2015 Fall Avian Survey

Oliver III Wind Energy Center
Oliver and Morton Counties, North Dakota

Prepared for:

Oliver Wind III, LLC

NEXTera ENERGY RESOURCES

April 2016

TETRA TECH

Executive Summary

Tetra Tech, Inc. was contracted by Oliver Wind III, LLC, a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC, to undertake fall avian use surveys for the proposed Oliver III Wind Energy Center (Project) located in Oliver and Morton Counties, North Dakota. The studies were conducted to identify potential avian impacts associated with constructing 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 August 18 through November 6, 2015, which included the fall migration season. Point-count surveys (fixed 800-meter [m] radius) were conducted at 9 point-count locations distributed throughout the Project Area.

A total of 3,648 birds from 34 species were observed within the Project Area. Overall mean bird use within the Project Area was 33.85 birds/20 minute (min) and ranged from 0 to 272 birds/20-min point-count survey. Mean use was highest for songbirds, waterfowl, and pigeons/dove species groupings (25.96, 2.46, 1.67 birds/20 min, respectively). The species with the highest mean use were the red-winged blackbird (13.25 birds/20 min), horned lark (6.81 birds/20 min), Canada goose (2.45 birds/20 min), and mourning dove (1.56 birds/20 min). The red-winged blackbird had the highest encounter rate (3.80 birds flying at rotor swept area [RSA] height/20 min). All other species had an encounter rate less than 1.00 birds flying at RSA height/20 min.

The avian community detected within the Project Area during fall avian surveys was characterized by species typical of agricultural lands and remnant grasslands in North Dakota. 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. Songbirds were identified as having potential risk of collision due to species within this group having the highest encounter rate within the Project Area and/or relatively high mean use. Songbird species with the highest potential risk was the red-winged blackbird due to an encounter rate of 3.80 birds flying at RSA height/20min. Red-winged blackbirds may be at the greatest fatality risk during the spring and fall due to their flocking characteristics throughout migration, which likely contributed to their relatively high encounter rate. Although risk of turbine-related fatalities at the Project exists, should they occur, they are unlikely to have population level impacts because red-winged blackbird populations in North Dakota are large (8.2 million, PIFSC 2013).

Waterfowl and Pigeons/doves were two other non-raptor species groups that contained species demonstrating potential collision risk factors. Within the Waterfowl group, Canada goose was species with the highest mean use (2.45 birds/20min); however, the encounter rate for Canada goose was low (0.28 birds flying at RSA height/20 min). Project-related fatalities of the Canada goose, should they occur, are unlikely to have population-level impacts because North Dakota populations for Canada goose are large and are increasing significantly in the Western Prairie and

Great Plains which includes North Dakota (455,800; Sauer et al. 2014, USFWS 2015c). Within the Pigeons/Doves group, mourning dove had the highest mean use (1.56 birds/20 min); however, the encounter rate for mourning dove was low (0.00 birds flying at RSA height/20 min) as no individuals were observed flying at the anticipated RSA height. Therefore, project-related fatalities of the mourning dove, should they occur, are unlikely to have population-level impacts because North Dakota populations for mourning dove are large (4.1 million) and are stable (PIFSC 2013, Sauer et al. 2014).

Raptor species observed during the point-count surveys were typical of species found in southwestern North Dakota. Swainson's hawks, turkey vultures, northern harriers and red-tailed hawks had the highest mean use among raptors (0.31, 0.21, 0.16 and 0.16 birds/20 min, respectively). Given the relatively low mean use of these raptors within the Project Area and relatively low encounter rates (less than 0.25 birds flying at RSA height/20 min, respectively); turbine-related fatalities at the Project are likely to be low. Results from post-construction fatality monitoring studies indicate that turkey vultures and red-tailed hawks are frequently found as turbine-related fatalities and the encounter rates suggests the Project may pose a low collision risk for these species. Comparatively, Swainson's hawks and northern harriers are found as fatalities less often. However, any fatalities of Swainson's hawks, turkey vultures, northern harriers and red-tailed hawks observed at the Project are not expected to have population level impacts because these populations are relatively stable or increasing (Farmer et al 2008). Nesting activity can also contribute to risk of turbine-related mortality as raptor activity is typically higher near active nests than areas without active nests. Therefore, nesting raptors may have increased potential for collision as they repeatedly fly within the Project Area during nesting activities. Therefore, collision risk at the Project may be somewhat higher for Swainson's hawks and red-tailed hawks because occupied nests were detected of these species within or near the Project Area during raptor nest surveys. Raptor nests detected within the Project Area included one occupied Swainson's hawk nest, one occupied great horned owl nest and five small unoccupied nests. Within a 2-mile buffer of the Project Area, two occupied red-tailed hawk nests, one occupied Swainson's hawk nest, and six small unoccupied nests were detected during raptor nest surveys. No known or potential eagle nests were detected. Other raptor species detected during spring surveys included American kestrel and ferruginous hawk. The low mean use and encounter rates of these species (less than 0.10 birds/20min and 0.00 birds flying at RSA height) suggest turbine related fatalities for these species at the Project are likely to be low.

Protected Species

No federally or state threatened or endangered species were observed during avian point-count surveys, raptor nest survey, or as incidental observations. Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (BGEPA) and although no eagles were observed during avian point-count surveys, one golden eagle was observed incidentally to raptor nest surveys. No bald or golden eagle nests were found within the Project Area or buffer surrounding the Project Area during the raptor nest surveys conducted in June and November 2015. Eagle-specific use surveys are underway to evaluate risk of Project activities to eagles and will be reported separately.

Most native birds are protected under the Migratory Bird Treaty Act (MBTA). Currently, there are no permits for incidental take of migratory birds. Historically, permits were not available under the BGEPA for incidental take from otherwise lawful activities; however, USFWS-promulgated regulations in 2009 provided for permits for incidental take of eagles associated with otherwise lawful activities, including wind energy (50 Code of Federal Regulations § 22.26). Only one permit has been issued to date and updates to the eagle permit regulations are expected in 2016.

Table ES-1. Fall Avian Use Summary

Variable	Result	Details
Non-raptors		
Mean use	32.89 birds/ 20 min	
Species detected at Oliver III that are commonly (> 15 records) detected as wind farm fatalities	Yes	Ring-necked Pheasant Gray Partridge Mourning Dove Common Nighthawk Northern Flicker Horned Lark Red-winged Blackbird Western Meadowlark
Federally listed[1] species observed within the Project Area	No	
State-listed[2] species within the Project Area	No	
State-listed[2] species within RSA	No	
Raptors		
Mean use	0.96 birds/20 min	
Species detected at Oliver III that are commonly (> 15 records) detected as wind farm fatalities	Yes	Turkey Vulture American Kestrel Red-tailed Hawk
Eagles observed within the Project Area	Yes	Incidental to Raptor Nest Survey
Eagles observed within the RSA	No	
Eagles observed nesting within the Project Area	No	
Federally listed species observed within the Project Area	No	
State-listed[2] species within the Project Area	No	
State-listed[2] species within the RSA	No	
Habitat		
Native habitat likely to be affected by development	Yes	Native Grassland
Lakes (waterfowl and crane attractant)	Yes	Nelson Lake, approx. 5 miles to the north. Sweet Briar Lake, approx. 4.5 miles to the southwest.
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Small waterbodies within the Project Area
Cliffs (used by raptors for nesting and traveling)	No	
Rivers (permanent water source, migration corridor)	No	
Known refuges or habitat features that may funnel migrants	No	

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

2 Only species protected by the federal ESA are considered threatened or endangered in North Dakota. The North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (Hagen et al. 2005) but these species are not afforded any formal protection by the state of North Dakota and there are no state permitting requirements covering them.

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1 Introduction

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), and effects of these fatalities upon population trends appear to be minimal (Erickson et al. 2014). 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 lower 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 consistent trend and is likely a species-specific response which declines with distance from turbines (Shafer and Buhl 2015). Studies have found decreased density or abundance of some species near turbines (e.g., grassland songbirds, Leddy et al. 1999, Erickson et al. 2004, Shaffer and Buhl 2015), while other species show no evidence of declines near turbines (Devereux et al. 2008, Shaffer and Buhl 2015, 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.

Agencies and non-governmental groups have raised particular concern over avoidance issues (e.g., habitat displacement) with respect to grouse species (Manville 2004, USFWS 2012). The existing information on avoidance by grouse species is limited to observational studies, with results varying by grouse species and source of disturbance (roads, oil and gas wells, vertical structures, transmission lines). 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, Sandercock et al. 2013).

Finally, most native, migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918. Under the MBTA it is unlawful to pursue, hunt, take, capture or kill; attempt to take, capture, or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any native migratory bird, part, nest, egg or product. The USFWS has established a permitting scheme for a variety of intentional activities, such as hunting and scientific research, but has not done so for the incidental take of migratory birds associated with otherwise lawful activities. As a result, currently there is no permitting framework that allows a wind energy company to protect itself from liability at wind energy facilities.

Oliver Wind III, LLC (Oliver Wind III), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC is planning to develop the Oliver III Wind Energy Center (Project) in Oliver and Morton counties, North Dakota on private lands (Figure 1). The Project is expected to be approximately 100 megawatts (MW) nameplate capacity using a combination of GE 2.1 MW and GE 1.79 MW turbines. The GE 2.1 MW turbines have a hub height of 80 meters and a rotor diameter of 116 meters for a maximum blade tip height of 138 meters. The GE 1.79 MW turbines have a hub height of 80 meters and a rotor diameter of 110 meters for a maximum blade tip height of 130 meters. Oliver Wind III is committed to environmental due diligence and has contracted Tetra Tech, Inc. (Tetra Tech) to conduct fall avian surveys at the Project to quantify local avian use in the area and to evaluate the potential impacts of the Project on bird species detected during the survey. These study objectives are consistent with recommendations from Tier 3 of the *USFWS Land-Based Wind Energy Guidelines* (USFWS 2012; USFWS Guidelines).

The Project Area covers approximately 21,878 acres and is located in the Missouri Plateau Ecoregion of the Northwestern Great 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 short-grass grassland prairie with associated wetlands (Bryce et al. 1996). Today, most grassland prairie has been largely replaced by agriculture in level areas. Remnant grassland prairie may still persist in areas of steep or broken topography. Agriculture in the area consists predominantly of dry-land farming of wheat, soybean, and corn interspersed with cattle grazing pastures.

