2009 Fall Avian Survey

Ashley Wind Energy Project
McIntosh County, North Dakota

Prepared For:

CPV Ashley Renewable Energy Company, LLC
50 Braintree Hill Office Park, Suite 300
Braintree, Massachusetts 02184

Prepared By:

Tetra Tech EC, Inc.
133 Federal Street, 6th Floor
Boston, Massachusetts 02110

March 2010

TETRA TECH EC, INC.

EXECUTIVE SUMMARY

Tetra Tech EC, Inc. was contracted by CPV Ashley Renewable Energy Company, LLC to undertake fall avian use surveys for the proposed Ashley Wind Energy Project (WEP) in McIntosh County, North Dakota. A qualified field biologist conducted the surveys to identify potential avian impacts associated with building and operating the wind conversion facility. The biologist performed weekly surveys at the WEP from August 11 to October 31, 2009, which included the fall season, at 7 points distributed throughout the WEP.

A field biologist observed 14,950 birds within the WEP, 14,741 birds from 79 species and 209 birds that could not be identified to species. Overall mean bird use within the Ashley WEP was 177.98 birds/ 20 minutes (min) and ranged from 0 to 1,692 birds/20 min.

The species with the highest mean use included the red-winged blackbird (38.42 birds/20 min), snow goose (24.52 birds/20 min), sandhill crane (19.11 birds/20 min), American coot (13.06 birds/20 min) and yellow-headed blackbird (9.80 birds/20 min). These five species accounted for 58.9 percent of all birds observed. Red-winged blackbird, snow goose, and sandhill crane had very high encounter rates (> 10.0 birds flying at rotor swept area [RSA] height/20 min). All are common migratory species during the fall in North Dakota and have relatively stable and large populations in central North America. As a result, any mortality of these species, should it occur, is unlikely to have population-level consequences. The field biologist observed all of the sandhill cranes on a single day (October 31).

Northern harriers and red-tailed hawks were the most common raptors observed at the WEP but in very low numbers (0.44 and 0.43 birds/20 min, respectively) and with very low encounter rates at the WEP (0.05 and 0.25 birds flying at RSA height/20 min, respectively). Red-tailed hawk and northern harrier fatalities have occurred at wind farms; however, the very low mean use and encounter rates at this site suggest a low probability of negative interactions with turbines. Additional raptor observations within the WEP included Swainson's hawk, rough-legged hawk, broad-winged hawk, ferruginous hawk, merlin, sharp-shinned hawk, and prairie falcon.; all had low mean use values (<0.25 birds/20min) and low encounter rates (<0.23 birds flying at RSA height/20min) indicating a low probability of negative interactions with turbines.

Listed and Sensitive Species

The biologists did not record any species listed on the Endangered Species Act or any federal candidate species. The bald eagle, detected as an incidental observation, is protected by the Bald and Golden Eagle Protection Act (BGEPA). The biologist observed three bald eagles flying at 400 meters (m) (above the RSA) approximately 1 mile to the southwest of the WEP on August 22. Although the biologist did not observe any of these individuals within the WEP, the observation does confirm the potential utilization of the area by bald eagles, although the probability of negative interaction is low. The BGEPA prohibits the take or disturbance of any bald 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, or 3) nest abandonment. The United States Fish and Wildlife Service (USFWS) has implemented a permitting process to allow take of bald and golden eagles on a limited basis under certain conditions.

State-listed species observed during avian surveys or as incidental observations included 10 Level I Species of Conservation Priority: American bittern, American white pelican, black tern, ferruginous hawk, Franklin's gull, grasshopper sparrow, Swainson's hawk, upland sandpiper, willet, and Wilson's phalarope. Additionally, 7 Level II Species of Conservation Priority were observed: bald eagle, canvasback, northern harrier, northern pintail, prairie falcon, redhead, and sharp-tailed grouse. Species that are listed as a Species of Conservation Priority in North Dakota are not afforded any formal protection by the state. Of the state-listed species, Franklin's gull, American white pelican, canvasback,

northern pintail Swainson's hawk, northern harrier, ferruginous hawk, prairie falcon, and black tern were observed flying at heights consistent with the anticipated RSA. Most of the state listed species had encounter rates of less than 1.00 birds flying at RSA height/20 min, mostly due to the low overall numbers of these species observed at the WEP; a low encounter rate suggests a low probability of negative interactions with turbines. Of the state-listed species, Franklin's gull and American white pelican had the highest encounter rates (3.27 and 6.78 birds flying at RSA height/20 min, respectively). Although no mortality of Franklin's gull or American white pelican has been reported at a wind farm, the high mean use and encounter rate at the WEP suggests the potential for negative turbine interactions. However, the North Dakota breeding populations of both species are stable. As a result, if any mortality were to occur at the WEP, it is unlikely to have any population-level impacts.

Table ES-1. Fall avian use summary.

Variable	Result	Details
Non-raptors		
Mean use	144.93 birds/ 20 min	
Number of species with high encounter rates (>2.0 birds at RSA height/20 min)	9	Table 5
Federally listed[1] species observed within the WEP	No	NA
State-listed species[2] within the WEP	Yes	8 Species of Level I Conservation Priority 4 Species of Level II Conservation Priority (Section 4.3)
State-listed species within RSA	Yes	5 Species (Section 4.3)
Raptors		
Mean use	1.50 birds/ 20 min	
Number of species with high encounter rates (>2.0 birds at RSA height/20 min)	None	NA
Eagles observed within the WEP	No	NA
Federally listed species observed within the WEP	No	NA
State-listed species within the WEP	Yes	2 Species of Level I Conservation Priority 3 Species of Level II Conservation Priority (Section 4.3)
State-listed species within the RSA	Yes	4 Species (Section 4.3)
Habitat		
Native habitat likely to be affected by development	Yes	Native prairie and wetlands
Lakes (waterfowl and waterbird attractant)	Yes	Numerous ponds within WEP and several large lakes outside WEP
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	Scattered throughout
Cliffs (raptor nesting and traveling)	No	NA
River (permanent water source, migration corridor)	No	NA
Known refuges or habitat features that may funnel migrants	Yes	Two Waterfowl Production Areas

[1] Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.
[2] The North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (NDGFD 2008).

TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX

.

1.0 INTRODUCTION

1.1 Wind Energy and Birds

Wind energy provides a clean, renewable energy source that is in high demand. 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), an observation that is consistent with overall patterns of avian abundance. In fact, at newer generation wind energy facilities outside of California, approximately 80 percent of documented mortalities have been songbirds, of which 50 percent are often nocturnal migrants (Erickson et al. 2001, Drewitt and Langston 2006, Johnson et al. 2007, Strickland and Morrison 2008). It is estimated that less than 0.01 percent of migrant songbirds that pass over wind farms are killed, based on radar data and mortality monitoring (Erickson 2007). Locally breeding songbirds may experience lower mortality rates than migrants because many of these species tend not 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 as fatalities at wind farms (Erickson et al. 2002). Mortality may be partially attributed to the flight displays in which male horned lark fly to heights of 80 meters (m) to 250 m (Pickwell 1931).

Despite the observation that most wind farm fatalities are songbirds, raptor mortality historically has received the most attention. Raptor mortality at newer generation wind projects has been low relative to previous generation wind farms, although there is substantial regional variation (Erickson et al. 2002, 2004, Johnson et al. 2002, Kerns and Kerlinger 2004, Jain et al. 2007). Although raptor mortality is reduced at newer generation facilities, mortality may not be eliminated by advances in turbine technology (e.g., turbine height, tower structure) and local micro-siting and site evaluation efforts are still necessary to lessen potential impacts to these species.

In addition to mortality associated with wind farms, concerns have been raised that some bird species may avoid areas near turbines after the wind farm is in operation (Drewitt and Langston 2006). For example, at the Buffalo Ridge wind energy facility in Lincoln County, Minnesota, densities of male songbirds were significantly lower in Conservation Reserve Program (CRP) grasslands containing turbines than in CRP grasslands without turbines (Leddy et al. 1999). It was hypothesized that the reduced density may be due to avoidance of turbine noise and maintenance activities, and reduced habitat quality due to the presence of access roads and large gravel pads surrounding the turbines (Leddy et al. 1999). Reduced abundance of grassland songbirds was found within 50 m of a turbine pad for a wind farm in Washington and Oregon, but the investigators attributed displacement to the direct loss of habitat or reduced habitat quality and not the presence of the turbines, suggesting that both habitat loss and operational concerns can contribute to avian displacement (Erickson et al. 2004). Recent research at two wind farms in North and South Dakota (Shaffer and Johnson 2008) suggests that certain grassland songbird species (2 of 4 species studied) may avoid turbines by as much as 200 m but these results have not been finalized (i.e., more species are currently being analyzed) nor assessed at additional sites. No studies have addressed whether or not these avoidance effects are temporary (i.e., the birds may habituate to the presence of turbines over time) or permanent.

Finally, all native 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 migratory bird, part, nest, egg or product. Despite extensive liability provisions, the United States Fish and Wildlife Service (USFWS) have narrowly interpreted its permitting authority. “As

currently written, USFWS's regulations establish a permitting scheme for a variety of intentional activities, such as hunting, falconry, certain import and export activities, depredation control, and scientific research. But…there is no permitting scheme for the incidental take of migratory birds during otherwise lawful activities" (Beveridge 2005). There is no permitting framework (i.e., incidental take permits) that allow a wind company to protect itself from liability at wind facilities; however, the USFWS does not usually take action if good faith efforts have been made to minimize impacts. To date, no wind development company has been charged for violations of the MBTA; however, utilities have been prosecuted successfully.

1.2 Study Description

CPV Ashley Renewable Energy Company, LLC (CPV) is planning to develop a 200 megawatt (MW) wind energy conversion facility in south central North Dakota in McIntosh County (Figure 1). The Ashley Wind Energy Project (WEP) is located on private lands under easement with CPV. CPV is committed to environmental due diligence and has contracted Tetra Tech EC, Inc. (Tetra Tech) to conduct fall avian surveys at the WEP to quantify local avian use in the area and to identify potential avian impacts associated with building and/or operating the proposed facility.

