlife Refuge
- Burleigh County Waterfowl Production Area
- State Highway
- Local Road

Canfield Lake National Wildlife Refuge

0.33 PC 02
0.83 PC 03
0.42 PC 04
0.42 PC 05
0.17 PC 06

1:75,000 WGS 1984 UTM 14

0 0.5 1 2 3 4 5 6 7 8 9 10 Miles

TETRA TECH

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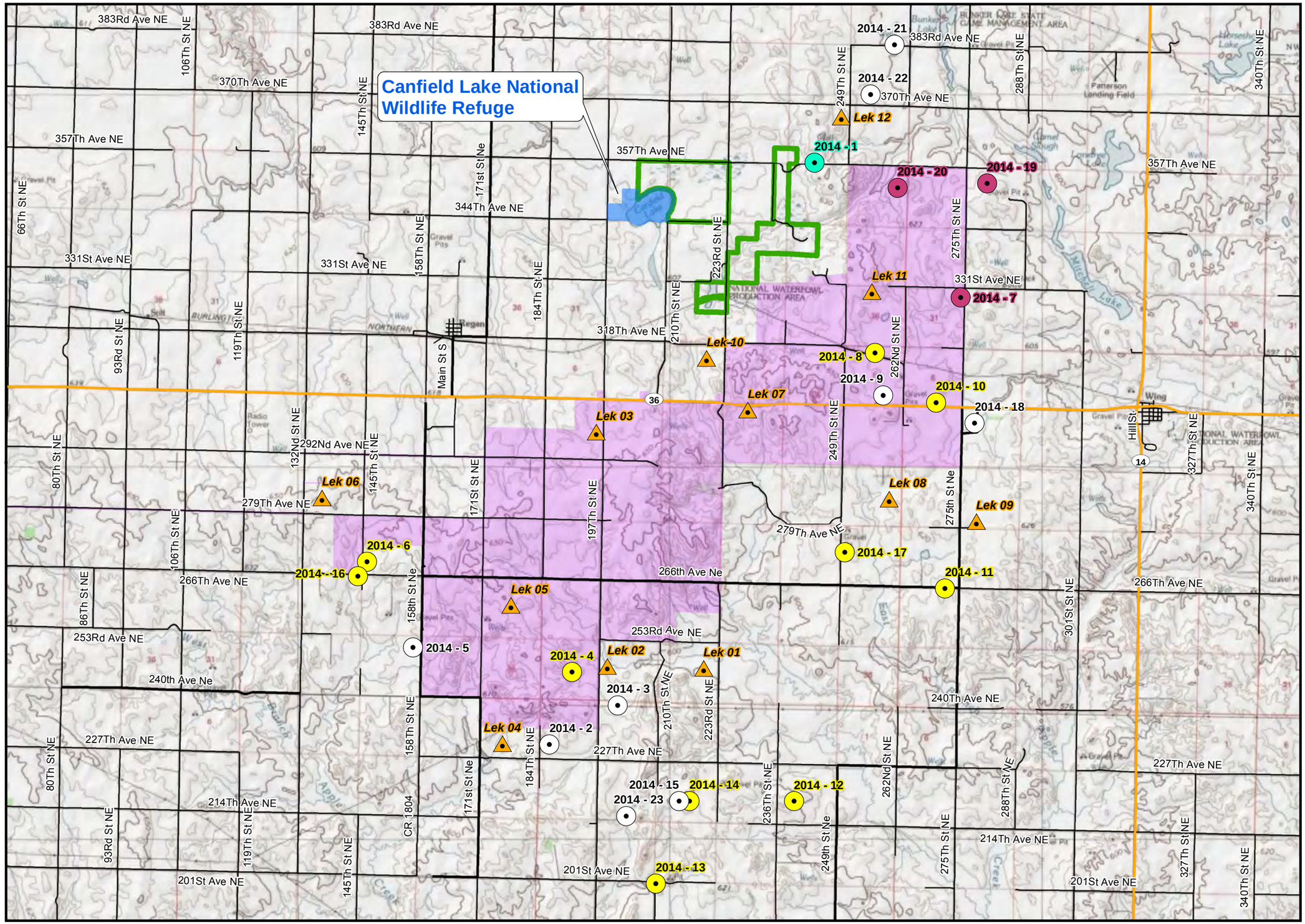

Figure 7

Raptor nest and lek location map (Spring 2014)

NEXTera ENERGY RESOURCES

Wilton IV Wind Energy Center

Burleigh County, ND
September 25, 2014

- Sharp-tailed grouse lek observation

Raptor Nest

- Swainson's hawk
- great horned owl
- red-tailed hawk
- Inactive Raptor Nest
- Project area
- Canfield Lake National Wildlife Refuge
- Burleigh County Waterfowl Production Area
- State Highway
- Local Road

TETRA TECH

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TABLES

Table 1. Wilton IV Wind Energy Center point count survey dates.

	Survey Number	Date(s)
Fall 2013		
	1	9/10
	2	9/19
	3	9/27
	4	10/3
	5	10/9
	6	10/16
	7	10/25
	8	11/1
	9	11/7
	10	11/15
Spring 2014		
	1	3/17
	2	3/24
	3	3/29
	4	4/4
	5	4/10
	6	4/19
	7	4/26
	8	5/2
	9	5/9
	10	5/16
	11	5/22
	12	5/31

Table 2. Avian mean use, by species group, observed during point-count surveys at the Wilton IV Wind Energy Center, 2013-2014.