North Dakota has 353 documented bird species (Faanes and Stewart 1982) and is situated within the Central Flyway, one of several broad bird migratory routes in North America (USFWS 2011). During fall migration, most birds that move along the Central Flyway travel from breeding grounds as far away as Alaska and northern Canada through the central states and eventually reach wintering grounds near the Gulf of Mexico and as far away as South America (USFWS 2011).

2 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 USFWS *Wind Energy Guidelines* (WEG; 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.

2.1 Avian Surveys

2.1.1 Point-count Surveys

An experienced field biologist (biologist) conducted 20-minute (min) point-count surveys at 9 locations to evaluate avian use, behavior, and species composition. Surveys were conducted for an additional 40 minutes limited to eagle observations; results of the eagle-specific surveys are reported under separate cover. The biologist conducted 12 weekly surveys from August 18 through November 6, 2015 (Table 1), thereby encompassing the fall migration period. Tetra Tech distributed the survey locations throughout the Project Area and chose locations that maximized 360-degree sight viewshed for the biologist while covering a diversity of habitats (Figure 2).

Data were collected on all birds detected within an 800-meter (m) radius of the point-count location. During the surveys at each point-count location, the biologist continuously recorded any avian visual or auditory observations including: species, number of individuals, time of observation, height above ground, flight distance, flight direction 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 facilities, 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, used 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. It should be noted, however, that this survey protocol can only detect nocturnal migrants should they utilize the Project as stopover habitat.

Tetra Tech chose 20-min 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

Tetra Tech conducted raptor nest surveys with the primary objective of documenting the presence of bald and golden eagle and other large raptor nests within the Project Boundary plus a 2-mile buffer (Survey Area). An initial ground-based survey was conducted on June 23, 2015, during the breeding season. A follow-up ground-based survey was conducted on November 28-29, 2015, during the non-breeding season when trees had dropped their leaves to increase visibility of raptor nests. An aerial and follow-up ground–based raptor nest survey out to 10 miles from the Project Boundary will be conducted during the breeding season (March – June) in spring 2016.

The nest surveys were conducted from public roadways by a local field biologist equipped with a spotting scope. The surveyor primarily focused on large trees sufficient to support nesting by large raptors.

A global positioning system (GPS) receiver using World Geodetic System 1984 (WGS84) Datum coordinates was used to aid in navigation and data recording. Data collected within the Survey Area included an inventory of all stick nests, occupancy status of nests (occupied or unoccupied), numbers of eggs or nestlings, and any observations of bald or golden eagles. Additionally, standardized data forms were used to record information.

If a nest was found, the following data were collected:

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

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

- **Occupied:** nest containing eggs, young, or an adult sitting on the nest indicating incubation or brooding or a nest showing evidence of use in the survey year such as fresh lining, droppings, feathers on or underneath, or adults near the nest (i.e., in tree) but not sitting on the nest.
- **Unoccupied:** nest showing no evidence of use and no adults present at the nest. Unoccupied eagle nests are categorized as eagle nests based on size of nest, size of material used in construction, and location (i.e., ospreys do not build nests as large as bald eagles and rarely builds nests in live trees).
- **Unknown:** The nest cannot be found or the nest is present, but because of its location (e.g., a tree cavity, rock cavity), a determination cannot be made.

- **Gone:** A nest that was located during a previous survey, but has subsequently been found to be destroyed and no longer exists. No evidence remains.

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

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

2.1.3 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, or 4) during the raptor nest survey. The biologist recorded these observations on separate data sheets and these data were not used in the formal analysis; however, a summary of incidental observed species is presented to provide additional information about species found in the local area.

2.2 Protected Species Information

The Endangered Species Act (ESA), 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 2013a). According to a current list of endangered, threatened, and candidate species for North Dakota Counties maintained by the USFWS, the listed avian species known to occur in Oliver and Morton Counties relative to the Project Area are the least tern, piping plover, red knot, and whooping crane (USFWS 2015a, USFWS 2015b).

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. The USFWS promulgated regulations in 2009 which provided for permits for incidental take of bald and golden eagles associated with otherwise lawful activities, including wind energy (50 Code of Federal Regulations § 22.26). Applications for incidental take permits under BGEPA are being considered by USFWS for bald eagles throughout the contiguous U.S. Incidental take permits for golden eagles are available only to projects located west of the 100th meridian (USFWS 2013b). However, since 2009, only one incidental take permit for golden eagles has been granted to a wind energy project, and no permits have been issued for incidental take of bald eagles at a wind energy facility. The USFWS issued an Advanced Notice of Rulemaking in April 2012 and is currently undergoing a process to revise the permit regulations in response to public comment relative to eagle population management objectives, compensatory mitigation, and programmatic permit issuance. It is unknown at this time what changes will be made or how they may affect the permitting process. According to a current list of species provided by the USFWS, bald and golden eagles are known to occur in Oliver and Morton Counties, North Dakota (USFWS 2015b).

In addition to federal listing, the North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (Hagen et al. 2005) although these species are not afforded any formal protection by the state of North Dakota and there are no state permitting requirements covering them. Only avian species protected by the federal ESA are considered threatened or endangered in North Dakota, therefore the only state-listed avian species with potential to occur in Oliver and Morton Counties are the same as the federal-listed avian species listed above.

2.3 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, the field 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 field biologist.

2.4 Analysis

2.4.1 Species Groupings

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

2.4.2 Avian Use

Tetra Tech derived avian use (mean use) of the Project Area by calculating the average number of birds observed per 20-min (birds/20 min) survey at each point-count location. To evaluate the 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 each 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 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 a species. Because individual birds are not uniquely marked nor 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.

2.4.3 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). Oliver Wind III plans to develop the Project using GE (General Electric) 2.10 MW and 1.79 MW (Megawatt) turbines. The 2.1 MW turbines have a hub height of 80 meters and rotor diameter of 116 meters and the 1.79 MW have a hub height of 80 meters and rotor diameter of 100 meters. With these specifications, the anticipated maximum RSA is estimated to be between approximately 22 and 138 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.

2.4.4 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:

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

$\boldsymbol{A}$ 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 of flying observations that were within the height range of a turbine RSA for a given species. The encounter rate provides information on the rate at which a species may move at a height that is consistent with the anticipated 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, Garvin et al. 2011, Nagy et al. 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.

2.4.5 Mortality Risk

The highly regional nature of avian mean use across North America and the scarce 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). In general, actual fatalities detected at nearby wind projects provide more relevant context of potential collision impacts of a wind project. As a result of uncertainty in predicting fatality rates, Tetra Tech did not attempt to derive mortality estimates from mean use data, but instead highlight those species or species groups with high use values that are most likely to experience Project-related mortality or are most likely to suffer population-level impacts from Project development. Additionally, in this report, Tetra Tech highlights species with high frequencies (greater than 50 percent) of observation, high encounter rates (greater than 0.99 birds flying at RSA height/20 min), and those with records of turbine-related fatality at other wind projects, as these variables may also indicate potential collision risk at the Project.

3 Results

3.1 Avian Use and Frequency of Occurrence

The biologist surveyed 4,469 acres of the Project Area during point-count surveys, covering approximately 22 percent of the total Project Area (21,878 acres; Figure 2). The 9 point-count locations were surveyed 12 times each, resulting in 108 total 20-minute surveys. A total of 3,656 birds from 34 species and 8 unidentified birds were recorded during the point-count surveys (Table 2). A total of 10 species groups were identified within the Project Area during point-count surveys: Songbirds, Waterfowl, Pigeons/Doves, Gamebirds, Raptors, Gulls/Terns, Waterbirds, Cranes/Rails, Woodpeckers, and Goatsuckers (Table 2). Overall mean bird use for the Oliver III Wind Energy Center was 33.85 birds/20 min and ranged from 0 to 272 birds observed during all surveys (Table 2).

Overall mean use by non-raptors was 32.89 birds/20 min. Species with the highest mean use belonged to three species groups: Songbirds, Waterfowl, and Pigeons/Doves. Songbirds had the highest mean use (25.96 birds/20 min) among non-raptor species groups, and comprised 76.7 percent of all birds observed (Table 2). The songbird species with the highest mean use were the red-winged blackbird and horned lark (13.25 and 6.81 birds/20 min, and observed in 39.1 and 20.1 percent of all surveys, respectively; Table 2). Combined, these 2 species accounted for 59.2 percent of all birds observed in the Project Area (Table 2). Waterfowl had the second highest mean use (2.46 birds/20 min) and comprised 7.3 percent of all birds observed with the majority of use attributed to observations of Canada goose (Table 2). Pigeons/Doves had the third highest mean use (1.67 birds/20 min) and comprised 4.9 percent of all birds observed with the majority of use attributed to observations of mourning dove (Tables 2). The remaining non-raptor species groups that were observed during surveys had mean use values less than 1.10 birds/20 min.

Non-raptor use had two peaks in the fall season; during late August and early October, while the remaining survey dates had much lower counts (Figure 3). The primary contributors to the high mean use observed on August 25 and 26 (105.89 birds/20 min) were red-winged blackbirds (470 individuals in 4 flocks of 100 individuals or greater). The primary contributors to the high mean use observed on October 7 and 8 (83.78 birds/20 min) were observations of red-winged blackbirds (450 individuals in 4 flocks of 100 individuals or greater). Non-raptor mean use was less than 41.00 birds/20 mins for all other survey dates (Figure 3).

Non-raptor use was highest at point-count locations 2 and 5 (Figure 4). The non-raptor mean use at point-count location 2 (49.83 birds/20 min) was driven largely by observations of red-winged blackbirds (283 individuals; Table 3). The habitat at point-count location 2 is primarily agriculture (wheat and corn) and grassland which is not unique within the Project Area. The non-raptor mean use at point-count location 5 (47.00 birds/20 min) was also driven largely by observations of red-winged blackbird (430 individuals; Table 3). The habitat at point-count location 5 is primarily agriculture (wheat and soybean) which is not unique within the Project Area. Non-raptor use was 41.00 birds/20 mins or less for all other point count locations (Figure 4).