The WEP is approximately 17,400 acres and is located in the Prairie Pothole Region. Although construction of a wind energy facility differs significantly from wholesale conversion of grassland to agricultural croplands (e.g., smaller disturbance footprint), disturbances of native prairies, particularly those that surround permanent or semi-permanent wetlands (prairie potholes), have the potential to affect important breeding and migratory stopover areas. The potholes are rich in aquatic life and support globally significant populations of breeding waterfowl (Bryce et al. 1998). Native prairie remnants do occur on unbroken rangelands and include western wheatgrass, bluestem, needle-and-thread, and needlegrass. Prairie cordgrass and northern reedgrass occur near wetlands (Bryce et al. 1998). In addition, several National Waterfowl Production Areas (WPA) exist within and adjacent to the WEP. WPAs are wetlands and grasslands set aside for the production of waterfowl and other wildlife species. These public lands, managed by the USFWS, were included in the National Wildlife Refuge System in 1966 through the National Wildlife Refuge Administration Act (USFWS 2007). Nearly 95 percent of WPAs are located in the prairie pothole areas of North and South Dakota, Minnesota, and Montana. North Dakota alone has 39 percent of the Nation's WPAs (USFWS 2007). By regulation, WPAs are open to hunting, fishing, and trapping in accordance with state laws. Other wildlife-dependent uses allowed include wildlife observation, photography, and environmental education (USFWS 2007).

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 (USFWS 2008). The Central Flyway runs through the central portion of the United States and, as a consequence, the WEP. Most birds that move along the Central Flyway travel from Canada through the central states, eventually reaching the tropics of South America via the Gulf of Mexico (USFWS 2008).

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. 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 federal and state-listed species, and species of concern.

2.1 Avian Surveys

2.1.1 Fixed-point Surveys

Tetra Tech employed a standard, accepted methodology for the avian surveys at the WEP, designed to be responsive to the level of effort recommended in the National Wind Coordinating Committee (NWCC) Guidance Document and the USFWS Interim Guidelines. An experienced field biologist conducted 20-minute (min) point count surveys at 7 locations within the WEP to evaluate avian use, behavior, and species composition during fall migration (Figure 2). The biologist conducted weekly surveys from August 11 to October 31 (Table 1), thereby encompassing the fall to early winter seasons. Tetra Tech distributed the survey locations throughout the WEP and chose locations that maximized the 360-degree sight distance for the observer and covered a diversity of habitats.

The field biologist collected data on all birds observed within an 800-m radius of the point count location. Surveys at each point lasted for 20 min, during which time biologists continuously recorded any visual or auditory observations. The biologist recorded the following data: species, number of birds, time of observation, height aboveground, behavior, and flight direction. Data on flight direction can be found in Appendix 1. The biologist calibrated flight heights and distances with a laser rangefinder and used local transmission lines and topographic maps as additional references.

The survey protocol used in this study is designed to collect data on all bird species 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 individuals use for soaring (Ballam 1984). Thus, raptors are more readily detected several hours after sunrise. Therefore, this protocol is appropriate for characterizing the bird community using the WEP during this time of year.

Tetra Tech chose 20-min survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 min 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 activity and 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 can 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 Incidental Observations

Incidental observations included observations in the vicinity (i.e. within approximately 1 mile) of the WEP that occurred 1) during travel between the 7 point count locations, 2) before or after the official 20-min survey period, and 3) outside of the 800-m radius circular plot. 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.

2.1.3 Listed Species Information

A list of species currently protected under the Endangered Species Act (ESA) can be found at http://www.fws.gov/endangered/wildlife.html. All native migratory species are protected by the MBTA.

The North Dakota Game and Fish Department (NDGFD) has identified 100 Species of Conservation Priority within North Dakota. These species are ranked in three priority levels based on such factors as known status, funding availability, and presence of breeding habitat within North Dakota (Hagen et al. 2005). The definitions of each rank are listed below:

> Level I: A species having a high level of conservation priority because of declining status either in North Dakota or across their range; or a high rate of occurrence in North Dakota constituting the core of the species' breeding range, but are at-risk range wide, and non- State Wildlife Grants funding is not readily available to them.
>
> Level II: Species having a moderate level of conservation priority; or a high level of conservation priority, but a substantial amount of non-State Wildlife Grant funding is available to them.
>
> Level III: North Dakota's species having a moderate level of conservation priority, but are believed to be peripheral or do not breed in North Dakota.

Species that are listed under the 100 Species of Conservation Priority are not afforded any formal protection by the state. NDGFD has plans to review and update the list of Species of Conservation Priority in 2010. Additional information on North Dakota Species of Conservation Priority can be found at: http://gf.nd.gov/conservation/toc.html.

2.1.4 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, and clarified if needed, all data sheets before data entry into a Filemaker™ 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 biologists.

2.2 Analysis

2.2.1 Species Groupings

Tetra Tech considered two primary groups of interest: raptors and non-raptors. Tetra Tech defined raptors as vultures, hawks, eagles, falcons, and owls. As turkey vulture flight behavior is similar to raptors and as they are often included as raptors in other studies, Tetra Tech has included them with raptors for the purpose of our analyses. Non-raptors were defined as all other species groups.

2.2.2 Avian Use

Tetra Tech derived avian use (mean use) of the WEP by calculating the average number of birds observed per 20-min survey at each point. To evaluate the diversity and composition of avian species using the WEP, Tetra Tech first summarized the number of birds and species. Tetra Tech also calculated 90 percent confidence intervals for all mean use values to provide an estimate of both spatial and temporal variability in mean use for the WEP. 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 high mean use is driven by a single event (e.g., a large flock of birds moving through the WEP on migration). Because individual birds are not uniquely marked and identified, actual population size or abundance cannot be determined. One individual may be counted multiple times during a survey period or across survey periods. Therefore, avian mean use does not equate to abundance.

2.2.3 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). At the time of this study, CPV has not selected a specific turbine type for the WEP. A likely turbine type to be used at the WEP has an 80-m hub height and up to a 101-m rotor diameter that was used to calculate the RSA. With these specifications, the estimated RSA was between 29.5 and 130.5 m above ground. Tetra Tech considered a bird to have flown within the height of the anticipated RSA if any of its recorded heights fell within the upper or lower limits of the anticipated RSA.

2.2.4 Encounter Rate

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

$$Encounter\ Rate = A*P_f*P_t$$

A is the mean number of birds/20 min for a given species, P_f is the proportion of all activity observations for a given species that were flying; and P_t is the proportion flying observations that were at the height 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 risk to a species. Species with a high encounter rate (i.e., > 2.0 birds at RSA height/20 min) are at a higher risk of collision than species with a low encounter rate (e.g., < 1.0 birds at RSA height/20min), but it does not mean that mortality is certain. Other factors such as turbine location and density or a species ability to detect turbine blades, flight maneuverability, and habitat selection also influence mortality (Orloff and Flannery 1992). Values are sensitive to large flocks of birds flying within the RSA; that is, a species will have a high encounter rate even if only seen a few times in large flying flocks. Encounter rate also does not account for migrating behavior of nocturnal migrants.

2.2.5 Mortality Risk

The relationship between pre-construction avian use and post-construction mortality is not yet completely defined due to a lack of pre- and post-construction data from sites with moderate to high avian use. Based on the available data collected at newer generation wind farms, although limited, it appears that low raptor use equates to low mortality and the few sites with very high raptor use also experience high raptor fatalities. Currently, there are no publicly available use and fatality data from sites with intermediate raptor use. Other factors that contribute to the uncertainty in predicting fatality rates is the highly regional nature of avian mean use across North America (Arnett et al. 2007) and the scarce data on avian mortality at wind farms in many parts of North America. The most comprehensive source of regional information on avian fatality rates is the Avian and Bat Fact Sheet (NWCC 2004) which is currently being revised. As a result of the uncertain relationship between avian use and avian mortality for most species groups, Tetra Tech did not attempt to derive mortality estimates from mean use data. Instead, Tetra Tech will highlight those species or groups that may experience mortality or displacement that could significantly affect local or regional populations, based on the data provided in this report and other information sources.

3.0 RESULTS

3.1 Avian Use and Frequency of Occurrence

The biologist surveyed 3,476 acres of the WEP during point count surveys, covering 20.0 percent of the WEP's total area. The biologist surveyed the 7 point count locations 12 times, resulting in a total of 84 20-min surveys. The biologist observed 14,950 birds within the WEP, 14,741 birds representing

79 species and 209 birds that could not be identified to species during (Table 2). Overall mean bird use within the Ashley WEP was 177.98 birds/20 min and ranged from 0 to 1,692 birds/20 min.

Overall mean use by non-raptors was 144.93 birds/20 min. Among non-raptor species groups, mean use was highest for songbirds (71.01 birds/20 min), followed by waterfowl (52.33 birds/20 min), waterbirds (25.57 birds/20 min), and cranes/rails (19.12 birds/20 min; Table 2). The remaining species groups have mean use values of less than 8.00 birds/20 min.

The non-raptor species with the highest mean included red-winged blackbird (38.42 birds/20 min), snow goose (24.52 birds/20 min), sandhill crane (19.11 birds/20 min), American coot (13.06 birds/20 min) and yellow-headed blackbird (9.80 birds/20 min). These five species accounted for 58.9 percent of all birds observed (Table 2).

The red-winged blackbird accounted for 54.1 percent of birds in the songbird species group (Table 2). The majority of red-winged blackbird observations were comprised of several large flocks (100-1,000 individuals) especially at point count locations 1, 2, and 4 (Table 3). Although 17 species of duck (i.e., most of the species that breed in the prairie region of North America) were observed at the WEP, snow goose and Canada goose observations accounted for 63.6 percent of the entire waterfowl species group (Table 2). Most of the snow geese and Canada geese were in large flying flocks (100-500 individuals) observed at point count locations 3, 4, and 6 for snow geese and point count locations 1, 3, and 7 for Canada geese (Table 3). American coots were one of the most widespread species at the WEP and comprised 51.1 percent of the waterbird group (Table 3). Sandhill cranes made up 99.99 percent of the entire crane/rail species group observed (Table 2). Most of the observations were of large migratory flocks (100-500 individuals) at a single point count location (7; Table 3) on a single day (October 31).