Species Group Species	Fall 2013			Spring 2014			Overall		
	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.
Waterfowl									
snow goose	1200	8	24.00	3151	7	52.52	4351	15	39.55
greater white-fronted goose	380	4	7.60	138	3	2.30	518	7	4.71
Canada goose	89	4	1.78	174	23	2.90	263	27	2.39
cackling goose	0	0	0.00	185	3	3.08	185	3	1.68
mallard	0	0	0.00	32	18	0.53	32	18	0.29
tundra swan	20	2	0.40	0	0	0.00	20	2	0.18
northern pintail	0	0	0.00	13	8	0.22	13	8	0.12
blue-winged teal	0	0	0.00	2	1	0.03	2	1	0.02
northern shoveler	0	0	0.00	1	1	0.02	1	1	0.01
Group Total	**1689**	**18**	**33.78**	**3696**	**64**	**61.60**	**5385**	**82**	**48.95**
Songbirds									
red-winged blackbird	856	8	17.12	610	22	10.17	1466	30	13.33
common grackle	928	16	18.56	81	18	1.35	1009	34	9.17
unidentified blackbird	195	2	3.90	335	2	5.58	530	4	4.82
horned lark	202	26	4.04	82	46	1.37	284	72	2.58
western meadowlark	20	18	0.40	85	84	1.42	105	102	0.95
European starling	10	2	0.20	76	3	1.27	86	5	0.78
brown-headed cowbird	7	1	0.14	40	10	0.67	47	11	0.43
American crow	24	5	0.48	11	7	0.18	35	12	0.32
American tree sparrow	30	1	0.60	0	0	0.00	30	1	0.27
barn swallow	25	5	0.50	0	0	0.00	25	5	0.23
bank swallow	0	0	0.00	24	1	0.40	24	1	0.22

Table 2. Avian mean use, by species group, observed during point-count surveys at the Wilton IV Wind Energy Center, 2013-2014.

Species Group Species	Fall 2013			Spring 2014			Overall		
	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.
Lapland longspur	0	0	0.00	17	2	0.28	17	2	0.15
snow bunting	16	2	0.32	0	0	0.00	16	2	0.15
bobolink	0	0	0.00	16	16	0.27	16	16	0.15
vesper sparrow	0	0	0.00	15	15	0.25	15	15	0.14
American goldfinch	11	7	0.22	2	2	0.03	13	9	0.12
savannah sparrow	0	0	0.00	10	10	0.17	10	10	0.09
grasshopper sparrow	0	0	0.00	10	10	0.17	10	10	0.09
American robin	0	0	0.00	9	3	0.15	9	3	0.08
tree swallow	0	0	0.00	8	2	0.13	8	2	0.07
yellow-headed blackbird	0	0	0.00	4	2	0.07	4	2	0.04
western kingbird	0	0	0.00	3	3	0.05	3	3	0.03
blue jay	0	0	0.00	2	1	0.03	2	1	0.02
yellow-rumped warbler	0	0	0.00	1	1	0.02	1	1	0.01
unidentified sparrow	0	0	0.00	1	1	0.02	1	1	0.01
song sparrow	0	0	0.00	1	1	0.02	1	1	0.01
northern shrike	1	1	0.02	0	0	0.00	1	1	0.01
eastern kingbird	0	0	0.00	1	1	0.02	1	1	0.01
Group Total	**2325**	**94**	**46.50**	**1444**	**263**	**24.07**	**3769**	**357**	**34.26**
Cranes/Rails									
sandhill crane	261	7	5.22	495	5	8.25	756	12	6.87
Group Total	**261**	**7**	**5.22**	**495**	**5**	**8.25**	**756**	**12**	**6.87**
Gulls/Terns									
unidentified gull	30	1	0.60	141	3	2.35	171	4	1.55

Table 2. Avian mean use, by species group, observed during point-count surveys at the Wilton IV Wind Energy, 2013-2014.

Species Group Species	Fall 2013			Spring 2014			Overall		
	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.
Franklin's gull	0	0	0.00	62	2	1.03	62	2	0.56
Bonaparte's gull	0	0	0.00	29	4	0.48	29	4	0.26
ring-billed gull	0	0	0.00	9	2	0.15	9	2	0.08
Group Total	**30**	**1**	**0.60**	**241**	**11**	**4.02**	**271**	**12**	**2.46**
Gamebirds									
ring-necked pheasant	6	6	0.12	51	49	0.85	57	55	0.52
sharp-tailed grouse	26	9	0.52	19	11	0.32	45	20	0.41
gray partridge	14	1	0.28	1	1	0.02	15	2	0.14
Group Total	**46**	**16**	**0.92**	**71**	**61**	**1.18**	**117**	**77**	**1.06**
Raptors									
red-tailed hawk	13	12	0.26	14	12	0.23	27	24	0.25
northern harrier	6	6	0.12	7	7	0.12	13	13	0.12
Swainson's hawk	2	2	0.04	1	1	0.02	3	3	0.03
turkey vulture	0	0	0.00	2	1	0.03	2	1	0.02
American kestrel	1	1	0.02	1	1	0.02	2	2	0.02
unidentified hawk	1	1	0.02	0	0	0.00	1	1	0.01
unidentified buteo	0	0	0.00	1	1	0.02	1	1	0.01
merlin	1	1	0.02	0	0	0.00	1	1	0.01
Cooper's hawk	1	1	0.02	0	0	0.00	1	1	0.01
bald eagle	1	1	0.02	0	0	0.00	1	1	0.01
Group Total	**26**	**25**	**0.52**	**26**	**23**	**0.43**	**52**	**48**	**0.47**
Waterbirds									
Wilson's snipe	0	0	0.00	12	11	0.20	12	11	0.11

Table 2. Avian mean use, by species group, observed during point-count surveys at the Wilton IV Wind Energy Center, 2013-2014.