Raptors are a group of special interest because of their propensity to fly at heights similar to a turbine RSA. Overall mean use for raptors was 0.96 birds/20 min (Table 2); the fifth highest value among the ten species groups. The raptor species with the highest mean use were the Swainson's hawk, turkey vulture, red-tailed hawk, and northern harrier (0.31, 0.21, 0.16, and 0.16 birds/20 min and observed in 0.9, 0.6, 0.5, and 0.5 percent of all surveys, respectively; Table 2). Other raptor species detected were the American kestrel and ferruginous hawk, each with mean use values less than 0.10 birds/20 min and observed in less than 0.5 percent of all surveys (Table 2).

Raptor use peaked mid-season and tapered off as the season progressed (Figure 5). Mean use by raptors was highest from September 23rd through October 1st (ranging from 2.56 to 3.44

birds/20 min; Figure 5). Species contributing to the high raptor mean use during these dates were turkey vulture (22 individuals observed) and Swainson's hawk (19 individuals observed). Mean use for raptors was less than 1.12 birds/20 min on all other survey dates (Figure 5).

Raptor mean use was highest at point-count locations 6, 1, and 9 (1.67, 1.58, and 1.29 birds/20 min, respectively; Figure 6). Raptor species which contributed to the high mean use at point-count locations 6 and 9 was turkey vulture (10 and 9 individuals, respectively) and at point-count location 1 was Swainson's hawk (14 individuals; Table 3). The habitat at these point-count locations were primarily row crop agriculture (wheat and soybean) and grasslands which may provide foraging opportunities for raptors, however these features are not unique to these point-count locations or within the Project Area. Point-count location 1 also had a transmission line within the count circle and point-count location 9 also included windbreaks which may provide perching and roosting opportunities; however, these features are not unique to these point-count locations or within the Project Area. Raptor mean use was equal to or less than 1.00 birds/20 min at all other point-count locations.

3.2 Flight Height and Encounter Rate

During fall avian use surveys, the biologist collected behavioral data for all birds observed during point-count surveys and 93.1 percent of these were observed flying. The biologist collected flight height data for 99.9 percent and flight direction for 53.8 percent of the individuals observed flying. Of non-raptor individuals observed flying, 77.8 percent flew below the height of the anticipated RSA and 22.2 percent flew at the height of the anticipated RSA (Table 4). Of raptor individuals observed flying, 51.0 percent flew below the height of the anticipated RSA and 49.0 percent flew at the height of the anticipated RSA (Table 4). There were no raptor or non-raptor species observed flying above the height of the anticipated RSA during point-count surveys. Generally, birds observed in flight were moving in a southerly direction (SE, S, SW; 69.8 percent; Appendix 1).

The red-winged blackbird had the highest encounter rate (3.80 birds flying at RSA height/20 min; Table 5). All other species had an encounter rate less than 1.0 birds flying at RSA height/20 min.

3.3 Raptor Nest Surveys

Raptor nests detected within the Project Area included one occupied Swainson's hawk nest, one occupied great horned owl nest, and five small unoccupied nests (Figure 7). Outside of the Project Area, surveyors located two red-tailed hawk occupied nests and eight small unoccupied nests (Figure 7). The small unoccupied nests were all located in trees and are most likely used by smaller raptor species found within the Project Area (e.g., red-tailed hawk and Swainson's hawk). No known or potential eagle nests were detected.

3.4 Incidental Observations

The biologist documented eleven species incidentally to point-count surveys (Table 6). All were observed during point count surveys except for gray partridge and rough-legged hawk.

3.5 Protected Species

No federally or state threatened, endangered, or candidate species were observed during avian point-count surveys or as an incidental observation. No eagles were observed during avian point-count surveys. However, the biologist observed one adult golden eagle during the raptor nest surveys. The eagle was observed perched on a power pole within the northeastern portion of the Project Area, near point-count location 4.

4 Discussion

The avian community detected within the Project Area during fall surveys was characterized by species associated with agricultural lands and pasture vegetation typical of North Dakota. Within disturbed habitats such as those found in the Project Area, the greatest potential impact of wind facilities to avian species is collisions with turbines rather than disturbance or displacement. For this reason, our discussion focuses on the potential collision risk of the Project. Recent meta-analyses of wind projects within similar regions and habitats to the Project Area have estimated an average all-bird fatality rate of 1.81 birds/MW/year in the Great Plains (Loss et al. 2013) and 2.29 small birds/MW/year in the Prairie biome (Erickson et al. 2014). Annual avian fatality rates at the Project, should fatalities occur, are expected to fall within this range.

4.1 Non-Raptor Use and Collision Risk

Songbirds were identified as having potential risk of collision due to high encounter rates and/or relatively high mean use rates. Encounter rate was highest for red-winged blackbirds (3.80 birds flying at RSA height/20 minutes; Table 5). All other songbird species had encounter rates less than 0.83 birds flying at RSA height/20 min. However, the horned lark had a relatively high frequency of detection compared to the other species (observed in 50.0 percent of all surveys) with moderate mean use (6.81 birds/20 min) and an encounter rate of 0.83 birds flying at RSA height/20 min. Red-winged blackbirds are local year-round residents and transient migratory species in this region of North Dakota and may be at the greatest fatality risk during the spring and fall due to their flocking characteristics, which may also be contributing to their relatively high encounter rate in comparison to other species. Additionally, the horned lark exhibits breeding flight displays that may bring them into the height of the RSA (Pickwell 1931). The red-winged blackbird and horned lark have been documented as fatalities at other wind energy projects (Tetra Tech unpublished data). Although risk of turbine-related fatalities at the Project exists for each of these species, they are unlikely to have population-level impacts because North Dakota populations for each species are large (8.2 million and 4.3 million, respectively; PIFSC 2013). When compared with other human-driven mortality causes for birds, wind turbines have significantly less mortalities (hundreds of thousands) than those caused by cats (billions) or buildings (hundreds of millions; Loss et al. 2015). Due to the small amount of the population that is likely to be killed by wind turbines (less than 1 percent by species), it is unlikely that population-level impacts will occur (Erickson et al. 2014).

Outside of the songbird group, Waterfowl and the Pigeons/Dove species groupings had the highest mean use. Canada goose was the species with the highest mean use and frequency of observation in the waterfowl group (2.45 birds/20 min and observed in 14.8 percent of all surveys, respectively). However, the encounter rate for Canada goose was low (0.28 birds flying at RSA height/20 min). Project-related fatalities of the Canada goose, should they occur, are unlikely to have population-level impacts because North Dakota populations for Canada goose are large and are increasing significantly in the Western Prairie and Great Plains which includes North Dakota (455,800; Sauer et al. 2014, USFWS 2015c). In addition, few fatalities of Canada goose have documented as wind farm fatalities in publicly available reports (Tetra Tech unpublished data). Within the Pigeons/Doves group, mourning dove had the highest mean use and frequency of observation (1.56 birds/20 min and observed in 29.6 percent of all surveys; Table 2). However, the encounter rate for mourning dove was low (0.00 birds flying at RSA height/20 min) as no individuals were observed flying at the anticipated RSA height. Mourning doves are found as turbine-related fatalities in low numbers based upon results from publicly post-construction mortality monitoring studies (Tetra Tech unpublished data). Therefore, project-related fatalities of the mourning dove, should they occur, are unlikely to have population-level impacts because North Dakota populations for mourning dove are large (4.1 million) and are stable (PIFSC 2013, Sauer et al. 2014).

The remaining non-raptor species detected during fall surveys likely have low risk of 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 publicly available results of mortality studies.

4.2 Raptor Use and Collision Risk

The unique foraging behavior of raptors is thought to contribute to their relatively greater susceptibility to turbine-collisions (Kikuchi 2008, de Lucas et al. 2008). As such, collision risk varies with species-specific traits such as flight behavior as well as site-specific variables such as turbine height and topography. A recent meta-analysis suggests that pre-construction studies provide poor indicators of post-construction mortality (Ferrer et al. 2012). Prior to Ferrer et al. (2012), high raptor use (> 2.0 birds/20 min) has often been associated with high raptor mortality at wind farms (Strickland et al. 2011). Conversely, raptor mortality often appears to be low when raptor use is low (< 1.0 birds/20 min; Strickland et al. 2011). In the case of this Project, overall raptor use was 1.07 birds/20 minutes, which is just above the low mean use mark of 1.0 birds/20 min. Although the respective collision risk of specific raptor species is not currently known, as more wind energy facilities complete studies of raptor behavior and post-construction mortality, species-specific and site-specific collision risk factors will become better understood.

Swainson's hawks, turkey vultures, red-tailed hawks, and northern harriers had the highest mean use (0.31, 0.21, 0.16, and 0.16 birds/20 min, respectively) for the raptor species group, and, except for turkey vultures, were the most frequently detected raptor species at the Project Area (observed in 17.6 and 15.7 percent of all surveys, respectively). These species are commonly associated with agricultural and grassland prairie habitats which provide opportunities for foraging, an activity associated with susceptibility to turbine collisions (Thelander et al. 2003).

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). Collision risk at the Project may be somewhat higher for Swainson's hawks during the breeding season as occupied nests were detected within or near the Project Area during raptor nest surveys. However, given the low mean use of Swainson's hawks within the Project Area, low encounter rate (0.07 birds flying at the RSA height/20 min) and the fact that they are not commonly detected as wind farm fatalities (Tetra Tech unpublished data), turbine-related fatalities at the Project are likely to be low. Project-related fatalities of Swainson's hawk, should they occur, are unlikely to have population-level impacts because populations are relatively stable in North Dakota (Sauer et al. 2014).

Turkey vultures 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, Kikuchi 2008). Additionally, turkey vultures have been observed engaging in high-risk flight behaviors at operational wind facilities (Garvin et al. 2011), and results from post-construction mortality monitoring studies indicate that this species is commonly found as a turbine-related fatality (Miller 2008, Tierney 2009, Hale and Karsten 2010, Piorkowski and O'Connell 2010). Based on this information, turkey vultures appear to have the highest risk of collision with Project turbines among raptor species observed during surveys. However, Garvin et al. (2011) documented that turkey vultures, despite high-risk flight behavior, also demonstrated collision avoidance behavior. Turkey vultures are common nationwide (18 million, PIFSC 2013) and are experiencing population-wide increases (Sauer et al. 2014). Taken together, these lines of evidence suggest that risk of turbine-related mortality at the Project exists for this species, but project-related fatalities of turkey vulture, should they occur, are unlikely to have population-level impacts.