Non-raptor mean use was highest on October 31 (601.29 birds/20 min; primarily due to sandhill crane and snow goose), October 18 (405.86 birds/20 min; primarily due to red-winged blackbird), and September 21 (347.57 birds/20 min; primarily due to Franklin's gull, American white pelican, and yellow-headed blackbird) (Figure 3). Mean use for non-raptors was highest at point count location 4 (410.08 birds/20 min) and observations at this point included yellow-headed blackbird (820 birds), snow goose (785 birds), American coot (744 birds), and red-winged blackbird (530 birds) (Table 4; Figure 4). These species were detected at other points count locations. The habitat features near point count location 4 consist of several wetlands and soybean fields which are common features within the WEP.

Overall mean use for raptors was 1.50 birds/20 min. Although raptors only constituted 0.9 percent of all birds observed, as a group, raptors were the second most frequently observed of all the species groups during the fall surveys (73.8% of all surveys; Table 2). The raptors with the highest mean use were the northern harrier (0.44 birds/20 min; 35.7% of all surveys) and red-tailed hawk (0.43 birds/20 min; 27.4% of all surveys). Mean use for each other raptor species was 0.30 birds/20 min or less: Swainson's hawk, rough-legged hawk, broad-winged hawk, ferruginous hawk, merlin, sharp-shinned hawk, and prairie falcon.

Mean use by raptors was highest on August 11 (3.14 birds/20 min, primarily due to red-tailed hawk; Figure 5). Mean use by raptors was lower than 2.00 birds/20 min for all other survey dates. Mean use by raptors was highest at point count location 5 (Figure 6). A total of 10 Swainson's hawk, 7 red-tailed hawk, 5 unidentified hawk, 3 northern harrier, 3 rough-legged hawk, 1 ferruginous hawk, 1 broad-winged hawk, 1 prairie falcon, and 1 merlin were observed at this location (Table 3). Point count location 5 is close to a transmission line and several fence lines which could serve as perches for raptors, indicating potential for continued level of high raptor activity at this location.

3.2 Flight Height and Encounter Rate

During fall avian use surveys, the biologist collected behavioral data for 100 percent of all birds observed during point count surveys. The biologist observed 82.4 percent of birds flying and collected flight height

data for 100 percent and flight direction for 89.5 percent of flying observations. Of non-raptor species observed flying, 9.8 percent flew above RSA height, 56.7 percent flew at RSA height, and 33.5 percent flew below RSA height (Table 4). Of raptor species observed flying, 5.3 percent flew above RSA height, 53.5 percent flew at RSA height, and 41.2 percent flew below RSA height. Overall, 76.6 percent of all flight observations were heading directly south.

The sandhill crane had the highest encounter rate (19.11 birds flying at RSA height/20 min), followed by red-winged blackbird (17.63 birds flying at RSA height/20 min) and snow goose (14.70 birds flying at RSA height/20 min; Table 5). Other species with a high encounter rate (>2.00 birds flying at RSA height/20 min) included American white pelican, barn swallow, ring-billed gull, Franklin's gull, Lapland longspur, and Canada goose. All other species had encounter rates of less than 2.00 birds flying at RSA height/20 min.

3.3 Incidental Observations

The biologist documented 64 species as incidental observations (Table 6), 13 of which—Western grebe, cattle egret, black-crowned night heron, bald eagle, American kestrel, great-horned owl, upland sandpiper, tree swallow, bank swallow, cliff swallow, European starling, grasshopper sparrow, clay-colored sparrow—were not detected during the 20-min point count surveys. Blackbirds such as red-winged blackbirds, common grackles, and yellow-headed blackbirds were detected as incidentals numbering in the thousands. Large flocks (groups of 100 or larger) of sandhill cranes and lesser scaup were also observed as incidental observations. It is possible that some of these flocks were also observed during point counts. Biologists observed several raptor species both as incidentals and during the point count surveys including the red-tailed hawk, northern harrier, Swainson's hawk, rough-legged hawk, ferruginous hawk, prairie falcon, and merlin.

4.0 DISCUSSION

4.1 Non-Raptor Use and Encounter Rate

Songbirds had the highest mean use out of all groups, a value which was driven by red-winged blackbird, yellow-headed blackbird, and barn swallow. Of these species, only the red-winged blackbird and barn swallow had high encounter rates. Both red-winged blackbird (Kerlinger et al. 2006, Jain et al. 2007) and barn swallow (Johnson et al. 2002) mortality have been documented at other wind energy facilities. Given the high mean use and encounter rates of these species at the WEP, turbine-related fatalities may occur. However, if fatalities do occur at the Ashley WEP, they are unlikely to have population-level impacts because these species have large (i.e., estimated over 1 million birds; Rich et al. 2004) statewide populations that are relatively stable (Sauer et al. 2008). Red-winged blackbirds are attracted to agricultural crops (corn, soybean, and sunflower) and are often targeted by the agriculture industry as a nuisance species through permits issued by the USFWS under the MBTA.

The prairie region of the northern Great Plains is one of the most important areas for duck reproduction in North America (Samson et al. 1998, Jones-Farrand et al. 2007). The region produces, on average, 50 percent of the primary species of game ducks on the continent (USFWS 2009a). For seven species—mallard, gadwall, blue-winged teal, northern shoveler, northern pintail, redhead, and canvasback—the prairie region accounts for more than 60 percent of the breeding population (USFWS 2009a); all of these species were detected during the fall surveys. The region is also a major migration corridor during fall and spring for other ducks, geese, shorebirds and other waterbirds (Skagen and Knopf 1994, Samson et al. 1998, Jones-Farrand et al. 2007).

Waterfowl had the second highest mean use of all species groups at the WEP. Seventeen species of waterfowl were observed at the WEP, including most species that breed in the prairie region of North America. There are designated WPAs around the WEP, several large lakes to the west (Green and Pudwell Lakes) and the south (Salt Lake) of the WEP that appear to attract waterfowl to the area. The

majority of the waterfowl were snow geese and Canada geese and each of these species had a high encounter rate. Snow geese and Canada geese mortality has been documented at other wind energy facilities but the overall numbers of fatalities are very low (i.e., fewer than 10 individuals per species; Erickson et al. 2004, Anderson et al. 2005, Jain et al. 2007). Canada geese breed in North Dakota and populations from north-central Canada migrate through the central flyway (includes North Dakota) during early October to mid November (Mowbray et al. 2002). Snow geese breed in northern Canada and migrate through North Dakota during October to November to major staging areas in South Dakota and Missouri (Mowbray et al. 2000). Waterfowl Breeding Population and Habitat Surveys (WBPHS) carried out jointly by the USFWS and Canada Wildlife Service (CWS) show an increasing trend in the Great Plains population (which includes North Dakota) of Canada geese since 2000 (population estimate ~600,000; USFWS 2009a). WBPHS of the Mid-Continent snow geese population that breed in Canada and travel through North Dakota on fall migration have shown a slight increase since 2000 (population estimate ~2,000,000; USFWS 2009a). The combination of the high encounter rate and prior evidence of negative turbine interactions at other wind facilities suggest that some fatalities of Canada and snow geese could occur at the WEP. If fatalities do occur at the WEP, they are not expected to have population-level impacts given regional population dynamics discussed above.

Waterbirds were ranked third among species groups in mean use of the WEP, with American coot and American white pelican ranking the highest in this group. The American white pelican had a high encounter rate and is a Species of Conservation priority (see Section 4.3). The biologist observed all American coots swimming in or standing on the margins of wetlands but never observed them in flight. The timing of American coot fall migration varies greatly with weather as coots are nocturnal migrants that often follow behind cold fronts coming out of Canada (Brisbin et al. 2002). Migration in North Dakota is during October to early November (Brisbin et al. 2002). Flight altitudes of coots are poorly understood but incoming flights of coots in rainy/overcast weather have been observed at heights of 30-40 m (Brisbin et al. 2002). American coot mortality has been recorded at other wind energy facilities but in low numbers (i.e., < 30 individuals; Johnson et al. 2002, Anderson et al. 2005, Kerlinger et al. 2006). Given the high numbers of coots using the area, some fatalities could occur at the WEP. If fatalities of American coots do occur at the WEP, they are not expected to have impacts on the local population as North Dakota population trends show a slight increase (Sauer et al. 2008).

Cranes/rails as a group ranked fourth among species groups in mean use mostly due to sandhill cranes, a species that had the highest encounter rate of all birds observed. All sandhill cranes were observed in flight and 100 percent of these observations were at RSA height. All observations were made on one day (October 31, 2009). This coincides with the natural migration period of sandhill cranes that pass through North Dakota during September through November heading south to wintering areas in the south central United States (Tacha et al. 1992). Generally, sandhill cranes tend to migrate at heights of less than 1,600 m with 75 percent observed migrating at heights between 150 – 760 m (Tacha et al. 1992) putting migratory individuals above RSA height. Sandhill cranes are most at risk of collisions with turbines when individuals are either taking off from the ground or coming in to land within the WEP or the surrounding area. The flight height profile of the cranes observed in the WEP suggests that these birds had either recently taken off from a nearby location, or were searching for a place to land. Although no sandhill crane fatality has been reported at wind energy facilities, the large numbers of sandhill cranes observed and their observed flight patterns within the WEP, fatalities could still occur at the WEP. The central region of the North American population of sandhill cranes is large (~650,000 individuals according to the International Crane Foundation; http://www.savingcranes.org/sandhillcrane.html) and appears to be stable (Sauer et al. 2008). Thus, any fatalities at the WEP are not expected to have population-level impacts.