Species Group Species	Fall 2013			Spring 2014			Overall		
	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.	# Birds	# Obs.	Mean Use # birds/ 20 min.
killdeer	0	0	0.00	12	10	0.20	12	10	0.11
upland sandpiper	0	0	0.00	5	5	0.08	5	5	0.05
marbled godwit	0	0	0.00	3	2	0.05	3	2	0.03
great blue heron	0	0	0.00	3	2	0.05	3	2	0.03
double-crested cormorant	3	1	0.06	0	0	0.00	3	1	0.03
Group Total	**3**	**1**	**0.06**	**35**	**30**	**0.58**	**38**	**31**	**0.35**
Pigeons/Doves									
rock pigeon	0	0	0.00	17	2	0.28	17	2	0.15
mourning dove	1	1	0.02	14	9	0.23	15	10	0.14
Group Total	**1**	**1**	**0.02**	**31**	**11**	**0.52**	**32**	**12**	**0.29**
Woodpeckers									
downy woodpecker	0	0	0.00	1	1	0.02	1	1	0.01
Group Total	**0**	**0**	**0.00**	**1**	**1**	**0.02**	**1**	**1**	**0.01**
Grand Total	**4381**	**163**	**87.62**	**6040**	**469**	**100.67**	**10421**	**632**	**94.74**

Table 3. Avian percent composition and frequency, sorted by species group, observed during point-count surveys at theWilton IV Wind Energy Center, 2013-2014.

Species Group Species	Fall 2013		Spring 2014		Overall	
	Percent Composition	**Frequency** % of surveys detected	**Percent Composition**	**Frequency** % of surveys detected	**Percent Composition**	**Frequency** % of surveys detected
Waterfowl						
snow goose	27.4	10.0	52.2	8.3	41.8	9.1
greater white-fronted goose	8.7	8.0	2.3	5.0	5.0	6.4
Canada goose	2.0	8.0	2.9	26.7	2.5	18.2
cackling goose	0.0	0.0	3.1	3.3	1.8	1.8
mallard	0.0	0.0	0.5	18.3	0.3	10.0
tundra swan	0.5	4.0	0.0	0.0	0.2	1.8
northern pintail	0.0	0.0	0.2	13.3	0.1	7.3
blue-winged teal	0.0	0.0	0.0	1.7	0.0	0.9
northern shoveler	0.0	0.0	0.0	1.7	0.0	0.9
Group Total	**38.6**	**26.0**	**61.2**	**51.7**	**51.7**	**40.0**
Songbirds						
red-winged blackbird	19.5	14.0	10.1	28.3	14.1	21.8
common grackle	21.2	22.0	1.3	23.3	9.7	22.7
unidentified blackbird	4.5	4.0	5.5	3.3	5.1	3.6
horned lark	4.6	46.0	1.4	53.3	2.7	50.0
western meadowlark	0.5	24.0	1.4	71.7	1.0	50.0
European starling	0.2	4.0	1.3	3.3	0.8	3.6
brown-headed cowbird	0.2	2.0	0.7	11.7	0.5	7.3
American crow	0.5	10.0	0.2	11.7	0.3	10.9
American tree sparrow	0.7	2.0	0.0	0.0	0.3	0.9
barn swallow	0.6	8.0	0.0	0.0	0.2	3.6
bank swallow	0.0	0.0	0.4	1.7	0.2	0.9
Lapland longspur	0.0	0.0	0.3	3.3	0.2	1.8
snow bunting	0.4	4.0	0.0	0.0	0.2	1.8
bobolink	0.0	0.0	0.3	16.7	0.2	9.1
vesper sparrow	0.0	0.0	0.2	18.3	0.1	10.0
American goldfinch	0.3	14.0	0.0	3.3	0.1	8.2

Table 3. Avian percent composition and frequency, sorted by species group, observed during point-count surveys at the Wilton IV Wind Energy Center, 2013-2014.

Species Group Species	Fall 2013		Spring 2014		Overall	
	Percent Composition	**Frequency** % of surveys detected	**Percent Composition**	**Frequency** % of surveys detected	**Percent Composition**	**Frequency** % of surveys detected
savannah sparrow	0.0	0.0	0.2	11.7	0.1	6.4
grasshopper sparrow	0.0	0.0	0.2	13.3	0.1	7.3
American robin	0.0	0.0	0.1	3.3	0.1	1.8
tree swallow	0.0	0.0	0.1	3.3	0.1	1.8
yellow-headed blackbird	0.0	0.0	0.1	3.3	0.0	1.8
western kingbird	0.0	0.0	0.0	5.0	0.0	2.7
blue jay	0.0	0.0	0.0	1.7	0.0	0.9
yellow-rumped warbler	0.0	0.0	0.0	1.7	0.0	0.9
unidentified sparrow	0.0	0.0	0.0	1.7	0.0	0.9
song sparrow	0.0	0.0	0.0	1.7	0.0	0.9
northern shrike	0.0	2.0	0.0	0.0	0.0	0.9
eastern kingbird	0.0	0.0	0.0	1.7	0.0	0.9
Group Total	**53.1**	**82.0**	**23.9**	**95.0**	**36.2**	**89.1**
Cranes/Rails						
sandhill crane	6.0	14.0	8.2	5.0	7.3	9.1
Group Total	**6.0**	**14.0**	**8.2**	**5.0**	**7.3**	**9.1**
Gulls/Terns						
unidentified gull	0.7	2.0	2.3	5.0	1.6	3.6
Franklin's gull	0.0	0.0	1.0	3.3	0.6	1.8
Bonaparte's gull	0.0	0.0	0.5	5.0	0.3	2.7
ring-billed gull	0.0	0.0	0.1	3.3	0.1	1.8
Group Total	**0.7**	**2.0**	**4.0**	**11.7**	**2.6**	**7.3**
Gamebirds						
ring-necked pheasant	0.1	10.0	0.8	56.7	0.5	35.5
sharp-tailed grouse	0.6	12.0	0.3	13.3	0.4	12.7
gray partridge	0.3	2.0	0.0	1.7	0.1	1.8
Group Total	**1.0**	**18.0**	**1.2**	**60.0**	**1.1**	**40.9**

Table 3. Avian percent composition and frequency, sorted by species group, observed during point-count surveys at the Witlon IV Wind Energy Center, 2013-2014.