Northern harriers have been seldom recorded as fatalities at other wind farms with publicly available data (Erickson et al. 2002, Young et al. 2003, Johnson and Erickson 2011), and the majority of foraging flights for the northern harrier occur below typical RSA heights (Whitfield and Madders 2006). The 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 and low encounter rate of 0.00 birds flying at the RSA height/20 min within the Project Area. Project-related fatalities of northern harrier, should they occur, are unlikely to have population-level impacts because populations are relatively stable in North Dakota (Sauer et al. 2014).

In a 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 (Jain 2005, Grodsky and Drake 2011, Johnson and Erickson 2011). Collison risk at the Project may be somewhat higher for red-tailed hawks during the breeding season because occupied nests were detected within or near the Project Area during raptor nest surveys. However, Project-related fatalities are unlikely to have population-level impacts because red-tailed hawk populations are significantly increasing in North Dakota (Sauer et al. 2014).

Other raptor species detected during fall point counts included American kestrel and ferruginous hawk. American kestrels are commonly found as fatalities at wind facilities (Erickson et al. 2002, Stantec 2010); however, an encounter rate of 0.00 birds flying at the RSA height/20 min for this species suggests a low risk for turbine collisions at the Project. The ferruginous hawk is not commonly found as fatalities at wind energy facilities according to publicly available data. Additionally, low use of the Project Area and an encounter rate of 0.00 birds flying at the RSA height/20 min, suggests a low risk of collision with Project turbines.

4.3 Protected Species

No federally threatened or endangered species were observed during avian point-count surveys or as an incidental observation.

Although no eagles were observed during avian point-count surveys, one golden eagle was observed in the Project Area during raptor nest surveys. This incidental detection suggests that golden eagles may occur in the Project Area in the future. No bald or golden eagle nests were found within the Project Area or 2-mile buffer during the raptor nest surveys conducted in June and November 2015; however, there are several bald eagle nests within 10 miles of the Project Area along the Missouri River that were outside of the Survey Area (Johnson 2010). Raptor nest surveys in spring 2016 will extend to 10 miles outside of the Project Area and will include this area.

Six bald eagle fatalities associated with wind energy facilities within the United States were reported from 1997 through June 2012 (Pagel et al. 2013). Since publication of the Pagel et al (2013) summary, one bald eagle fatality has been reported at a wind energy facility in North Dakota (Public Prairie Broadcasting 2015). Bald eagles are believed to be at less risk of turbine collision than golden eagles because they tend to focus their hunting efforts for fish and waterfowl in lakes and rivers (Buehler 2000).

Seventy-nine golden eagle mortalities associated with wind energy facilities within the United States were reported from 1997 through June 2012, excluding the Altamont Pass Wind Resource Area in California (Pagel et al. 2013); however, to date no golden eagle mortalities have been reported at wind energy facilities in North Dakota. Golden eagles are believed to be more at risk of turbine collision than bald eagles because they hunt for land-based prey along topographic contours where turbines are often located (Kochert et al. 2002). Although golden eagles may occur in the Project Area during any time of the year, the species is unlikely to breed within the Project Area due to a lack of suitable habitat; however, suitable habitat may be present outside of the Project Area in bluffs along Square Butte Creek which will be surveyed in spring 2016. Eagles use surveys are underway to evaluate risk of Project activities to eagles.

According to the Comprehensive Wildlife Conservation Strategy for North Dakota, there are 45 avian species of conservation priority from three tier levels (Hagen et al. 2005). According to Hagen et al (2005), Level I species are those having a high level of conservation priority because of declining status in North Dakota or across their range; or have a high rate of occurrence in North Dakota, constituting the core of the species breeding range, but may be at-risk range-wide. These are species that are in decline and presently receive little or no monetary support or conservation efforts. North Dakota Game and Fish Department has a clear obligation to use State Wildlife Grants (SWG) funding to implement conservation actions that directly benefit these species. Level II species are those having a moderate level of conservation priority; or a high level of conservation priority but a substantial level of non-SWG funding is available to them. North Dakota Game and Fish Department will use SWG funding to implement conservation actions to benefit Level II species if SWG funding for Level I species is sufficient or conservation needs have been met (Hagen et al. 2005).

Of 45 avian species of conservation priority in North Dakota, five species of conservation priority were found within the Project Area from two tier levels. The Level I species observed were the ferruginous hawk, Franklin's gull and Swainson's hawk. As discussed previously, the mean use for ferruginous hawk and Swainson's hawk was low (less than 1.0 birds/20 min). The mean use for Franklin's gull was also low (less than 0.50 birds/20 min). The encounter rates for Level I species were also less than 0.50 birds flying at the RSA height/20 min for this species suggests a low risk for turbine collisions at the Project. The Level II species observed at the Project Area were northern harrier and sharp-tailed grouse. As discussed previously, the mean use for northern harrier was low (less than 1.0 birds/20 min) and the encounter rate was 0.00 birds flying at the RSA height/20 min for this species suggests a low risk for turbine collisions at the Project. Grouse typically fly at heights below the RSA which was the pattern at the Project Area for sharp-tailed grouse (0.00 birds flying at the RSA height/20 min). Mean use for the Project Area was also low (0.14 birds/20 min) with sharp-tailed grouse only observed at points 7 and 8; however, the habitat at these locations do not appear to significantly different from the other point-count locations with the Project Area.

5 Conclusions

Results of the fall 2015 avian surveys at the Oliver III Wind Energy Center suggest an overall low impact of the Project on the local avian community. The mean-use rate at the Project by non-raptors is primarily driven by observations of large flocks of a few common residents and migratory species. If avian fatality rates are similar to other wind facilities within the prairie biome, we would expect them to fall between 0.42–5.59 birds/MW/year (Erickson et al. 2014). Additionally, the potential for turbine-related fatalities exists for nocturnal migrant species not identifiable by the methods of this study.

No federally or state listed threatened or endangered species were detected during avian point-count surveys. There were no eagles observed during avian point-count surveys; however, one golden eagle was observed incidentally during raptor nest surveys. No known or potential eagle nests were detected. Eagles are protected under the Bald and Golden Eagle Protection Act and all native migratory avian species are protected by the Migratory Bird Treaty Act of 1918. However, currently, there are no permits for incidental take of migratory birds.