4.2 Raptor Use and Encounter Rate

High raptor use has been associated with high raptor mortality at new generation wind farms (Erickson 2007). Conversely, raptor mortality appears to be low when raptor use is low, as defined by Erickson (2007) as less than 1.0 bird/20 min. Based on mean use, the Ashley WEP would be considered a moderate risk site for raptor mortality with a group mean use of 1.50 birds/20 min. However, the observed flight behavior of the most commonly observed raptors suggests that the overall risk to raptors at the Ashley WEP is low.

Northern harriers and red-tailed hawks were the most commonly observed raptor species during avian surveys. Although both species have been reported as fatalities at existing wind farms (Johnson et al. 2002, Young et al. 2003, Erickson et al. 2004, Jain 2005), the very low encounter rates (0.05 and 0.25 birds flying at RSA height/20 min, respectively) observed at the WEP suggest that the probability of a turbine-related fatalities for northern harrier and red-tailed hawk at the WEP is low.

The biologist also observed Swainson's hawk, rough-legged hawk, ferruginous hawk, broad-winged hawk, American kestrel, prairie falcon, merlin, and sharp-shinned hawk within the WEP but with low mean use values, thereby minimizing the potential for negative turbine-related impacts to these species. Mean use by raptors was highest at point count location 5. Point count location 5 is close to a transmission line and several fence lines which could serve as perches for raptors, indicating the potential for continued raptor activity at this location.

4.3 Listed and Sensitive Species

4.3.1 Endangered Species Act

The biologist did not detect any species listed as candidate, threatened or endangered under the ESA.

4.3.2 Bald and Golden Eagle Protection Act

The bald eagle, detected as an incidental observation, is protected by the Bald and Golden Eagle Protection Act (BGEPA). The biologist observed three bald eagles flying at 400 m (above the RSA) approximately 1 mile to the southwest of the WEP on August 22. Although the biologist did not observe any of these individuals within the WEP, the observation does confirm the potential utilization of the area by bald eagles, although the probability of negative interaction is low. The 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, or 3) nest abandonment. The USFWS (2009b) has implemented a permitting process to allow take of bald and golden eagles on a limited basis under certain conditions (i.e., if the USFWS determines that the take is compatible with the preservation of the eagles and cannot be practicably avoided). Preservation is defined as consistent with the goal for a stable or increasing breeding population based off of regional populations. Additionally, preservation is valid if the take is necessary to alleviate a safety hazard to the public or the eagles, ensures public health, nest prevents the use of a human engineered structure, or the activity or mitigation will provide a net benefit for the eagles. Permit applications can be found at www.fws.gov/migratorybirds/CurrentBirdIssues/Management/BaldEagle. To Tetra Tech's knowledge, no wind developer has been prosecuted under the BGEPA; however, utility companies have been prosecuted successfully under the BGEPA for not taking appropriate steps to minimize the potential for eagle collisions with power lines.

4.3.3 North Dakota Species of Conservation Priority

State-listed species observed during avian surveys or as incidental observations included 10 Level I Species of Conservation Priority: American bittern, American white pelican, black tern, ferruginous hawk, Franklin's gull, grasshopper sparrow, Swainson's hawk, upland sandpiper, willet, and Wilson's

phalarope. Additionally, 7 Level II Species of Conservation Priority were observed: bald eagle, canvasback, northern harrier, northern pintail, prairie falcon, redhead, and sharp-tailed grouse. Of these state-listed species, Franklin's gull, American white pelican, canvasback, northern pintail, Swainson's hawk, northern harrier, ferruginous hawk, prairie falcon, and black tern were observed flying at the height of the anticipated RSA. However, most of the observed listed species had encounter rates of less than 1.0 birds flying at RSA height/20 min, mostly due to the low overall numbers observed; the low encounter rates suggests a low probability of negative interactions with turbines.

Franklin's gull and American white pelican had the highest encounter rates of the state-listed species. All of the Franklin's gulls observed were in flight, 95.2 percent were observed at RSA height, and all were observed flying south or southeast, suggesting migratory behavior. Franklin's gull breeds in the prairie pothole regions of the Dakotas and central Canada; in September to early October, they start to coalesce into large migratory flocks that migrate to wintering areas south of the equator (Burger and Gochfeld 2009). Although no mortality of Franklin's gull has been reported at a wind farm, the high mean use and encounter rate at the WEP suggests the potential for negative interactions. Trends in the overall North American population of Franklin's gull have shown a steady rate of increase while the regional North Dakota population trend has shown a slight increase (Sauer et al. 2008). As a result, if any mortality were to occur at the WEP, it is unlikely to have any population-level impacts.

Of the American white pelicans observed at the WEP, 100 percent were observed in flight with 97.8 percent flying at RSA height. All but 15 of the American white pelicans were observed flying south, indicating that most were migrating through the WEP. American white pelicans are known to breed in North Dakota (Knopf and Evans 2004). Migration of American white pelican is generally from September to November and is initiated when lakes start to freeze over (Knopf and Evans 2004). Although no mortality of American white pelicans has been reported at a wind farm, the high mean use and encounter rate at the WEP suggests the potential for negative interactions. Breeding population trends in North Dakota have shown a slight increase (Sauer et al. 2008). As a result, if any mortality were to occur at the WEP it is unlikely to have any population-level impacts.

4.4 Ashley WEP Conclusions

The biologist did not detect any species listed as candidate, threatened or endangered under the ESA. The point count surveys at the Ashley WEP suggest that the WEP is utilized by a wide number and diversity of bird species during the fall migratory period. However, the behavioral data (e.g., flight patterns) suggest that the probability of negative interactions between birds and turbines at the Ashley WEP is generally low for most species. The two species with the highest encounter rates (sandhill crane and red-winged blackbird) have stable regional populations (Sauer et al. 2008); therefore, if fatalities do occur they are unlikely to have population-level consequences. Nocturnal migrants (e.g., some songbirds) may pass through the WEP and would not be detected by the survey methods used in this study if the birds did not stop-over within the WEP. However, mortality of nocturnal migrants at the WEP is not expected to have population-level implications because less than 0.01 percent of nocturnal migrants that fly through wind farms are killed (Erickson 2007).

The level of raptor use at the Ashley WEP suggests that raptor mortality will be low. Northern harriers and red-tailed hawks were the most common raptors observed at the WEP and fatalities of both species have occurred at wind farms (Kerns and Kerlinger 2004, Anderson et al. 2005, Kerlinger et al. 2006). However, the overall numbers and encounter rates of northern harriers and red-tailed hawks detected at the Ashley WEP were low, thereby minimizing the probability of negative interactions with turbines.

5.0 LITERATURE CITED

Anderson, R., J. Tom, N. Neumann, W.P. Erickson, M.D. Strickland, M. Bourasse, K.J. Bay, and K.J. Sernka. 2005. Avian monitoring and risk assessment at the San Gorgonio Wind Resource Area. Technical report prepared by State Energy Resources Conservation and Development Commission and Western EcoSystems Technology, Inc. for National Renewable Energy Laboratory. Golden, CO.

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, MA.

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.

Brisbin, Jr., I.L., and T.B. Mowbray. 2002. American Coot (*Fulica americana*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/697a.

Bryce, S., J.M. Omernik, D.E. Pater, M. Ulmer, J. Schaar, J. Freeouf, R. Johnson, P. Kuck, and S.H. Azevedo. 1998. Ecoregions of North Dakota and South Dakota. Northern Prairie Wildlife Research Center, Jamestown, ND. Accessed December 7, 2009. http://www.npwrc.usgs.gov/resource/habitat/ndsdeco/index.htm

Burger, J., and M. Gochfeld. 2009. Franklin's Gull (*Larus pipixcan*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/116.

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

Erickson, W.P. 2007. Summary of methods and results for prediction and estimation of impacts and risk. Presented at NWCC Probability of Impact Workshop, 13 November 2007, Golden, CO.

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 collisions. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.

Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final 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.

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.

Faanes, Craig A., and Robert 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 at: http://www.npwrc.usgs.gov/resource/birds/chnbird/chnbird.htm.

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. 454 pp. Available at: http://www.gf.nd.gov/conservation/cwcs.html

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. Master's thesis. Iowa State University, Ames, IA.

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2007. 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, 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.

Jones-Farrand, D.T., D.H. Johnson, L.W. Burger, Jr., and M.R. Ryan. 2007. Grassland Establishment for Wildlife Conservation. Pages 25-43 in Fish and Wildlife Response to Farmbill Conservation Practices. Technical Review 07-1.

Kerlinger, P., R. Curry, L. Culp, A. Jain, C. Wilkerson, B. Fischer, and A. Hasch. 2006. Post construction avian and bat fatality monitoring study for the High Winds wind power project. Solano County, California: Two Year Report. Prepared for High Winds, LLC, FPL Energy.

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.

Knopf, F.L., and R.M. Evans. 2004. American White Pelican (*Pelecanus erythrorhynchos*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/057doi:10.2173/bna.57.

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.

Mowbray, T.B., C.R. Ely, J.S. Sedinger and R.E. Trost. 2002. Canada Goose (*Branta canadensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/682doi:10.2173/bna.682.

Mowbray, T/B., F.Cooke, and B.Ganter. 2000. Snow Goose (*Chen caerulescens*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/514doi:10.2173/bna.514.

NWCC (National Wind Coordinating Collaborative). 2004. Wind Turbine Interactions with Birds and Bats: A Summary of Research Results and Remaining Questions. http://www.nationalwind.org/publications/wildlife.htm.

NDGFD (North Dakota Game and Fish Department). 2008. Comprehensive Wildlife Conservation Strategy: 100 Species of Conservation Priority, accessed December 9, 2009. http://gf.nd.gov/conservation/levels-list.html.

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.

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

Rich, T.D., C. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, and T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY.

Samson, F.B., F.L. Knopf, and W.R. Ostlie. 1998. Regional trends of biological resources--grasslands. *In* Status and trends of the nation's biological resources. Volume 2 (M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran, editors). U.S. Department of the Interior, Geological Survey, Reston, VA.

Sauer, J.R., J.E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, results and analysis 1966 - 2006. Version 05.15.2008. USGS Patuxent Wildlife Research Center, Laurel, MD.