Species Group Species	Fall 2013		Spring 2014		Overall	
	Percent Composition	**Frequency** % of surveys detected	**Percent Composition**	**Frequency** % of surveys detected	**Percent Composition**	**Frequency** % of surveys detected
Raptors						
red-tailed hawk	0.3	24.0	0.2	20.0	0.3	21.8
northern harrier	0.1	12.0	0.1	11.7	0.1	11.8
Swainson's hawk	0.0	4.0	0.0	1.7	0.0	2.7
turkey vulture	0.0	0.0	0.0	1.7	0.0	0.9
American kestrel	0.0	2.0	0.0	1.7	0.0	1.8
unidentified hawk	0.0	2.0	0.0	0.0	0.0	0.9
unidentified buteo	0.0	0.0	0.0	1.7	0.0	0.9
merlin	0.0	2.0	0.0	0.0	0.0	0.9
Cooper's hawk	0.0	2.0	0.0	0.0	0.0	0.9
bald eagle	0.0	2.0	0.0	0.0	0.0	0.9
Group Total	**0.6**	**44.0**	**0.4**	**30.0**	**0.5**	**36.4**
Waterbirds						
Wilson's snipe	0.0	0.0	0.2	13.3	0.1	7.3
killdeer	0.0	0.0	0.2	13.3	0.1	7.3
upland sandpiper	0.0	0.0	0.1	8.3	0.0	4.5
marbled godwit	0.0	0.0	0.0	1.7	0.0	0.9
great blue heron	0.0	0.0	0.0	3.3	0.0	1.8
double-crested cormorant	0.1	2.0	0.0	0.0	0.0	0.9
Group Total	**0.1**	**2.0**	**0.6**	**33.3**	**0.4**	**19.1**
Pigeons/Doves						
rock pigeon	0.0	0.0	0.3	3.3	0.2	1.8
mourning dove	0.0	2.0	0.2	15.0	0.1	9.1
Group Total	**0.0**	**2.0**	**0.5**	**18.3**	**0.3**	**10.9**
Woodpeckers						
downy woodpecker	0.0	0.0	0.0	1.7	0.0	0.9
Group Total	**0.0**	**0.0**	**0.0**	**1.7**	**0.0**	**0.9**

Table 4a. Avian species observed by point during Spring 2014 point-count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points				
			2	3	4	5	6
snow goose	3151	7	2	2120	720	309	0
red-winged blackbird	610	22	2	14	18	522	54
sandhill crane	495	5	0	0	320	110	65
unidentified blackbird	335	2	0	35	0	0	300
cackling goose	185	3	75	110	0	0	0
Canada goose	174	23	29	80	37	26	2
unidentified gull	141	3	0	100	0	41	0
greater white-fronted goose	138	3	74	0	0	4	60
western meadowlark	85	84	18	21	10	17	19
horned lark	82	46	34	12	15	4	17
common grackle	81	18	29	20	5	6	21
European starling	76	3	0	0	0	0	76
Franklin's gull	62	2	12	50	0	0	0
ring-necked pheasant	51	49	7	3	17	13	11
brown-headed cowbird	40	10	10	8	5	3	14
mallard	32	18	12	2	15	3	0
Bonaparte's gull	29	4	3	0	16	10	0
bank swallow	24	1	24	0	0	0	0
sharp-tailed grouse	19	11	2	1	10	0	6
rock pigeon	17	2	0	0	0	0	17
Lapland longspur	17	2	0	0	15	0	2
bobolink	16	16	5	3	4	3	1
vesper sparrow	15	15	3	2	2	2	6
red-tailed hawk	14	12	2	6	3	3	0
mourning dove	14	9	4	2	2	2	4
northern pintail	13	8	4	0	8	1	0
Wilson's snipe	12	11	4	6	0	2	0
killdeer	12	10	5	0	2	1	4
American crow	11	7	0	0	2	3	6
savannah sparrow	10	10	0	2	4	1	3
grasshopper sparrow	10	10	5	4	0	1	0
ring-billed gull	9	2	0	1	0	8	0
American robin	9	3	8	1	0	0	0
tree swallow	8	2	8	0	0	0	0
northern harrier	7	7	2	2	1	1	1
upland sandpiper	5	5	1	1	1	0	2
yellow-headed blackbird	4	2	2	2	0	0	0
western kingbird	3	3	0	0	1	2	0
marbled godwit	3	2	0	0	3	0	0
great blue heron	3	2	0	0	0	0	3
turkey vulture	2	1	0	2	0	0	0
blue-winged teal	2	1	0	0	2	0	0

Table 4a. Avian species observed by point during Spring 2014 point-count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points				
			2	3	4	5	6
blue jay	2	1	0	0	2	0	0
American goldfinch	2	2	1	0	1	0	0
yellow-rumped warbler	1	1	0	1	0	0	0
unidentified sparrow	1	1	0	0	1	0	0
unidentified buteo	1	1	0	0	1	0	0
Swainson's hawk	1	1	0	0	0	1	0
song sparrow	1	1	0	0	0	1	0
northern shoveler	1	1	1	0	0	0	0
gray partridge	1	1	0	0	1	0	0
eastern kingbird	1	1	0	1	0	0	0
downy woodpecker	1	1	0	1	0	0	0
American kestrel	1	1	0	0	0	0	1
Grand Total	**6040**	**469**	**388**	**2613**	**1244**	**1100**	**695**