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FIGURES

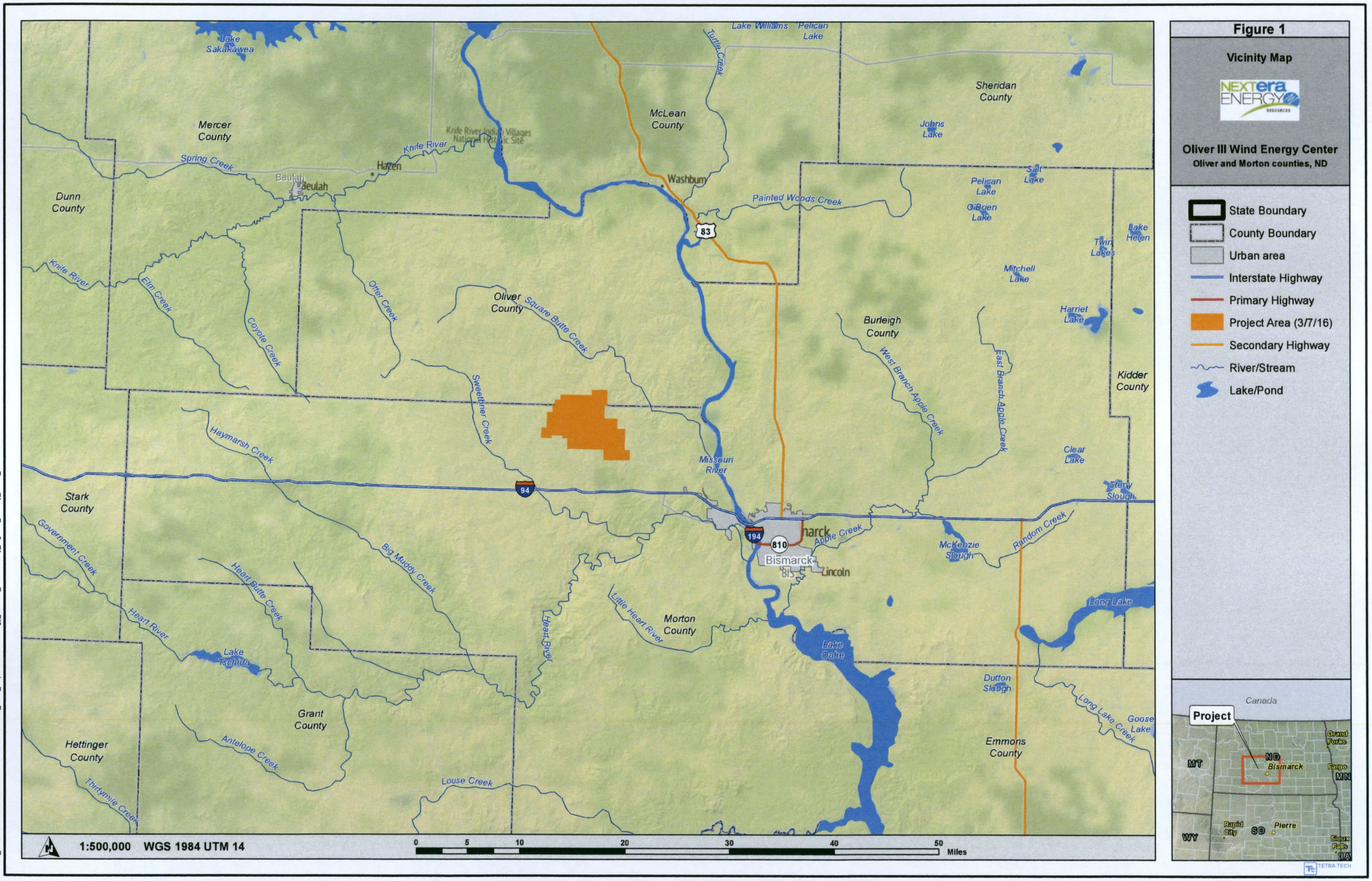

Figure 1

Vicinity Map

Oliver III Wind Energy Center
Oliver and Morton counties, ND

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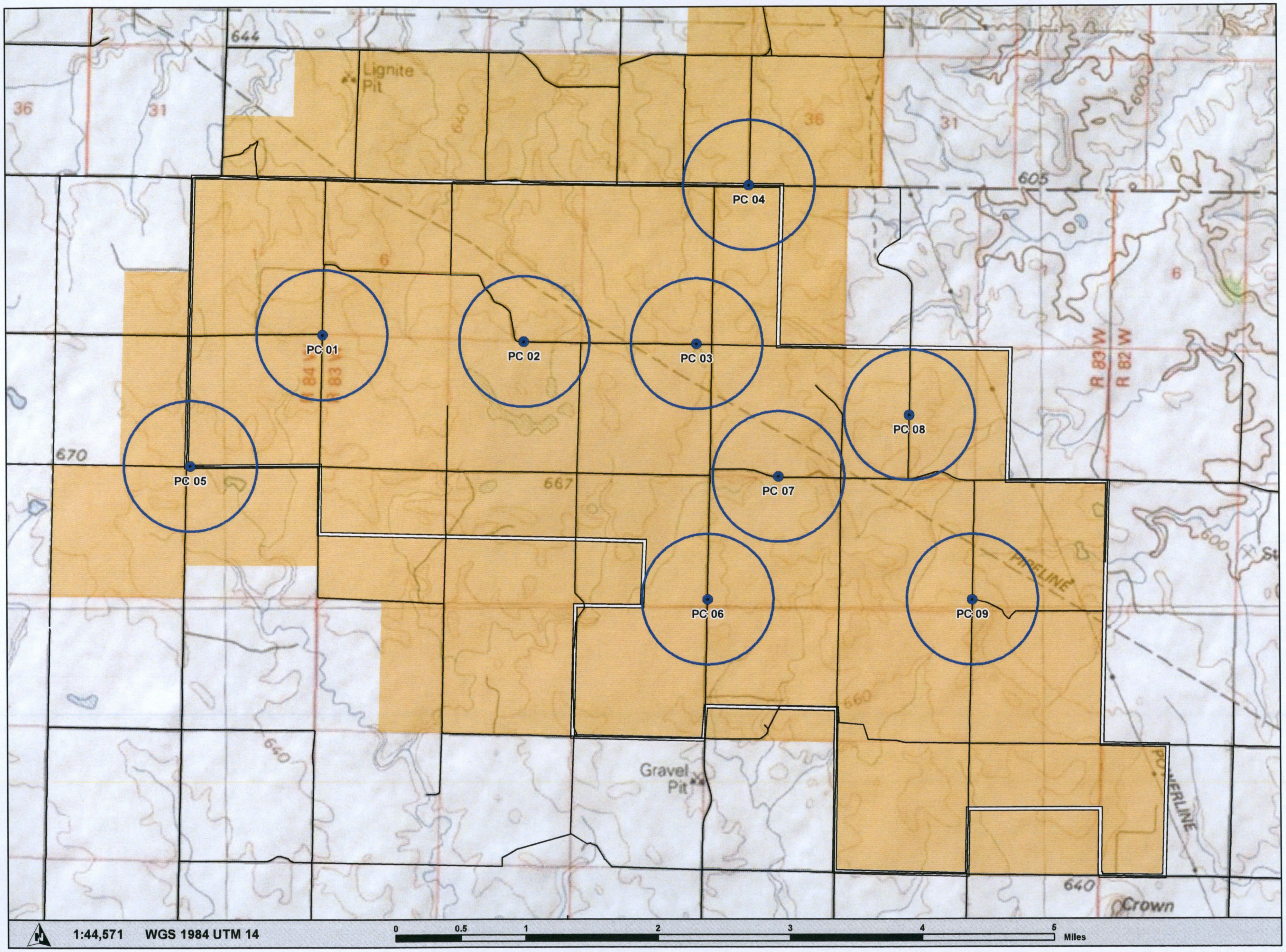


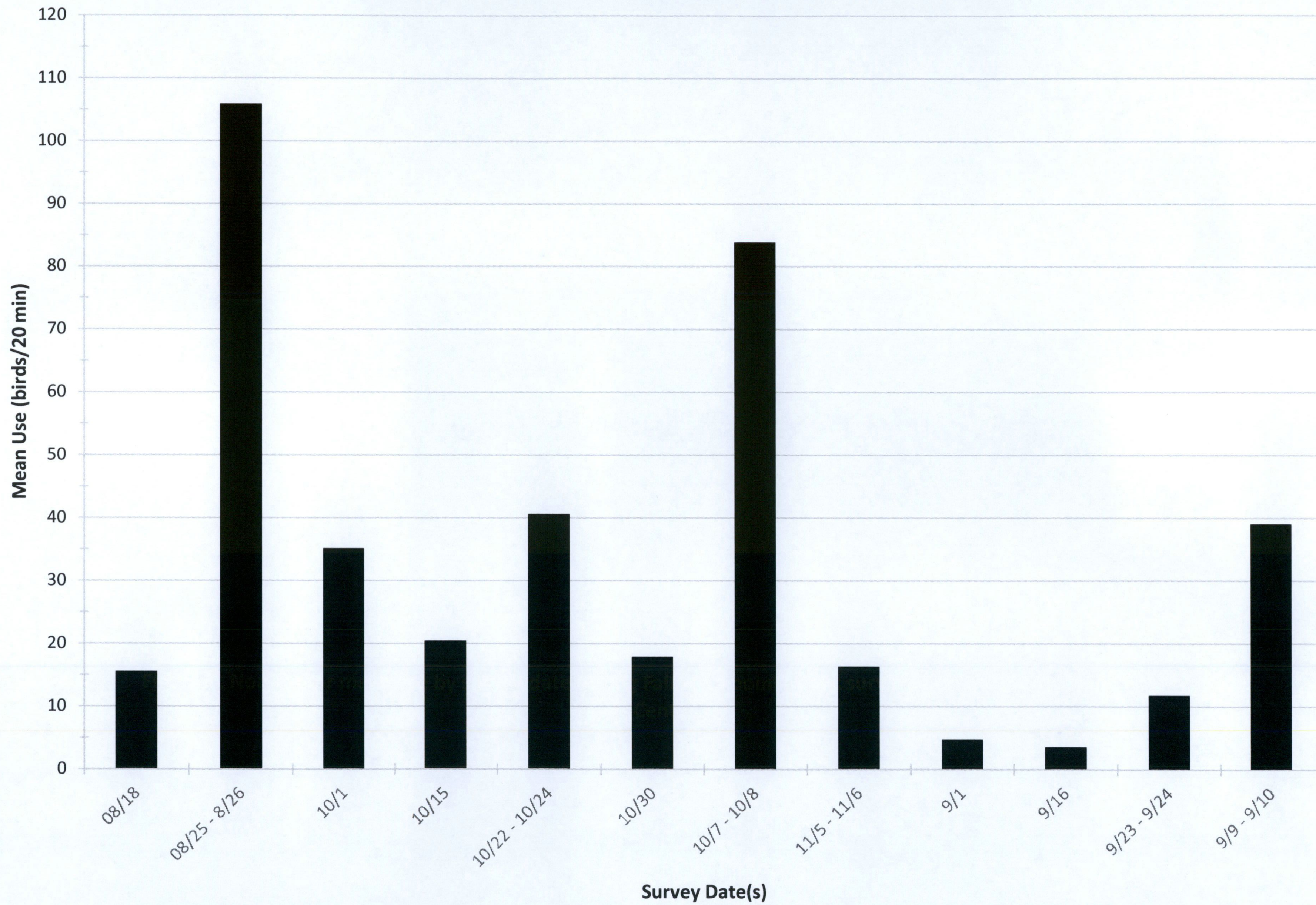
Figure 2

Point-count location map (Fall 2015)

Oliver III Wind Energy Center
Oliver and Morton counties, ND
Last Modified: 01-19-2016

- Avian Survey Point
- Avian Survey Point 800-m Radius
- **PC# Point count number**
- Proposed Project Area (03-07-2016)
- Original Proposed Project Area (05-20-2015)
- Local Road

Figure 3. Non-raptor mean use by survey date during Fall 2015 point-count surveys at the Oliver III Wind Energy Center