Shaffer, J., and D.H. Johnson. 2008. Displacement effects of wind developments on grassland birds in the Northern Great Plains. NWCC Wind Wildlife Conference, October 2008. Milwaukee, WI.

Skagen, S.K., and F.L. Knopf. 1994. Migrating shorebirds and habitat dynamics at a prairie wetland complex. Wilson Bulletin 106:91-105.

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.

Tacha, T.C., S.A. Nesbitt, and P.A. Vohs. 1992. Sandhill Crane (*Grus canadensis*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/031doi:10.2173/bna.31.

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). 2009a. Waterfowl population status, 2009. U.S. Department of the Interior, Washington, D.C. USA.

USFWS. 2009b. Eagle permits; Take necessary to protect interests in particular localities. Federal Register 74:46836-46879.

USFWS. 2008. Flyways. Retrieved from: http://flyways.us/flyways/central.

USFWS. 2007. "Waterfowl Production Areas – Prairie Jewels of the National Wildlife Refuge System". Last revised June 7, 2007. Retrieved December 9, 2009 at: http://www.fws.gov/refuges/smallwetlands/WPAs/FactSheetWPA-june2007.pdf

Young, D.P., Jr., W.P. Erickson, R.E. Good, M.D. Strickland, and G.D. Johnson. 2003. Avian and bat mortality associated with the initial phase of the Foote Creek Rim Wind Power Project, Carbon County, Wyoming: November 1998 - June 2002. Technical Report prepared by WEST, Inc. for Pacificorp, Inc., SeaWest Windpower, Inc. and Bureau of Land Management.

TABLES

Table 1. Fall 2009 point count survey dates at Ashley Wind Energy Project.

Survey number	Date(s)
1	8/11
2	8/15
3	8/22
4	8/30
5	9/6
6	9/14
7	9/21
8	9/27
9	10/4
10	10/11
11	10/18
12	10/31

Table 2. Avian species, by species grouping, observed during fall 2009 point count surveys at the Ashley Wind Energy Project.

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	3227	25	38.42	(13.74-63.10)	25.0	54.1%	21.6%
yellow-headed blackbird	5	823	4	9.80	(0.00-21.22)	4.8	13.8%	5.5%
barn swallow	6	811	34	9.65	(5.58-13.72)	35.7	13.6%	5.4%
Lapland longspur	10	405	4	4.82	(0.00-9.96)	4.8	6.8%	2.7%
northern rough-winged swallow	15	192	8	2.29	(0.68-3.90)	9.5	3.2%	1.3%
common grackle	16	148	5	1.76	(0.26-3.26)	6.0	2.5%	1.0%
horned lark	24	54	5	0.64	(0.00-1.43)	6.0	0.9%	0.4%
American goldfinch	26	51	7	0.61	(0.18-1.04)	8.3	0.9%	0.3%
western kingbird	28	47	14	0.56	(0.21-0.91)	13.1	0.8%	0.3%
unidentified songbird	29	45	1	0.54	(0.00-1.42)	1.2	0.8%	0.3%
western meadowlark	36	31	15	0.37	(0.18-0.56)	15.5	0.5%	0.2%
American robin	36	31	2	0.37	(0.00-0.80)	2.4	0.5%	0.2%
snow bunting	38	30	1	0.36	(0.00-0.95)	1.2	0.5%	0.2%
yellow-rumped warbler	47	13	1	0.15	(0.00-0.40)	1.2	0.2%	0.1%
savannah sparrow	47	13	4	0.15	(0.02-0.28)	4.8	0.2%	0.1%
eastern kingbird	47	13	5	0.15	(0.00-0.31)	3.6	0.2%	0.1%
brown-headed cowbird	47	13	3	0.15	(0.00-0.37)	3.6	0.2%	0.1%
vesper sparrow	55	8	5	0.10	(0.02-0.18)	6.0	0.1%	0.1%
Smith's longspur	63	5	1	0.06	(0.00-0.16)	1.2	0.1%	0.0%
blue jay	71	2	2	0.02	(0.00-0.05)	2.4	0.0%	0.0%
song sparrow	75	1	1	0.01	(0.00-0.03)	1.2	0.0%	0.0%
gray catbird	75	1	1	0.01	(0.00-0.03)	1.2	0.0%	0.0%
chipping sparrow	75	1	1	0.01	(0.00-0.03)	1.2	0.0%	0.0%
Group Total		**5965**	**149**	**71.01**	(42.45-99.57)	**76.2**		**39.9%**
Waterfowl								
snow goose	2	2060	9	24.52	(3.04-46.00)	7.1	46.9%	13.8%
Canada goose	7	732	34	8.71	(4.80-12.62)	32.1	16.7%	4.9%
mallard	9	407	31	4.85	(2.54-7.16)	34.5	9.3%	2.7%

Table 2. Avian species, by species grouping, observed during fall 2009 point count surveys at the Ashley Wind Energy Project.

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
blue-winged teal	11	383	20	4.56 (1.71-7.41)	21.4	8.7%	2.6%
redhead	14	282	9	3.36 (0.95-5.77)	9.5	6.4%	1.9%
green-winged teal	18	108	7	1.29 (0.20-2.38)	7.1	2.5%	0.7%
unidentified duck	19	88	5	1.05 (0.03-2.07)	6.0	2.0%	0.6%
lesser scaup	20	81	2	0.96 (0.00-2.53)	2.4	1.8%	0.5%
northern shoveler	21	78	7	0.93 (0.20-1.66)	8.3	1.8%	0.5%
northern pintail	23	66	6	0.79 (0.14-1.44)	6.0	1.5%	0.4%
canvasback	30	43	2	0.51 (0.00-1.29)	2.4	1.0%	0.3%
gadwall	40	23	3	0.27 (0.00-0.58)	3.6	0.5%	0.2%
ruddy duck	41	21	3	0.25 (0.00-0.54)	3.6	0.5%	0.1%
bufflehead	55	8	2	0.10 (0.00-0.21)	2.4	0.2%	0.1%
tundra swan	59	7	1	0.08 (0.00-0.22)	1.2	0.2%	0.0%
American wigeon	59	7	3	0.08 (0.00-0.16)	3.6	0.2%	0.0%
hooded merganser	75	1	1	0.01 (0.00-0.03)	1.2	0.0%	0.0%
common goldeneye	75	1	1	0.01 (0.00-0.03)	1.2	0.0%	0.0%
Group Total		**4396**	**146**	**52.33** (29.61-75.05)	**66.7**		**29.4%**
Waterbirds							
American coot	4	1097	35	13.06 (7.89-18.23)	36.9	51.1%	7.3%
American white pelican	8	582	12	6.93 (0.00-15.72)	11.9	27.1%	3.9%
pectoral sandpiper	17	141	11	1.68 (0.58-2.78)	13.1	6.6%	0.9%
double-crested cormorant	22	73	9	0.87 (0.11-1.63)	10.7	3.4%	0.5%
Wilson's phalarope	25	52	1	0.62 (0.00-1.64)	1.2	2.4%	0.3%
killdeer	26	51	15	0.61 (0.27-0.95)	17.9	2.4%	0.3%
unidentified sandpiper	30	43	1	0.51 (0.00-1.35)	1.2	2.0%	0.3%
lesser yellowlegs	32	37	8	0.44 (0.07-0.81)	9.5	1.7%	0.2%
great egret	44	15	4	0.18 (0.00-0.42)	4.8	0.7%	0.1%
pied-billed grebe	52	10	4	0.12 (0.01-0.23)	4.8	0.5%	0.1%
greater yellowlegs	53	9	1	0.11 (0.00-0.29)	1.2	0.4%	0.1%
great blue heron	53	9	8	0.11 (0.05-0.17)	9.5	0.4%	0.1%

Table 2. Avian species, by species grouping, observed during fall 2009 point count surveys at the Ashley Wind Energy Project.

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
Baird's sandpiper	55	8	1	0.10 (0.00-0.26)	1.2	0.4%	0.1%
short-billed dowitcher	61	6	3	0.07 (0.00-0.14)	3.6	0.3%	0.0%
long-billed dowitcher	61	6	1	0.07 (0.00-0.19)	1.2	0.3%	0.0%
least sandpiper	63	5	1	0.06 (0.00-0.16)	1.2	0.2%	0.0%
common snipe	71	2	1	0.02 (0.00-0.06)	1.2	0.1%	0.0%
willet	75	1	1	0.01 (0.00-0.03)	1.2	0.0%	0.0%
American bittern	75	1	1	0.01 (0.00-0.03)	1.2	0.0%	0.0%
Group Total		**2148**	**118**	**25.57** (15.27-35.87)	**70.2**		**14.4%**
Cranes/Rails							
sandhill crane	3	1605	4	19.11 (0.00-50.54)	1.2	99.9%	10.7%
sora	75	1	1	0.01 (0.00-0.03)	1.2	0.1%	0.0%
Group Total		**1606**	**5**	**19.12** (0.00-50.55)	**2.4**		**10.7%**
Gulls/Terns							
ring-billed gull	12	290	8	3.45 (0.00-8.95)	8.3	45.4%	1.9%
Franklin's gull	13	289	3	3.44 (0.00-7.41)	3.6	45.2%	1.9%
laughing gull	32	37	1	0.44 (0.00-1.16)	1.2	5.8%	0.2%
unidentified gull	43	18	2	0.21 (0.00-0.53)	2.4	2.8%	0.1%
herring gull	68	3	3	0.04 (0.01-0.07)	3.6	0.5%	0.0%
black tern	71	2	2	0.02 (0.00-0.05)	2.4	0.3%	0.0%
Group Total		**639**	**19**	**7.61** (0.00-16.84)	**17.9**		**4.3%**
Raptors							
northern harrier	32	37	33	0.44 (0.32-0.56)	35.7	29.4%	0.2%
red-tailed hawk	35	36	31	0.43 (0.29-0.57)	27.4	28.6%	0.2%
Swainson's hawk	42	19	11	0.23 (0.11-0.35)	13.1	15.1%	0.1%
unidentified hawk	44	15	12	0.18 (0.05-0.31)	9.5	11.9%	0.1%
rough-legged hawk	55	8	8	0.10 (0.05-0.15)	9.5	6.3%	0.1%
broad-winged hawk	66	4	3	0.05 (0.00-0.10)	3.6	3.2%	0.0%
ferruginous hawk	68	3	3	0.04 (0.01-0.07)	3.6	2.4%	0.0%
merlin	71	2	2	0.02 (0.00-0.05)	2.4	1.6%	0.0%

Table 2. Avian species, by species grouping, observed during fall 2009 point count surveys at the Ashley Wind Energy Project.