Table 4b. Avian species observed by point during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points				
			2	3	4	5	6
snow goose	1200	8	495	60	445	0	200
common grackle	928	16	32	18	575	74	229
red-winged blackbird	856	8	42	14	550	50	200
greater white-fronted goose	380	4	65	40	0	0	275
sandhill crane	261	7	49	0	165	2	45
horned lark	202	26	82	53	35	8	24
unidentified blackbird	195	2	0	0	0	150	45
Canada goose	89	4	13	40	0	10	26
unidentified gull	30	1	30	0	0	0	0
American tree sparrow	30	1	0	0	0	0	30
sharp-tailed grouse	26	9	0	4	22	0	0
barn swallow	25	5	0	13	3	9	0
American crow	24	5	0	1	0	8	15
western meadowlark	20	18	3	2	1	7	7
tundra swan	20	2	0	6	14	0	0
snow bunting	16	2	0	0	15	0	1
gray partridge	14	1	0	0	0	14	0
red-tailed hawk	13	12	3	3	2	4	1
American goldfinch	11	7	2	1	4	3	1
European starling	10	2	0	0	0	7	3
brown-headed cowbird	7	1	0	7	0	0	0
ring-necked pheasant	6	6	0	0	4	2	0
northern harrier	6	6	2	1	1	2	0
double-crested cormorant	3	1	0	0	3	0	0
Swainson’s hawk	2	2	0	1	0	1	0
unidentified hawk	1	1	0	0	0	0	1
northern shrike	1	1	0	0	1	0	0
mourning dove	1	1	0	0	0	1	0
merlin	1	1	1	0	0	0	0
Cooper's hawk	1	1	0	0	1	0	0
bald eagle	1	1	0	0	0	1	0
American kestrel	1	1	0	0	1	0	0
Grand Total	**4381**	**163**	**819**	**264**	**1842**	**353**	**1103**

Table 5. Summary of avian flight heights (includes flying birds only) in relation to the turbine rotor swept area (RSA)[1] during point-count surveys at Wilton IV Wind Energy Center, 2013-2014.

	Fall 2013		Spring 2014		Overall	
	Number of Birds	Percentage of Birds	Number of Birds	Percentage of Birds	Number of Birds	Percentage of Birds
Non-raptors						
Above RSA height (>131.5m)	775	18.9%	3971	69.3%	4746	48.3%
At RSA height (28.5m–131.5m)	1052	25.6%	1037	18.1%	2089	21.2%
Below RSA height (<28.5m)	2277	55.5%	719	12.6%	2996	30.5%
Raptors						
Above RSA height (>131.5m)	0	0.0%	1	4.5%	1	2.4%
At RSA height (28.5m–131.5m)	6	30.0%	0	0.0%	6	14.3%
Below RSA height (<28.5m)	14	70.0%	21	95.5%	35	83.3%

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

Table 6a. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2014 point-count surveys at the Wilton IV 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
red-winged blackbird	8.34	10.17 (0.00 - 23.88)	96.9	0.0	84.6	15.4
unidentified blackbird	5.00	5.58 (0.00 - 13.84)	100.0	0.0	89.6	10.4
cackling goose	1.25	3.08 (0.00 - 6.70)	100.0	59.5	40.5	0.0
Canada goose	1.13	2.90 (1.23 - 4.57)	97.7	50.0	40.0	10.0
European starling	0.85	1.27 (0.00 - 3.19)	100.0	0.0	67.1	32.9
rock pigeon	0.20	0.28 (0.00 - 0.63)	100.0	0.0	70.6	29.4
snow goose	0.15	52.52 (0.00 - 113.95)	100.0	99.7	0.3	0.0
ring-billed gull	0.13	0.15 (0.00 - 0.37)	100.0	11.1	88.9	0.0
American crow	0.10	0.18 (0.07 - 0.29)	72.7	0.0	75.0	25.0
sharp-tailed grouse	0.08	0.32 (0.12 - 0.52)	78.9	0.0	33.3	66.7
American robin	0.03	0.15 (0.00 - 0.37)	88.9	0.0	25.0	75.0
horned lark	0.02	1.37 (0.88 - 1.86)	78.0	0.0	1.6	98.4
yellow-rumped warbler	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
yellow-headed blackbird	0.00	0.07 (0.00 - 0.15)	100.0	0.0	0.0	100.0
Wilson's snipe	0.00	0.20 (0.08 - 0.32)	8.3	0.0	0.0	100.0
western meadowlark	0.00	1.42 (1.18 - 1.66)	10.6	0.0	0.0	100.0
western kingbird	0.00	0.05 (0.00 - 0.10)	100.0	0.0	0.0	100.0
vesper sparrow	0.00	0.25 (0.12 - 0.38)	0.0	0.0	0.0	0.0
upland sandpiper	0.00	0.08 (0.02 - 0.14)	0.0	0.0	0.0	0.0
unidentified sparrow	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
unidentified gull	0.00	2.35 (0.00 - 5.29)	99.3	0.0	0.0	100.0
unidentified buteo	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
turkey vulture	0.00	0.03 (0.00 - 0.08)	0.0	0.0	0.0	0.0
tree swallow	0.00	0.13 (0.00 - 0.32)	100.0	0.0	0.0	100.0
Swainson’s hawk	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
song sparrow	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
savannah sparrow	0.00	0.17 (0.07 - 0.27)	30.0	0.0	0.0	100.0
sandhill crane	0.00	8.25 (0.00 - 17.61)	100.0	100.0	0.0	0.0
red-tailed hawk	0.00	0.23 (0.12 - 0.34)	92.9	7.7	0.0	92.3