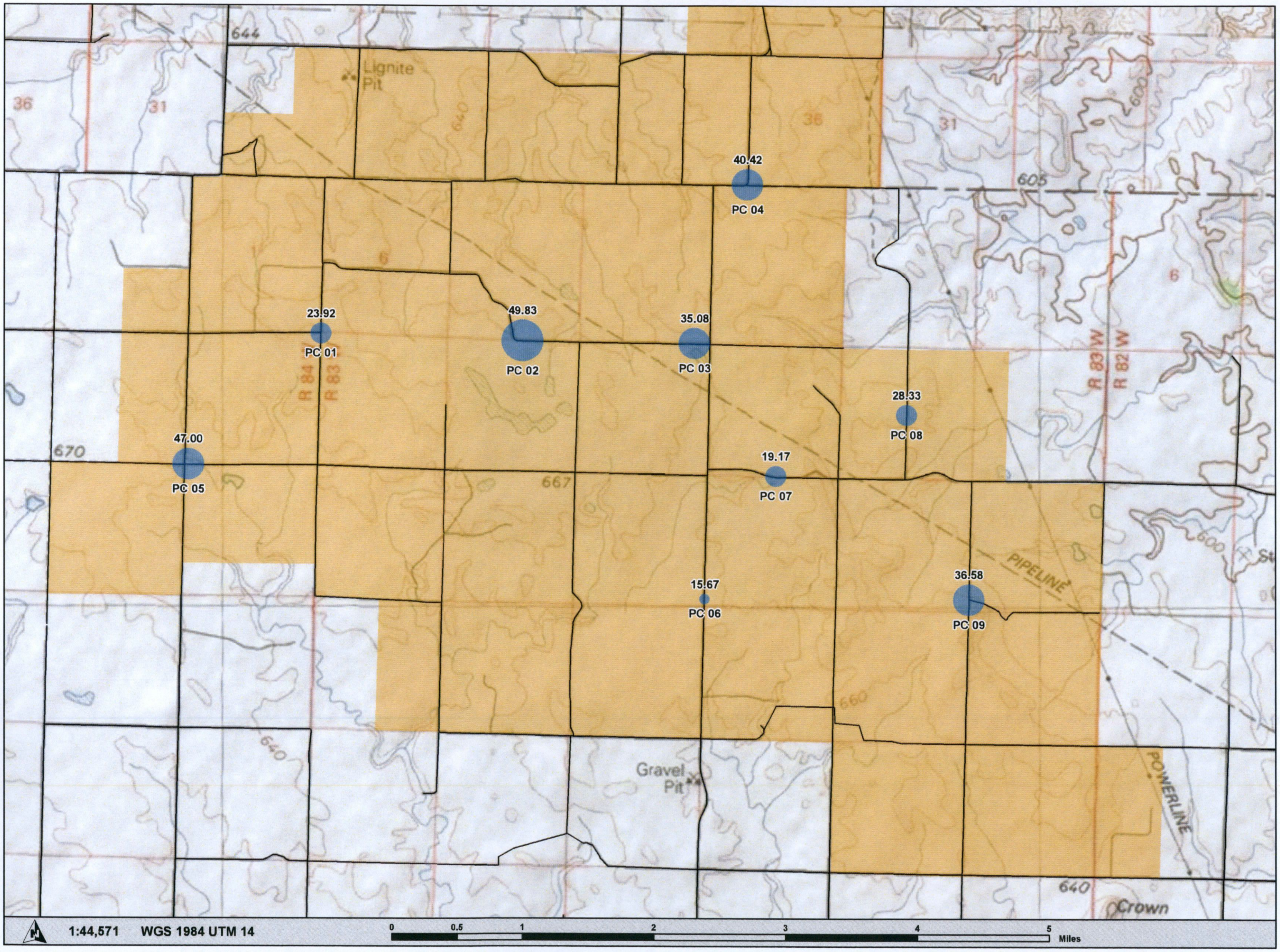


Figure 4

Non-raptor mean use by point-count location (Fall 2015)

NEXTera ENERGY RESOURCES

Oliver III Wind Energy Center

Oliver and Morton counties, ND

Last Modified: 01-19-2016

Non-raptors Per 20 Minutes

- 0.01 - 16.00
- 16.01 - 32.00
- 32.01 - 48.00
- 48.01 - 64.00

 # Mean use value

PC# Point count number

Proposed Project Area (03-07-2016)

Local Road

Note: The minimum mean use value for non-rapters per 20 minutes is equal to 15.67. This is significantly higher than that of the rapters.

TETRA TECH

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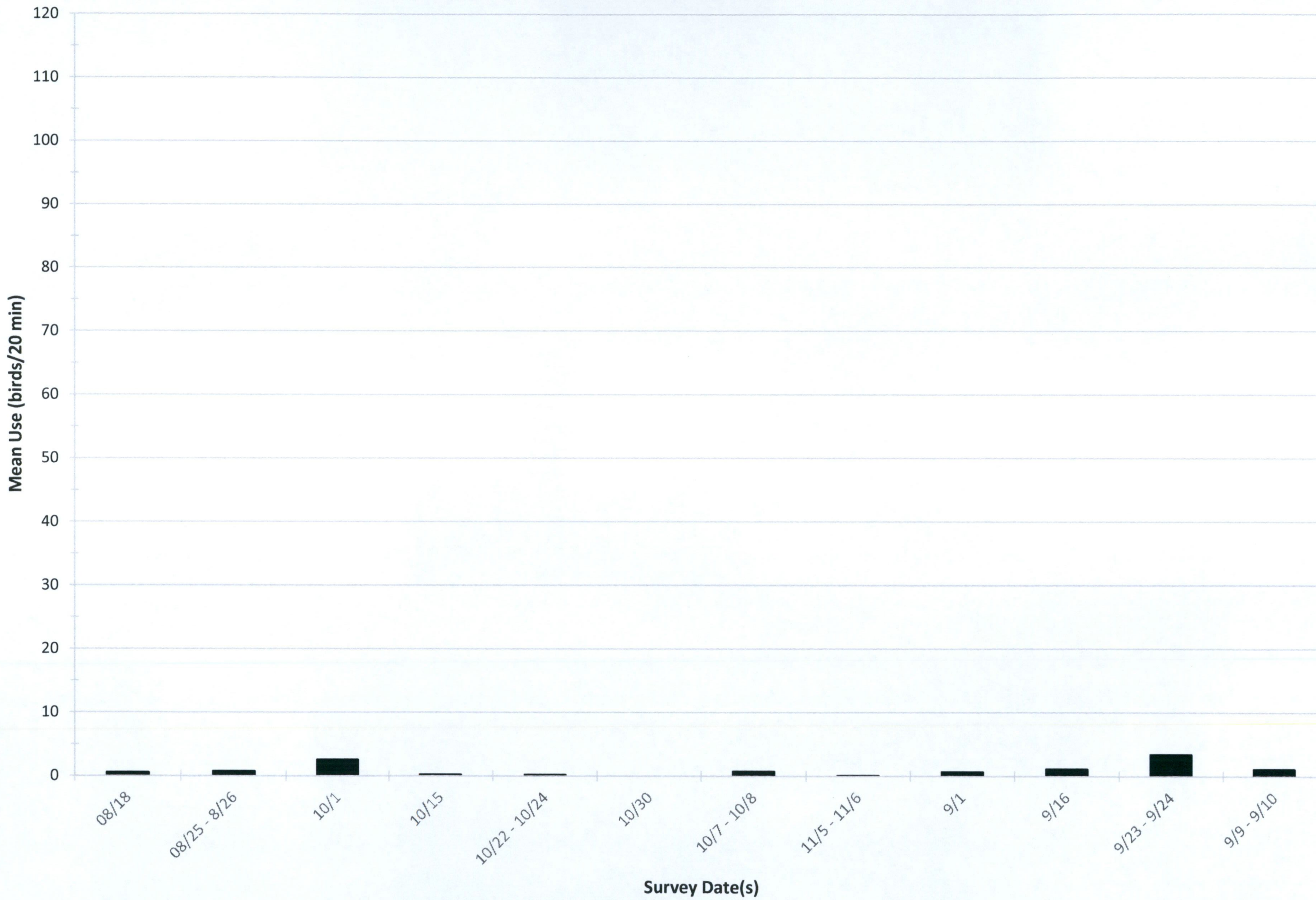
Figure 5. Raptor mean use by survey date during Fall 2015 point-count surveys at the Oliver III Wind Energy Center



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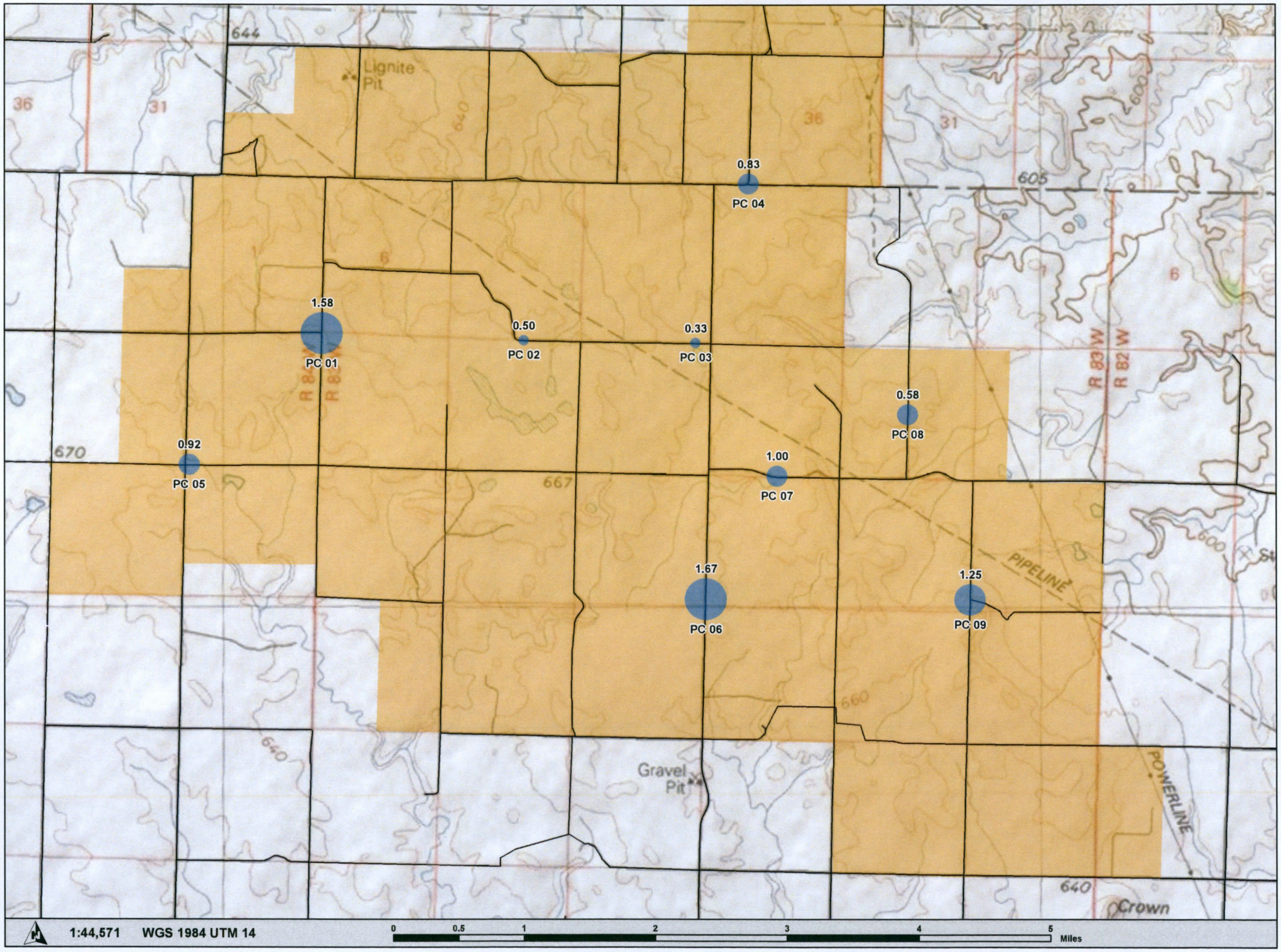