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
sharp-shinned hawk	75	1	1	0.01 (0.00-0.03)	1.2	0.8%	0.0%
prairie falcon	75	1	1	0.01 (0.00-0.03)	1.2	0.8%	0.0%
Group Total		**126**	**105**	**1.50** (1.24-1.76)	**73.8**		**0.8%**
Pigeons/Doves							
mourning dove	38	30	5	0.36 (0.00-0.78)	6.0	66.7%	0.2%
rock pigeon	44	15	3	0.18 (0.01-0.35)	3.6	33.3%	0.1%
Group Total		**45**	**8**	**0.54** (0.09-0.99)	**9.5**		**0.3%**
Gamebirds							
sharp-tailed grouse	47	13	1	0.15 (0.00-0.40)	1.2	65.0%	0.1%
wild turkey	66	4	1	0.05 (0.00-0.13)	1.2	20.0%	0.0%
ring-necked pheasant	68	3	3	0.04 (0.01-0.07)	3.6	15.0%	0.0%
Group Total		**20**	**5**	**0.24** (0.00-0.51)	**6.0**		**0.1%**
Woodpeckers							
northern flicker	63	5	2	0.06 (0.00-0.14)	2.4	100.0%	0.0%
Group Total		**5**	**2**	**0.06** (0.00-0.14)	**2.4**		**0.0%**
Grand Total		**14950**	**557**	**177.98** (124.17-231.78)			

[1] A ranking of 1 indicates highest mean use

Table 3. Avian species observed by point during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds	Number of Obs.	Points						
			1	2	3	4	5	6	7
red-winged blackbird	3227	25	1214	791	254	530	225	211	2
snow goose	2060	9	0	45	705	785	85	440	0
sandhill crane	1605	4	0	0	0	0	0	0	1605
American coot	1097	35	0	0	124	744	155	0	74
yellow-headed blackbird	823	4	0	3	0	820	0	0	0
barn swallow	811	34	79	17	100	223	23	184	185
Canada goose	732	34	100	47	301	65	3	56	160
American white pelican	582	12	1	0	0	13	452	1	115
mallard	407	31	0	4	16	186	27	113	61
Lapland longspur	405	4	0	35	245	0	0	85	40
blue-winged teal	383	20	2	0	0	227	3	75	76
ring-billed gull	290	8	0	2	0	283	1	3	1
Franklin’s gull	289	3	0	0	0	194	95	0	0
redhead	282	9	0	0	0	194	12	0	76
northern rough-winged swallow	192	8	35	0	15	101	0	17	24
common grackle	148	5	38	6	0	25	0	19	60
pectoral sandpiper	141	11	0	0	0	70	0	71	0
green-winged teal	108	7	0	0	0	74	0	10	24
unidentified duck	88	5	0	3	6	16	63	0	0
lesser scaup	81	2	0	0	0	0	0	1	80
northern shoveler	78	7	0	0	0	72	0	0	6
double-crested cormorant	73	9	16	2	39	2	0	14	0
northern pintail	66	6	0	0	0	20	21	0	25
horned lark	54	5	40	9	2	0	3	0	0
Wilson's phalarope	52	1	0	0	0	52	0	0	0
killdeer	51	15	2	5	4	18	0	22	0
American goldfinch	51	7	0	0	6	8	8	29	0
western kingbird	47	14	3	12	3	18	3	0	8
unidentified songbird	45	1	0	0	0	45	0	0	0
unidentified sandpiper	43	1	0	0	0	43	0	0	0
canvasback	43	2	0	0	0	0	43	0	0
northern harrier	37	33	3	4	6	5	3	6	10
lesser yellowlegs	37	8	0	1	0	4	0	32	0
laughing gull	37	1	0	0	0	37	0	0	0
red-tailed hawk	36	31	7	7	1	3	7	6	5
western meadowlark	31	15	3	10	1	7	2	0	8
American robin	31	2	0	0	0	0	31	0	0
snow bunting	30	1	30	0	0	0	0	0	0
mourning dove	30	5	0	23	3	0	2	0	2
gadwall	23	3	0	0	0	15	0	4	4

Table 3. Avian species observed by point during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds	Number of Obs.	Points						
			1	2	3	4	5	6	7
ruddy duck	21	3	0	0	0	3	18	0	0
Swainson's hawk	19	11	0	0	4	2	10	3	0
unidentified gull	18	2	0	18	0	0	0	0	0
unidentified hawk	15	12	5	2	1	0	5	1	1
rock pigeon	15	3	0	15	0	0	0	0	0
great egret	15	4	1	12	0	0	0	2	0
yellow-rumped warbler	13	1	0	0	0	0	13	0	0
sharp-tailed grouse	13	1	0	0	13	0	0	0	0
savannah sparrow	13	4	0	0	0	0	3	6	4
eastern kingbird	13	5	2	11	0	0	0	0	0
brown-headed cowbird	13	3	1	11	0	0	0	1	0
pied-billed grebe	10	4	0	0	5	5	0	0	0
greater yellowlegs	9	1	0	0	0	0	0	9	0
great blue heron	9	8	0	2	2	3	0	1	1
vesper sparrow	8	5	1	0	0	0	1	2	4
rough-legged hawk	8	8	1	0	0	1	3	1	2
bufflehead	8	2	0	0	0	0	8	0	0
Baird's sandpiper	8	1	0	0	0	0	0	8	0
tundra swan	7	1	0	0	0	7	0	0	0
American wigeon	7	3	0	0	2	0	0	0	5
short-billed dowitcher	6	3	0	0	0	0	0	6	0
long-billed dowitcher	6	1	0	0	0	0	0	6	0
Smith's longspur	5	1	0	5	0	0	0	0	0
northern flicker	5	2	0	5	0	0	0	0	0
least sandpiper	5	1	0	0	0	0	0	5	0
wild turkey	4	1	0	0	0	4	0	0	0
broad-winged hawk	4	3	0	0	0	0	1	0	3
ring-necked pheasant	3	3	0	0	0	1	1	1	0
herring gull	3	3	0	0	0	3	0	0	0
ferruginous hawk	3	3	0	1	0	1	1	0	0
merlin	2	2	0	0	0	1	1	0	0
common snipe	2	1	0	0	0	0	0	2	0
black tern	2	2	0	0	0	1	0	1	0
blue jay	2	2	0	1	0	0	1	0	0
willet	1	1	0	0	1	0	0	0	0
sharp-shinned hawk	1	1	0	0	0	0	0	1	0
song sparrow	1	1	0	0	0	0	0	1	0
sora	1	1	0	0	1	0	0	0	0
prairie falcon	1	1	0	0	0	0	1	0	0
hooded merganser	1	1	0	0	0	1	0	0	0

Table 3. Avian species observed by point during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds	Number of Obs.	Points						
			1	2	3	4	5	6	7
gray catbird	1	1	0	0	0	0	1	0	0
common goldeneye	1	1	0	0	0	1	0	0	0
chipping sparrow	1	1	0	0	1	0	0	0	0
American bittern	1	1	0	0	0	1	0	0	0
Grand Total	**14950**	**557**	**1584**	**1109**	**1861**	**4934**	**1335**	**1456**	**2671**

Table 4. Summary of avian flight heights[1] in relation to the turbine rotor swept area (RSA)[2] during fall 2009 point count surveys at the Ashley Wind Energy Project.

		Birds	
		Number	**Percentage**
Non-raptors			
	Above RSA height (>130.5m)	1192	9.8%
	At RSA height (29.5m–130.5m)	6920	56.7%
	Below RSA height (<29.5m)	4087	33.5%
Raptors			
	Above RSA height (>130.5m)	6	5.3%
	At RSA height (29.5m–130.5m)	61	53.5%
	Below RSA height (<29.5m)	47	41.2%

[1] Includes only flying birds with flight height data

[2]These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during fall 2009 point count surveys at the Ashley Wind Energy Project.

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
sandhill crane	19.11	19.11 (0.00 - 50.54)	100.0	0.0	100.0	0.0
red-winged blackbird	17.63	38.42 (13.74 - 63.10)	99.7	6.8	46.0	47.1
snow goose	14.70	24.52 (3.04 - 46.00)	100.0	40.0	60.0	0.0
American white pelican	6.78	6.93 (0.00 - 15.72)	100.0	0.0	97.8	2.2
barn swallow	5.72	9.65 (5.58 - 13.72)	100.0	0.0	59.3	40.7
ring-billed gull	3.33	3.45 (0.00 - 8.95)	98.3	0.0	98.2	1.8
Franklin's gull	3.27	3.44 (0.00 - 7.41)	100.0	0.0	95.2	4.8
Lapland longspur	2.92	4.82 (0.00 - 9.96)	100.0	0.0	60.5	39.5
Canada goose	2.33	8.71 (4.80 - 12.62)	94.7	19.5	28.3	52.2
northern rough-winged swallow	1.32	2.29 (0.68 - 3.90)	100.0	0.0	57.8	42.2
blue-winged teal	0.89	4.56 (1.71 - 7.41)	49.9	0.0	39.3	60.7
northern pintail	0.55	0.79 (0.14 - 1.44)	69.7	0.0	100.0	0.0
unidentified songbird	0.54	0.54 (0.00 - 1.42)	100.0	0.0	100.0	0.0
unidentified sandpiper	0.51	0.51 (0.00 - 1.35)	100.0	0.0	100.0	0.0
double-crested cormorant	0.49	0.87 (0.11 - 1.63)	80.8	20.3	69.5	10.2
canvasback	0.47	0.51 (0.00 - 1.29)	93.0	0.0	100.0	0.0
mallard	0.46	4.85 (2.54 - 7.16)	10.1	0.0	95.1	4.9
common grackle	0.30	1.76 (0.26 - 3.26)	100.0	0.0	16.9	83.1
unidentified duck	0.26	1.05 (0.03 - 2.07)	28.4	0.0	88.0	12.0
mourning dove	0.25	0.36 (0.00 - 0.78)	86.7	0.0	80.8	19.2
red-tailed hawk	0.25	0.43 (0.29 - 0.57)	83.3	3.3	70.0	26.7
Swainson's hawk	0.22	0.23 (0.11 - 0.35)	100.0	0.0	94.7	5.3
unidentified gull	0.21	0.21 (0.00 - 0.53)	100.0	0.0	100.0	0.0
great egret	0.14	0.18 (0.00 - 0.42)	100.0	0.0	80.0	20.0
tundra swan	0.08	0.08 (0.00 - 0.22)	100.0	0.0	100.0	0.0
unidentified hawk	0.07	0.18 (0.05 - 0.31)	86.7	38.5	46.2	15.4

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during fall 2009 point count surveys at the Ashley Wind Energy Project.