Table 6a. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Spring 2014 point-count surveys at the Wilton IV 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
ring-necked pheasant	0.00	0.85 (0.64 - 1.06)	5.9	0.0	0.0	100.0
northern shoveler	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
northern pintail	0.00	0.22 (0.08 - 0.36)	69.2	0.0	0.0	100.0
northern harrier	0.00	0.12 (0.05 - 0.19)	100.0	0.0	0.0	100.0
mourning dove	0.00	0.23 (0.09 - 0.37)	85.7	0.0	0.0	100.0
mallard	0.00	0.53 (0.22 - 0.84)	75.0	0.0	0.0	100.0
marbled godwit	0.00	0.05 (0.00 - 0.13)	100.0	0.0	0.0	100.0
Lapland longspur	0.00	0.28 (0.00 - 0.69)	100.0	0.0	0.0	100.0
killdeer	0.00	0.20 (0.07 - 0.33)	58.3	0.0	0.0	100.0
greater white-fronted goose	0.00	2.30 (0.00 - 4.89)	100.0	100.0	0.0	0.0
grasshopper sparrow	0.00	0.17 (0.07 - 0.27)	10.0	0.0	0.0	100.0
gray partridge	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
great blue heron	0.00	0.05 (0.00 - 0.11)	100.0	0.0	0.0	100.0
Franklin's gull	0.00	1.03 (0.00 - 2.43)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
downy woodpecker	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
common grackle	0.00	1.35 (0.37 - 2.33)	95.1	0.0	0.0	100.0
blue-winged teal	0.00	0.03 (0.00 - 0.08)	0.0	0.0	0.0	0.0
Bonaparte's gull	0.00	0.48 (0.00 - 1.00)	100.0	0.0	0.0	100.0
bobolink	0.00	0.27 (0.12 - 0.42)	75.0	0.0	0.0	100.0
blue jay	0.00	0.03 (0.00 - 0.08)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.67 (0.16 - 1.18)	20.0	0.0	0.0	100.0
bank swallow	0.00	0.40 (0.00 - 1.06)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
American goldfinch	0.00	0.03 (0.00 - 0.07)	100.0	0.0	0.0	100.0

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

Table 6b. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2013 point-count surveys at the Wilton IV 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
snow goose	8.00	24.00 (2.83 - 45.17)	83.3	60.0	40.0	0.0
greater white-fronted goose	6.30	7.60 (0.08 - 15.12)	100.0	17.1	82.9	0.0
sandhill crane	3.02	5.22 (0.95 - 9.49)	100.0	42.1	57.9	0.0
unidentified blackbird	3.00	3.90 (0.00 - 9.02)	100.0	0.0	76.9	23.1
tundra swan	0.28	0.40 (0.00 - 0.90)	70.0	0.0	100.0	0.0
Canada goose	0.26	1.78 (0.16 - 3.40)	100.0	0.0	14.6	85.4
common grackle	0.16	18.56 (0.00 - 37.92)	100.0	0.0	0.9	99.1
red-tailed hawk	0.10	0.26 (0.15 - 0.37)	69.2	0.0	55.6	44.4
merlin	0.02	0.02 (0.00 - 0.05)	100.0	0.0	100.0	0.0
American goldfinch	0.02	0.22 (0.07 - 0.37)	100.0	0.0	9.1	90.9
western meadowlark	0.00	0.40 (0.18 - 0.62)	40.0	0.0	0.0	100.0
unidentified hawk	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
unidentified gull	0.00	0.60 (0.00 - 1.59)	100.0	0.0	0.0	100.0
Swainson’s hawk	0.00	0.04 (0.00 - 0.09)	100.0	0.0	0.0	100.0
sharp-tailed grouse	0.00	0.52 (0.16 - 0.88)	50.0	0.0	0.0	100.0
snow bunting	0.00	0.32 (0.00 - 0.81)	93.8	0.0	0.0	100.0
red-winged blackbird	0.00	17.12 (0.00 - 35.69)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	0.12 (0.03 - 0.21)	0.0	0.0	0.0	0.0
northern shrike	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
northern harrier	0.00	0.12 (0.04 - 0.20)	100.0	0.0	0.0	100.0
mourning dove	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
horned lark	0.00	4.04 (2.04 - 6.04)	99.0	0.0	0.0	100.0
gray partridge	0.00	0.28 (0.00 - 0.74)	100.0	0.0	0.0	100.0
European starling	0.00	0.20 (0.00 - 0.45)	0.0	0.0	0.0	0.0
double-crested cormorant	0.00	0.06 (0.00 - 0.16)	100.0	0.0	0.0	100.0
Cooper's hawk	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.14 (0.00 - 0.37)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.50 (0.02 - 0.98)	100.0	0.0	0.0	100.0
bald eagle	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0

Table 6b. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2013 point-count surveys at the Wilton IV 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
American tree sparrow	0.00	0.60 (0.00 - 1.59)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
American crow	0.00	0.48 (0.07 - 0.89)	100.0	0.0	0.0	100.0

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

Table 6c. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] at the Wilton IV Wind Energy Center, from 9/10/2013-5/31/2014.