Figure 6

Raptor mean use by point-count location (Fall 2015)

Oliver III Wind Energy Center
Oliver and Morton counties, ND
Last Modified: 01-19-2016

Raptors Per 20 Minutes
- 0.21 - 0.50
- 0.51 - 1.00
- 1.01 - 1.50
- 1.51 - 2.00

\# Mean use value
PC# Point count number

Local Road
Proposed Project Area (03-07-2016)

TETRA TECH

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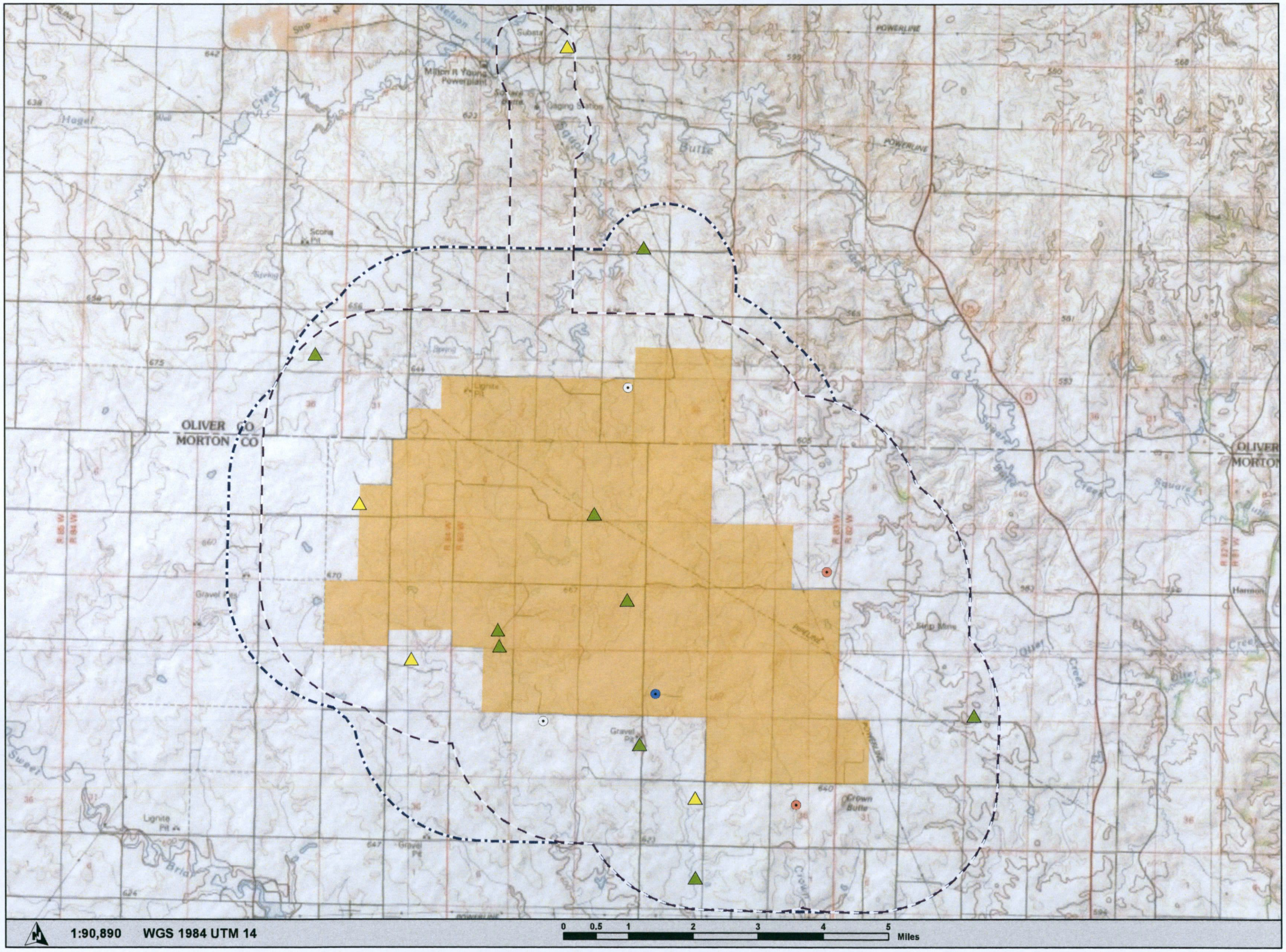
Figure 7

Raptor nest location map (Summer and Fall 2015)

Oliver III Wind Energy Center

Oliver and Morton counties, ND
Last Modified: 01-19-2016



Raptor Nests

- Occupied Great-horned Owl nest
- Occupied Red-tailed hawk nest
- Occupied Swainson's hawk nest
- Small Unoccupied Inactive Nests Found in Summer 2015
- Small Unoccupied Inactive Nests Found in Fall 2015
- Proposed Project Area (03-07-2016)
- Summer 2015 Survey Area
- Fall 2015 Survey Area

TETRA TECH

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TABLES

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Table 1. Fall 2015 point-count survey dates at the Oliver III Wind Energy Center.

Survey number	Date(s)	
1	8/18	2015
2	8/25-8/26	2015
3	9/1	2015
4	9/9-9/10	2015
5	9/16	2015
6	9/23-9/24	2015
7	10/1	2015
8	10/7-10/8	2015
9	10/15	2015
10	10/22-10/24	2015
11	10/30	2015
12	11/5-11/6	2015

Table 2. Avian species, by species grouping, observed during Fall 2015 point-count surveys at the Oliver III Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)		Frequency % of surveys detected	Percent Composition	
							Group	Overall
Songbirds								
red-winged blackbird	1	1431	23	13.25	(7.13-19.37)	19.4	51.0%	39.1%
horned lark	2	736	63	6.81	(4.74-8.88)	50.0	26.2%	20.1%
western meadowlark	5	161	43	1.49	(1.02-1.96)	32.4	5.7%	4.4%
American robin	6	131	20	1.21	(0.63-1.79)	14.8	4.7%	3.6%
common grackle	8	84	5	0.78	(0.00-1.72)	4.6	3.0%	2.3%
eastern kingbird	11	57	28	0.53	(0.33-0.73)	19.4	2.0%	1.6%
brown-headed cowbird	12	53	4	0.49	(0.00-1.00)	3.7	1.9%	1.4%
European starling	13	42	3	0.39	(0.02-0.76)	2.8	1.5%	1.1%
barn swallow	16	28	8	0.26	(0.02-0.50)	5.6	1.0%	0.8%
American crow	16	28	4	0.26	(0.02-0.50)	3.7	1.0%	0.8%
snow bunting	20	22	4	0.20	(0.01-0.39)	3.7	0.8%	0.6%
American goldfinch	24	16	16	0.15	(0.08-0.22)	10.2	0.6%	0.4%
western kingbird	26	9	4	0.08	(0.01-0.15)	3.7	0.3%	0.2%
cliff swallow	29	3	1	0.03	(0.00-0.08)	0.9	0.1%	0.1%
black-billed magpie	30	2	2	0.02	(0.00-0.04)	1.9	0.1%	0.1%
house wren	32	1	1	0.01	(0.00-0.03)	0.9	0.0%	0.0%
Group Total		**2804**	**229**	**25.96**	(19.24-32.68)	**87.0**		**76.7%**
Waterfowl								
Canada goose	3	265	16	2.45	(1.34-3.56)	14.8	99.6%	7.2%
mallard	32	1	1	0.01	(0.00-0.03)	0.9	0.4%	0.0%
Group Total		**266**	**17**	**2.46**	(1.35-3.57)	**15.7**		**7.3%**
Pigeons/Doves								
mourning dove	4	168	47	1.56	(1.02-2.10)	29.6	93.3%	4.6%
rock pigeon	25	12	2	0.11	(0.00-0.24)	1.9	6.7%	0.3%
Group Total		**180**	**49**	**1.67**	(1.12-2.22)	**29.6**		**4.9%**
Gamebirds								
ring-necked pheasant	7	97	53	0.90	(0.63-1.17)	38.0	85.1%	2.7%
sharp-tailed grouse	21	17	4	0.16	(0.03-0.29)	3.7	14.9%	0.5%
Group Total		**114**	**57**	**1.06**	(0.75-1.37)	**38.9**		**3.1%**

Table 2. Avian species, by species grouping, observed during Fall 2015 point-count surveys at the Oliver III Wind Energy Center.