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
green-winged teal	0.07	1.29 (0.20 - 2.38)	5.6	0.0	100.0	0.0
rough-legged hawk	0.05	0.10 (0.05 - 0.15)	75.0	0.0	66.7	33.3
broad-winged hawk	0.05	0.05 (0.00 - 0.10)	100.0	0.0	100.0	0.0
northern harrier	0.05	0.44 (0.32 - 0.56)	97.3	0.0	11.1	88.9
great blue heron	0.02	0.11 (0.05 - 0.17)	88.9	0.0	25.0	75.0
ferruginous hawk	0.01	0.04 (0.01 - 0.07)	66.7	0.0	50.0	50.0
sharp-shinned hawk	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
prairie falcon	0.01	0.01 (0.00 - 0.03)	100.0	0.0	100.0	0.0
merlin	0.01	0.02 (0.00 - 0.05)	100.0	0.0	50.0	50.0
yellow-rumped warbler	0.00	0.15 (0.00 - 0.40)	100.0	0.0	0.0	100.0
yellow-headed blackbird	0.00	9.80 (0.00 - 21.22)	100.0	0.0	0.0	100.0
wild turkey	0.00	0.05 (0.00 - 0.13)	0.0	0.0	0.0	0.0
Wilson's phalarope	0.00	0.62 (0.00 - 1.64)	0.0	0.0	0.0	0.0
willet	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
western meadowlark	0.00	0.37 (0.18 - 0.56)	64.5	0.0	0.0	100.0
western kingbird	0.00	0.56 (0.21 - 0.91)	93.6	0.0	0.0	100.0
vesper sparrow	0.00	0.10 (0.02 - 0.18)	75.0	0.0	0.0	100.0
sharp-tailed grouse	0.00	0.15 (0.00 - 0.40)	100.0	0.0	0.0	100.0
song sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
sora	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
snow bunting	0.00	0.36 (0.00 - 0.95)	100.0	0.0	0.0	100.0
Smith's longspur	0.00	0.06 (0.00 - 0.16)	100.0	0.0	0.0	100.0
short-billed dowitcher	0.00	0.07 (0.00 - 0.14)	0.0	0.0	0.0	0.0
savannah sparrow	0.00	0.15 (0.02 - 0.28)	76.9	0.0	0.0	100.0
ruddy duck	0.00	0.25 (0.00 - 0.54)	0.0	0.0	0.0	0.0
rock pigeon	0.00	0.18 (0.01 - 0.35)	60.0	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during fall 2009 point count surveys at the Ashley Wind Energy Project.

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	0.04 (0.01 - 0.07)	33.3	0.0	0.0	100.0
redhead	0.00	3.36 (0.95 - 5.77)	0.0	0.0	0.0	0.0
pectoral sandpiper	0.00	1.68 (0.58 - 2.78)	55.3	0.0	0.0	100.0
pied-billed grebe	0.00	0.12 (0.01 - 0.23)	0.0	0.0	0.0	0.0
northern shoveler	0.00	0.93 (0.20 - 1.66)	0.0	0.0	0.0	0.0
northern flicker	0.00	0.06 (0.00 - 0.14)	100.0	0.0	0.0	100.0
lesser yellowlegs	0.00	0.44 (0.07 - 0.81)	0.0	0.0	0.0	0.0
lesser scaup	0.00	0.96 (0.00 - 2.53)	98.8	0.0	0.0	100.0
least sandpiper	0.00	0.06 (0.00 - 0.16)	0.0	0.0	0.0	0.0
long-billed dowitcher	0.00	0.07 (0.00 - 0.19)	0.0	0.0	0.0	0.0
laughing gull	0.00	0.44 (0.00 - 1.16)	100.0	0.0	0.0	100.0
killdeer	0.00	0.61 (0.27 - 0.95)	45.1	0.0	0.0	100.0
hooded merganser	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
horned lark	0.00	0.64 (0.00 - 1.43)	94.4	0.0	0.0	100.0
herring gull	0.00	0.04 (0.01 - 0.07)	33.3	0.0	0.0	100.0
greater yellowlegs	0.00	0.11 (0.00 - 0.29)	0.0	0.0	0.0	0.0
gray catbird	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
gadwall	0.00	0.27 (0.00 - 0.58)	0.0	0.0	0.0	0.0
eastern kingbird	0.00	0.15 (0.00 - 0.31)	84.6	0.0	0.0	100.0
common snipe	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
common goldeneye	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
chipping sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
bufflehead	0.00	0.10 (0.00 - 0.21)	0.0	0.0	0.0	0.0
black tern	0.00	0.02 (0.00 - 0.05)	100.0	0.0	0.0	100.0
blue jay	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
brown-headed cowbird	0.00	0.15 (0.00 - 0.37)	7.7	0.0	0.0	100.0

Table 5. Avian flight height characteristics in relation to the turbine rotor swept area (RSA)[1] during fall 2009 point count surveys at the Ashley Wind Energy Project.

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
Baird's sandpiper	0.00	0.10 (0.00 - 0.26)	0.0	0.0	0.0	0.0
American wigeon	0.00	0.08 (0.00 - 0.16)	0.0	0.0	0.0	0.0
American robin	0.00	0.37 (0.00 - 0.80)	100.0	0.0	0.0	100.0
American goldfinch	0.00	0.61 (0.18 - 1.04)	90.2	0.0	0.0	100.0
American coot	0.00	13.06 (7.89 - 18.23)	0.0	0.0	0.0	0.0
American bittern	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0

[1]These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

Table 6. Incidental observations of birds during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species
American bittern
American coot
American goldfinch
American kestrel
American wigeon
American white pelican
bald eagle
bank swallow
barn swallow
black-crowned night-heron
brown-headed cowbird
black tern
bufflehead
blue-winged teal
cattle egret
Canada goose
canvasback
clay-colored sparrow
cliff swallow
common grackle
double-crested cormorant
eastern kingbird
European starling
ferruginous hawk
Franklin's gull
great blue heron
great horned owl
great egret
grasshopper sparrow
herring gull
horned lark
hooded merganser
killdeer
Lapland longspur
lesser scaup
mallard
merlin
mourning dove
northern harrier
northern pintail
northern rough-winged swallow
northern shoveler

Table 6. Incidental observations of birds during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species
pied-billed grebe
pectoral sandpiper
prairie falcon
ring-billed gull
redhead
rough-legged hawk
red-tailed hawk
ruddy duck
red-winged blackbird
sandhill crane
savannah sparrow
snow goose
sora
song sparrow
Swainson's hawk
tree swallow
unidentified duck
unidentified falcon
unidentified gull
unidentified hawk
unidentified songbird
upland sandpiper
vesper sparrow
western grebe
western kingbird
western meadowlark
yellow-headed blackbird

FIGURES

Burleigh County
Kidder County
Stutsman County
Barnes County
Dutton Slough
Long Lake
Pursian Lake
Lake George
Streeter Memorial State Park
Alkaline Lake
Buffalo Creek
Beaver Creek
James River
North Dakota
Amies Lake
Bone Hill Creek
Goose Lake
McKenna Lake
Long Lake Creek
Cottonwood Creek
LaMoure County
Logan County
Beaver Lake State Park
Beaver Lake
Doyles Lake
Maple Creek
Maple River
Emmons County
Mud Lake
Miller Lake
Walther Slough
Beaver Creek
South Branch Beaver Creek
Green Lake
Pudwill Lake
Baumgartner Lake
Schwan Lake
Senger Lake
McIntosh County
Goose Lake
South Fork Maple River
Dickey County
Rice Lake
Lake Hoskins
Kislingbury Lake
Elm River
Coldwater Lake
Pheasant Lake
1804
Spring Creek
Campbell County
Long Lake
Elm Lake
Dry Branch
Maple River
Willow Creek
Brown County
Dry Run Creek
South Dakota
McPherson County
Alkali Lake
Foot Creek
Columbia Road Reservoir
Corson County
Lake Oahe
Snake Creek
Elm River
James River
Salt Lake
Richmond Lake

Figure 1

Vicinity map.
Ashley Wind Energy Project
McIntosh County, ND

CPV

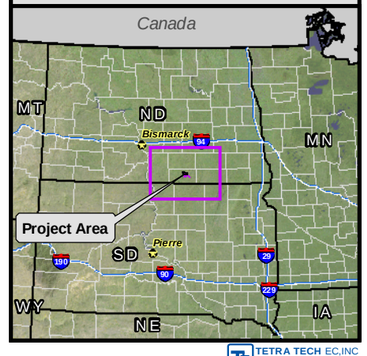
- 200-MW WEP
- Federal Highway
- State Highway
- State Boundary
- County Boundary
- River/Stream
- Perennial Lake
- Intermittent Lake

DATA SOURCES: ESRI Streetmap 2005

N W E S

1:500,000
NAD 1983 UTM 14

0 2 4 6 8 10
Miles



TETRA TECH EC,INC

P:\GIS_PROJECTS\Competitive_Power_Ventures\Ashley\MXDs\Avian_Survey\2009\Fall\Report_Maps\200MW_Analysis\CPV_Ashley_AvianSurvey_Figure2_Point_Count_Location_011410_LTab.mxd - Last Accessed: 1/15/2010 - Map Scale correct at ANSI B (17" x 11")

Figure 2

Point count location map (fall 2009).