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
red-winged blackbird	4.55	13.33 (0.00 - 35.17)	98.7	0.0	34.6	65.4
unidentified blackbird	4.09	4.82 (0.00 - 26.66)	100.0	0.0	84.9	15.1
snow goose	3.90	39.55 (17.72 - 61.39)	100.0	90.1	9.9	0.0
greater white-fronted goose	2.86	4.71 (0.00 - 26.55)	100.0	39.2	60.8	0.0
sandhill crane	1.37	6.87 (0.00 - 28.71)	100.0	80.0	20.0	0.0
Canada goose	0.74	2.39 (0.00 - 24.23)	98.5	32.8	31.3	35.9
cackling goose	0.68	1.68 (0.00 - 23.52)	100.0	59.5	40.5	0.0
European starling	0.46	0.78 (0.00 - 22.62)	88.4	0.0	67.1	32.9
tundra swan	0.18	0.18 (0.00 - 24.10)	100.0	0.0	100.0	0.0
rock pigeon	0.11	0.15 (0.00 - 21.99)	100.0	0.0	70.6	29.4
ring-billed gull	0.07	0.08 (0.00 - 21.92)	100.0	11.1	88.9	0.0
common grackle	0.07	9.17 (0.00 - 31.01)	99.6	0.0	0.8	99.2
American crow	0.05	0.32 (0.00 - 22.16)	91.4	0.0	18.8	81.3
red-tailed hawk	0.05	0.25 (0.00 - 22.08)	81.5	4.5	22.7	72.7
sharp-tailed grouse	0.05	0.41 (0.00 - 22.25)	62.2	0.0	17.9	82.1
American robin	0.02	0.08 (0.00 - 21.92)	88.9	0.0	25.0	75.0
merlin	<0.01	0.01 (0.00 - 23.93)	100.0	0.0	100.0	0.0
horned lark	<0.01	2.58 (0.00 - 24.42)	93.0	0.0	0.4	99.6
American goldfinch	<0.01	0.12 (0.00 - 21.96)	100.0	0.0	7.7	92.3
yellow-rumped warbler	0.00	0.01 (0.00 - 21.85)	100.0	0.0	0.0	100.0
yellow-headed blackbird	0.00	0.04 (0.00 - 21.87)	100.0	0.0	0.0	100.0
Wilson's snipe	0.00	0.11 (0.00 - 21.95)	100.0	0.0	0.0	100.0
western meadowlark	0.00	0.95 (0.00 - 22.79)	16.2	0.0	0.0	100.0
western kingbird	0.00	0.03 (0.00 - 21.87)	100.0	0.0	0.0	100.0
vesper sparrow	0.00	0.14 (0.00 - 21.97)	0.0	0.0	0.0	0.0
upland sandpiper	0.00	0.05 (0.00 - 21.88)	0.0	0.0	0.0	0.0

Table 6c. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] at the Wilton IV Wind Energy Center, from 9/10/2013-5/31/2014.

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
unidentified sparrow	0.00	0.01 (0.00 - 21.85)	0.0	0.0	0.0	0.0
unidentified hawk	0.00	0.01 (0.00 - 23.93)	0.0	0.0	0.0	0.0
unidentified gull	0.00	1.55 (0.00 - 23.39)	99.4	0.0	0.0	100.0
unidentified buteo	0.00	0.01 (0.00 - 21.85)	0.0	0.0	0.0	0.0
turkey vulture	0.00	0.02 (0.00 - 21.86)	0.0	0.0	0.0	0.0
tree swallow	0.00	0.07 (0.00 - 21.91)	100.0	0.0	0.0	100.0
Swainson's hawk	0.00	0.03 (0.00 - 21.87)	100.0	0.0	0.0	100.0
song sparrow	0.00	0.01 (0.00 - 21.85)	0.0	0.0	0.0	0.0
snow bunting	0.00	0.15 (0.00 - 24.07)	93.8	0.0	0.0	100.0
savannah sparrow	0.00	0.09 (0.00 - 21.93)	30.0	0.0	0.0	100.0
ring-necked pheasant	0.00	0.52 (0.00 - 22.36)	5.3	0.0	0.0	100.0
northern shrike	0.00	0.01 (0.00 - 23.93)	0.0	0.0	0.0	0.0
northern shoveler	0.00	0.01 (0.00 - 21.85)	0.0	0.0	0.0	0.0
northern pintail	0.00	0.12 (0.00 - 21.96)	69.2	0.0	0.0	100.0
northern harrier	0.00	0.12 (0.00 - 21.96)	100.0	0.0	0.0	100.0
mourning dove	0.00	0.14 (0.00 - 21.97)	86.7	0.0	0.0	100.0
mallard	0.00	0.29 (0.00 - 22.13)	75.0	0.0	0.0	100.0
marbled godwit	0.00	0.03 (0.00 - 21.87)	100.0	0.0	0.0	100.0
Lapland longspur	0.00	0.15 (0.00 - 21.99)	100.0	0.0	0.0	100.0
killdeer	0.00	0.11 (0.00 - 21.95)	66.7	0.0	0.0	100.0
grasshopper sparrow	0.00	0.09 (0.00 - 21.93)	10.0	0.0	0.0	100.0
gray partridge	0.00	0.14 (0.00 - 21.97)	93.3	0.0	0.0	100.0
great blue heron	0.00	0.03 (0.00 - 21.87)	100.0	0.0	0.0	100.0
Franklin's gull	0.00	0.56 (0.00 - 22.40)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.01 (0.00 - 21.85)	0.0	0.0	0.0	0.0
downy woodpecker	0.00	0.01 (0.00 - 21.85)	100.0	0.0	0.0	100.0

Table 6c. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] at the Wilton IV Wind Energy Center, from 9/10/2013-5/31/2014.