Species Grouping	Overall Rank[1]	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
Raptors							
Swainson's hawk	15	34	22	0.31 (0.09-0.53)	17.6	32.7%	0.9%
turkey vulture	19	23	4	0.21 (0.00-0.42)	3.7	22.1%	0.6%
red-tailed hawk	21	17	17	0.16 (0.10-0.22)	15.7	16.3%	0.5%
northern harrier	21	17	17	0.16 (0.10-0.22)	15.7	16.3%	0.5%
unidentified buteo	27	8	8	0.07 (0.03-0.11)	7.4	7.7%	0.2%
American kestrel	28	4	4	0.04 (0.01-0.07)	3.7	3.8%	0.1%
ferruginous hawk	32	1	1	0.01 (0.00-0.03)	0.9	1.0%	0.0%
Group Total		**104**	**73**	**0.96** (0.65-1.27)	**51.9**		**2.8%**
Gulls/Terns							
ring-billed gull	9	61	4	0.56 (0.10-1.02)	3.7	60.4%	1.7%
Franklin's gull	14	40	2	0.37 (0.00-0.84)	1.9	39.6%	1.1%
Group Total		**101**	**6**	**0.94** (0.29-1.59)	**5.6**		**2.8%**
Waterbirds							
killdeer	10	58	11	0.54 (0.17-0.91)	10.2	100.0%	1.6%
Group Total		**58**	**11**	**0.54** (0.17-0.91)	**10.2**		**1.6%**
Cranes/Rails							
sandhill crane	18	26	1	0.24 (0.00-0.64)	0.9	100.0%	0.7%
Group Total		**26**	**1**	**0.24** (0.00-0.64)	**0.9**		**0.7%**
Woodpeckers							
northern flicker	30	2	2	0.02 (0.00-0.04)	1.9	100.0%	0.1%
Group Total		**2**	**2**	**0.02** (0.00-0.04)	**1.9**		**0.1%**
Goatsuckers							
common nighthawk	32	1	1	0.01 (0.00-0.03)	0.9	100.0%	0.0%
Group Total		**1**	**1**	**0.01** (0.00-0.03)	**0.9**		**0.0%**
Grand Total		**3656**	**446**	**33.85** (26.55-41.15)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during Fall 2015 point-count surveys at the Oliver III Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points								
			1	2	3	4	5	6	7	8	9
red-winged blackbird	1431	23	100	283	108	151	430	44	35	130	150
horned lark	736	63	26	63	83	170	71	39	114	55	115
Canada goose	265	16	48	73	90	0	3	0	16	13	22
mourning dove	168	47	24	16	23	27	19	16	13	15	15
western meadowlark	161	43	17	20	14	26	4	27	11	26	16
American robin	131	20	1	25	2	14	0	5	6	0	78
ring-necked pheasant	97	53	18	14	7	5	10	5	11	18	9
common grackle	84	5	0	60	5	0	0	13	6	0	0
ring-billed gull	61	4	0	0	17	14	0	0	0	16	14
killdeer	58	11	0	0	21	20	0	0	0	16	1
eastern kingbird	57	28	5	5	3	12	6	5	1	8	12
brown-headed cowbird	53	4	30	0	0	0	0	6	0	17	0
European starling	42	3	0	15	0	0	16	11	0	0	0
Franklin's gull	40	2	0	11	0	29	0	0	0	0	0
Swainson's hawk	34	22	14	1	2	1	5	1	6	3	1
American crow	28	4	0	0	12	9	0	3	0	4	0
barn swallow	28	8	18	8	2	0	0	0	0	0	0
sandhill crane	26	1	0	0	26	0	0	0	0	0	0
turkey vulture	23	4	0	0	0	3	0	10	1	0	9
snow bunting	22	4	0	0	6	0	0	6	10	0	0
northern harrier	17	17	4	2	2	2	1	3	0	1	2
red-tailed hawk	17	17	1	3	0	2	3	1	3	1	3
sharp-tailed grouse	17	4	0	0	0	0	0	0	3	14	0
American goldfinch	16	16	0	1	2	4	2	2	3	1	1
rock pigeon	12	2	0	0	0	0	0	5	0	7	0
western kingbird	9	4	0	3	0	0	2	0	0	0	4
unidentified buteo	8	8	0	0	0	1	2	2	2	1	0

Table 3. Avian species observed by point during Fall 2015 point-count surveys at the Oliver III Wind Energy Center.

Species	Number of Birds	Number of Obs.	Points								
			1	2	3	4	5	6	7	8	9
American kestrel	4	4	0	0	0	1	0	2	0	1	0
cliff swallow	3	1	0	0	0	3	0	0	0	0	0
black-billed magpie	2	2	0	0	0	0	1	0	0	0	1
northern flicker	2	2	0	0	0	0	0	0	1	0	1
common nighthawk	1	1	0	1	0	0	0	0	0	0	0
ferruginous hawk	1	1	0	0	0	0	0	1	0	0	0
house wren	1	1	0	0	0	1	0	0	0	0	0
mallard	1	1	0	0	0	0	0	1	0	0	0
Grand Total	**3656**	**446**	**306**	**604**	**425**	**495**	**575**	**208**	**242**	**347**	**454**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during Fall 2015 point-count surveys at the Oliver III Wind Energy Center.

		Birds	
		Number	Percentage
Non-raptors			
	At RSA height (22m–138m)	733	22.2%
	Below RSA height (<22m)	2569	77.8%
Raptors			
	At RSA height (22m–138m)	48	49.0%
	Below RSA height (<22m)	50	51.0%

[1]Includes only flying birds with flight height data

[2]These values assume a rotor diameter of 116 meters and a hub height of 80 meters

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2015 point-count surveys at the Oliver III 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	3.80	13.25 (7.13 - 19.37)	99.9	0.0	28.7	71.3
horned lark	0.83	6.81 (4.74 - 8.88)	99.3	0.0	12.3	87.7
common grackle	0.59	0.78 (0.00 - 1.72)	100.0	0.0	75.0	25.0
Canada goose	0.29	2.45 (1.34 - 3.56)	78.9	0.0	14.8	85.2
brown-headed cowbird	0.28	0.49 (0.00 - 1.00)	100.0	0.0	56.6	43.4
ring-billed gull	0.28	0.56 (0.10 - 1.02)	100.0	0.0	49.2	50.8
Franklin's gull	0.27	0.37 (0.00 - 0.84)	100.0	0.0	72.5	27.5
sandhill crane	0.24	0.24 (0.00 - 0.64)	100.0	0.0	100.0	0.0
American crow	0.22	0.26 (0.02 - 0.50)	100.0	0.0	85.7	14.3
turkey vulture	0.21	0.21 (0.00 - 0.42)	100.0	0.0	100.0	0.0
red-tailed hawk	0.11	0.16 (0.10 - 0.22)	76.5	0.0	92.3	7.7
Swainson's hawk	0.07	0.31 (0.09 - 0.53)	97.1	0.0	24.2	75.8
unidentified buteo	0.04	0.07 (0.03 - 0.11)	100.0	0.0	62.5	37.5
American goldfinch	0.00	0.15 (0.08 - 0.22)	87.5	0.0	0.0	100.0
American kestrel	0.00	0.04 (0.01 - 0.07)	100.0	0.0	0.0	100.0
American robin	0.00	1.21 (0.63 - 1.79)	87.0	0.0	0.0	100.0
barn swallow	0.00	0.26 (0.02 - 0.50)	100.0	0.0	0.0	100.0
black-billed magpie	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
cliff swallow	0.00	0.03 (0.00 - 0.08)	100.0	0.0	0.0	100.0
common nighthawk	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.53 (0.33 - 0.73)	75.4	0.0	0.0	100.0
European starling	0.00	0.39 (0.02 - 0.76)	100.0	0.0	0.0	100.0
ferruginous hawk	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
house wren	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
killdeer	0.00	0.54 (0.17 - 0.91)	91.4	0.0	0.0	100.0
mallard	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
mourning dove	0.00	1.56 (1.02 - 2.10)	79.2	0.0	0.0	100.0
northern flicker	0.00	0.02 (0.00 - 0.04)	100.0	0.0	0.0	100.0
northern harrier	0.00	0.16 (0.10 - 0.22)	100.0	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during Fall 2015 point-count surveys at the Oliver III 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	0.90 (0.63 - 1.17)	7.2	0.0	0.0	100.0
rock pigeon	0.00	0.11 (0.00 - 0.24)	100.0	0.0	0.0	100.0
snow bunting	0.00	0.20 (0.01 - 0.39)	100.0	0.0	0.0	100.0
sharp-tailed grouse	0.00	0.16 (0.03 - 0.29)	64.7	0.0	0.0	100.0
western kingbird	0.00	0.08 (0.01 - 0.15)	66.7	0.0	0.0	100.0
western meadowlark	0.00	1.49 (1.02 - 1.96)	90.7	0.0	0.0	100.0

[1]These values assume a rotor diameter of 116 (meters) and a hub height of 80 (meters)

Table 6. Incidental observations of birds during Fall 2015 point count surveys at the Oliver IIIWind Energy Center.

Species	Number of individuals
Swainson's hawk	45
Canada goose	38
red-tailed hawk	24
northern harrier	13
sharp-tailed grouse	12
European starling	9
gray partridge	7
ring-necked pheasant	5
turkey vulture	4
American kestrel	2
rough-legged hawk	1
Grand Total	**160**

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APPENDIX

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Appendix 1. Flight directions of birds observed during Fall 2015 point-count surveys at the Oliver III Wind Energy Center.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
red-winged blackbird	867	16	11.5	0.0	0.0	31.1	53.5	0.0	3.8	0.0	0.0
Canada goose	209	13	13.4	0.0	16.7	25.8	9.1	5.7	23.9	5.3	0.0
horned lark	119	6	7.6	0.0	0.0	75.6	4.2	0.0	12.6	0.0	0.0
mourning dove	105	24	34.3	0.0	28.6	0.0	28.6	3.8	4.8	0.0	0.0
common grackle	82	4	0.0	0.0	7.3	89.0	0.0	0.0	0.0	3.7	0.0
ring-billed gull	61	4	27.9	0.0	49.2	23.0	0.0	0.0	0.0	0.0	0.0
brown-headed cowbird	49	3	0.0	0.0	61.2	0.0	12.2	0.0	26.5	0.0	0.0
western meadowlark	43	5	0.0	0.0	0.0	48.8	32.6	0.0	18.6	0.0	0.0
Franklin's gull	40	2	0.0	0.0	72.5	0.0	27.5	0.0	0.0	0.0	0.0
Swainson's hawk	32	20	3.1	0.0	3.1	15.6	68.8	0.0	9.4	0.0	0.0
European starling	31	2	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
American robin	31	4	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
American crow	28	4	42.9	0.0	10.7	0.0	46.4	0.0	0.0	0.0	0.0
sandhill crane	26	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
turkey vulture	23	4	0.0	0.0	4.3	0.0	39.1	56.5	0.0	0.0	0.0
barn swallow	19	2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
northern harrier	14	14	21.4	7.1	7.1	7.1	35.7	0.0	14.3	7.1	0.0
killdeer	14	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
red-tailed hawk	13	13	7.7	0.0	0.0	15.4	23.1	15.4	23.1	15.4	0.0
unidentified buteo	8	8	12.5	25.0	25.0	0.0	0.0	25.0	0.0	12.5	0.0
rock pigeon	7	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
ring-necked pheasant	5	2	0.0	0.0	40.0	0.0	60.0	0.0	0.0	0.0	0.0
American kestrel	3	3	33.3	0.0	33.3	0.0	33.3	0.0	0.0	0.0	0.0
black-billed magpie	1	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Total	**1830**	**157**	**11.5**	**0.2**	**10.4**	**32.8**	**34.8**	**2.2**	**7.2**	**1.0**	**0.0**

[1] Includes only flying birds with flight directions

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