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
double-crested cormorant	0.00	0.03 (0.00 - 23.95)	100.0	0.0	0.0	100.0
Cooper's hawk	0.00	0.01 (0.00 - 23.93)	100.0	0.0	0.0	100.0
blue-winged teal	0.00	0.02 (0.00 - 21.86)	0.0	0.0	0.0	0.0
Bonaparte's gull	0.00	0.26 (0.00 - 22.10)	100.0	0.0	0.0	100.0
bobolink	0.00	0.15 (0.00 - 21.98)	87.5	0.0	0.0	100.0
blue jay	0.00	0.02 (0.00 - 21.86)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.43 (0.00 - 22.27)	31.9	0.0	0.0	100.0
barn swallow	0.00	0.23 (0.00 - 24.15)	100.0	0.0	0.0	100.0
bank swallow	0.00	0.22 (0.00 - 22.06)	100.0	0.0	0.0	100.0
bald eagle	0.00	0.01 (0.00 - 23.93)	0.0	0.0	0.0	0.0
American tree sparrow	0.00	0.27 (0.00 - 24.19)	100.0	0.0	0.0	100.0
American kestrel	0.00	0.02 (0.00 - 21.86)	100.0	0.0	0.0	100.0

[1]These values assume a GE 1.715 MW turbine with a rotor diameter of 103 (m) and a hub height of 80 (m)

Table 7. Incidental observations of birds during point counts at the Wilton IV Wind Energy Center, 2013-2014.

Species	Fall 2013	Spring 2014	Overall
	Number of birds	Number of birds	Number of birds
European starling	400	0	400
snow goose	0	300	300
red-winged blackbird	0	100	100
Canada goose	26	46	72
Franklin's gull	65	0	65
red-tailed hawk	23	9	32
mallard	0	26	26
canvasback	0	26	26
northern harrier	9	10	19
Bonaparte's gull	18	0	18
American kestrel	6	2	8
sharp-tailed grouse	0	4	4
blue jay	4	0	4
turkey vulture	0	2	2
tundra swan	2	0	2
marbled godwit	0	2	2
green-winged teal	0	2	2
gray partridge	0	2	2
bald eagle	0	2	2
Swainson's hawk	0	1	1
rough-legged hawk	0	1	1
northern flicker	0	1	1
eastern bluebird	0	1	1
broad-winged hawk	1	0	1
Grand Total	**554**	**537**	**1091**

APPENDICES

Appendix 1a. Flight directions of birds observed during Spring 2014 point-count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
snow goose	3151	7	95.5	0.3	0.0	0.1	0.0	0.0	0.0	4.1	0.0
red-winged blackbird	500	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
sandhill crane	495	5	22.2	0.0	0.0	0.0	0.0	0.0	35.4	42.4	0.0
unidentified blackbird	300	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
cackling goose	185	3	0.0	0.0	40.5	52.4	0.0	0.0	7.0	0.0	0.0
Canada goose	155	20	26.5	38.7	0.0	1.3	27.7	0.0	1.3	4.5	0.0
unidentified gull	140	2	28.6	0.0	0.0	0.0	0.0	0.0	0.0	71.4	0.0
greater white-fronted goose	138	3	2.9	0.0	0.0	53.6	0.0	0.0	0.0	43.5	0.0
Franklin's gull	62	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
European starling	31	2	19.4	0.0	0.0	0.0	80.6	0.0	0.0	0.0	0.0
Bonaparte's gull	29	4	55.2	0.0	0.0	0.0	0.0	0.0	3.4	41.4	0.0
rock pigeon	12	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
red-tailed hawk	11	9	9.1	9.1	0.0	18.2	9.1	27.3	0.0	27.3	0.0
sharp-tailed grouse	10	5	30.0	0.0	30.0	0.0	0.0	10.0	0.0	30.0	0.0
horned lark	10	3	20.0	0.0	0.0	0.0	70.0	0.0	0.0	10.0	0.0
ring-billed gull	9	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American crow	6	3	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern pintail	3	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern harrier	2	2	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0	0.0
great blue heron	2	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
blue jay	2	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American robin	2	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Total	**5255**	**79**	**71.4**	**1.4**	**1.7**	**3.4**	**1.4**	**5.8**	**3.6**	**11.2**	**0.0**

[1] Includes only flying birds with flight directions

Appendix 1b. Flight directions of birds observed during Fall 2013 point-count surveys at the Wilton IV Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
snow goose	1000	7	0.0	0.0	4.5	89.5	0.0	6.0	0.0	0.0	0.0
common grackle	553	3	0.0	8.1	0.0	0.0	90.4	0.0	0.0	1.4	0.0
red-winged blackbird	550	2	0.0	9.1	0.0	0.0	90.9	0.0	0.0	0.0	0.0
greater white-fronted goose	380	4	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
sandhill crane	261	7	0.0	0.0	1.5	80.5	16.1	1.9	0.0	0.0	0.0
unidentified blackbird	195	2	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
Canada goose	89	4	0.0	0.0	0.0	70.8	29.2	0.0	0.0	0.0	0.0
unidentified gull	30	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American crow	15	3	0.0	13.3	86.7	0.0	0.0	0.0	0.0	0.0	0.0
tundra swan	14	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
red-tailed hawk	8	7	0.0	0.0	12.5	50.0	0.0	0.0	0.0	37.5	0.0
sharp-tailed grouse	4	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
northern harrier	3	3	0.0	0.0	33.3	33.3	33.3	0.0	0.0	0.0	0.0
double-crested cormorant	3	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
Swainson's hawk	2	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
merlin	1	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
American kestrel	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Grand Total	**3109**	**50**	**1.0**	**3.1**	**2.2**	**56.7**	**34.5**	**2.1**	**0.1**	**0.4**	**0.0**

[1] Includes only flying birds with flight directions