Ashley Wind Energy Project
McIntosh County, ND

CPV

- Avian Survey Point
- Avian Survey Point 800-m Radius
- PC# Point Count Number
- 200-MW WEP
- River/Stream
- Lake/Pond
- Other Road

DATA SOURCES: ESRI Streetmap 2005, National Geographic Society 2009

1:70,000
NAD 1983 UTM 14
Last Modified: 1/14/2010

0 0.5 1 1.5 2
Miles

Canada
MT ND SD MN WY NE IA
Bismarck
Pierre
Project Area

TETRA TECH EC,INC

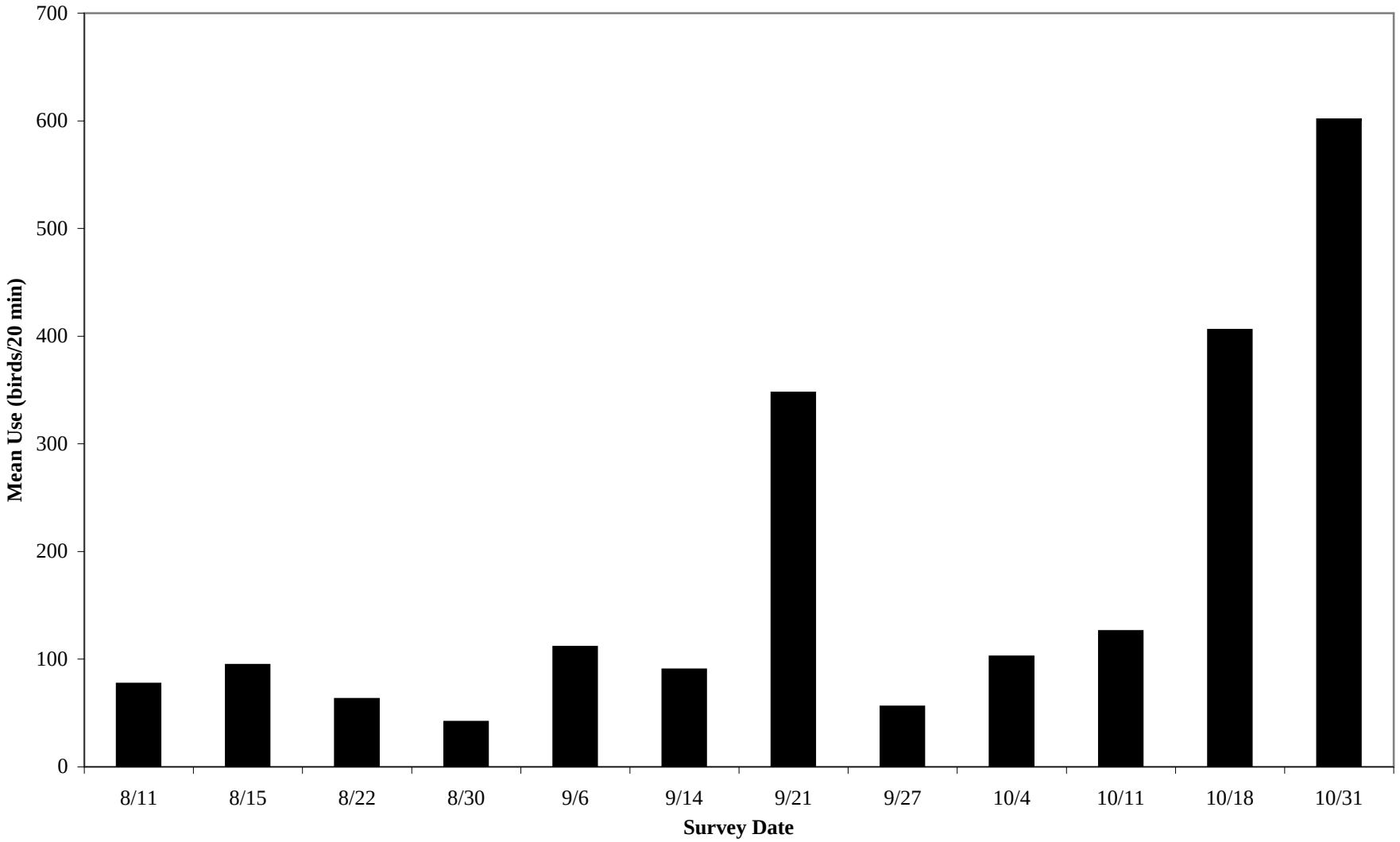


Figure 3. Mean non-raptor use by survey date (fall 2009).

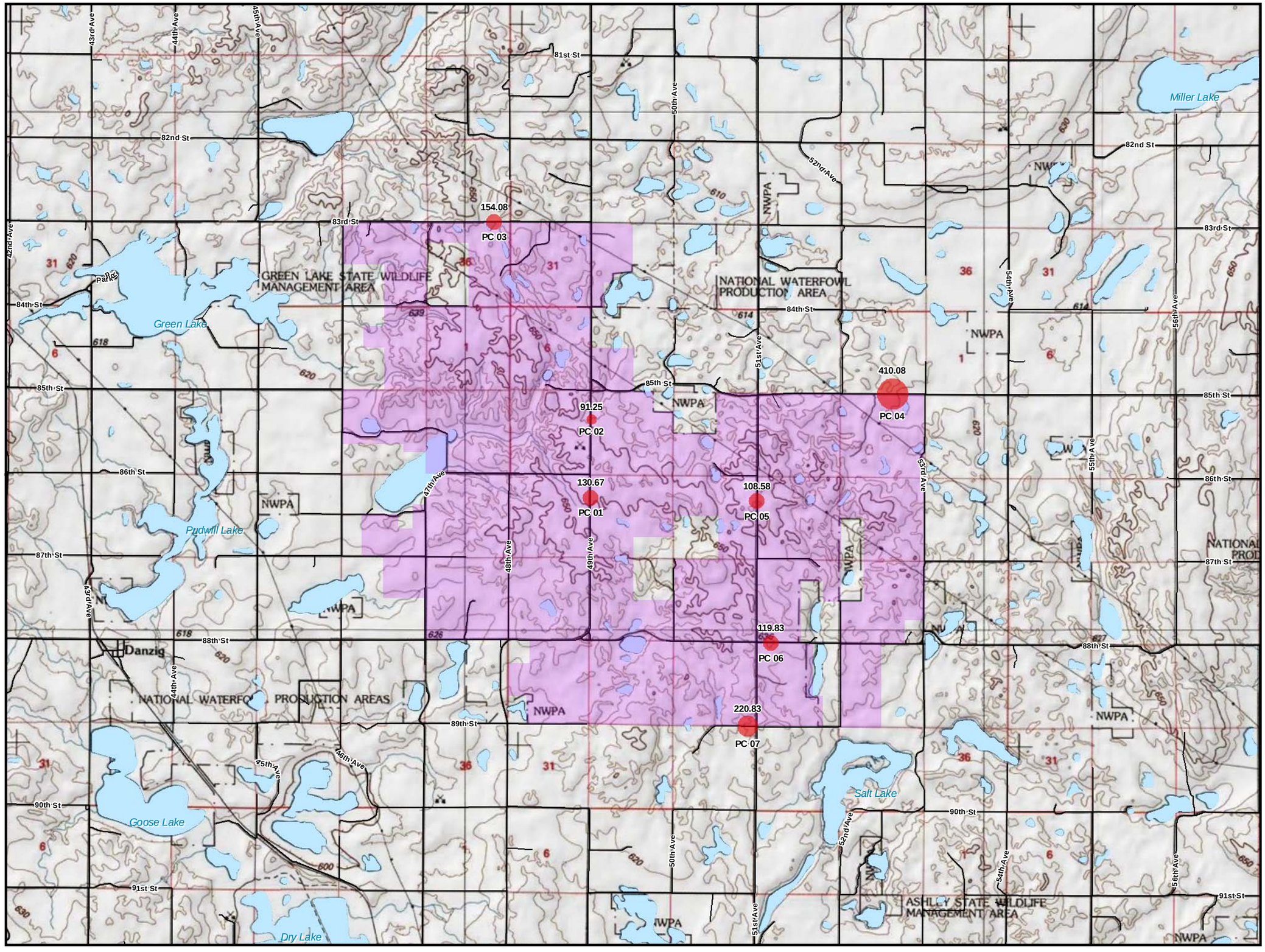


Figure 4

Non-raptor mean use by point count location (fall 2009). Ashley Wind Energy Project McIntosh County, ND

CPV

Non-raptors per 20 minutes

- 0.00 - 100.00
- 100.01 - 200.00
- 200.01 - 300.00
- 300.01 - 400.00
- 400.01 - 500.00

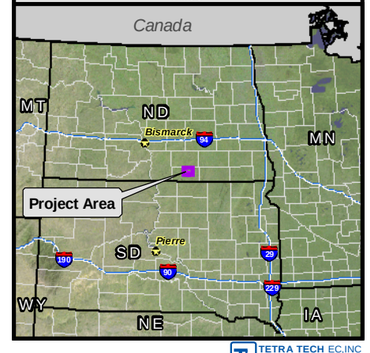
\# Mean Use Value
PC# Point Count Number

- 200-MW WEP
- River/Stream
- Lake/Pond
- Other Road

DATA SOURCES: ESRI Streetmap 2005, National Geographic Society 2009

1:70,000
NAD 1983 UTM 14
Last Modified: 12/15/2009

0 0.5 1 1.5 2
Miles



TETRA TECH EC,INC

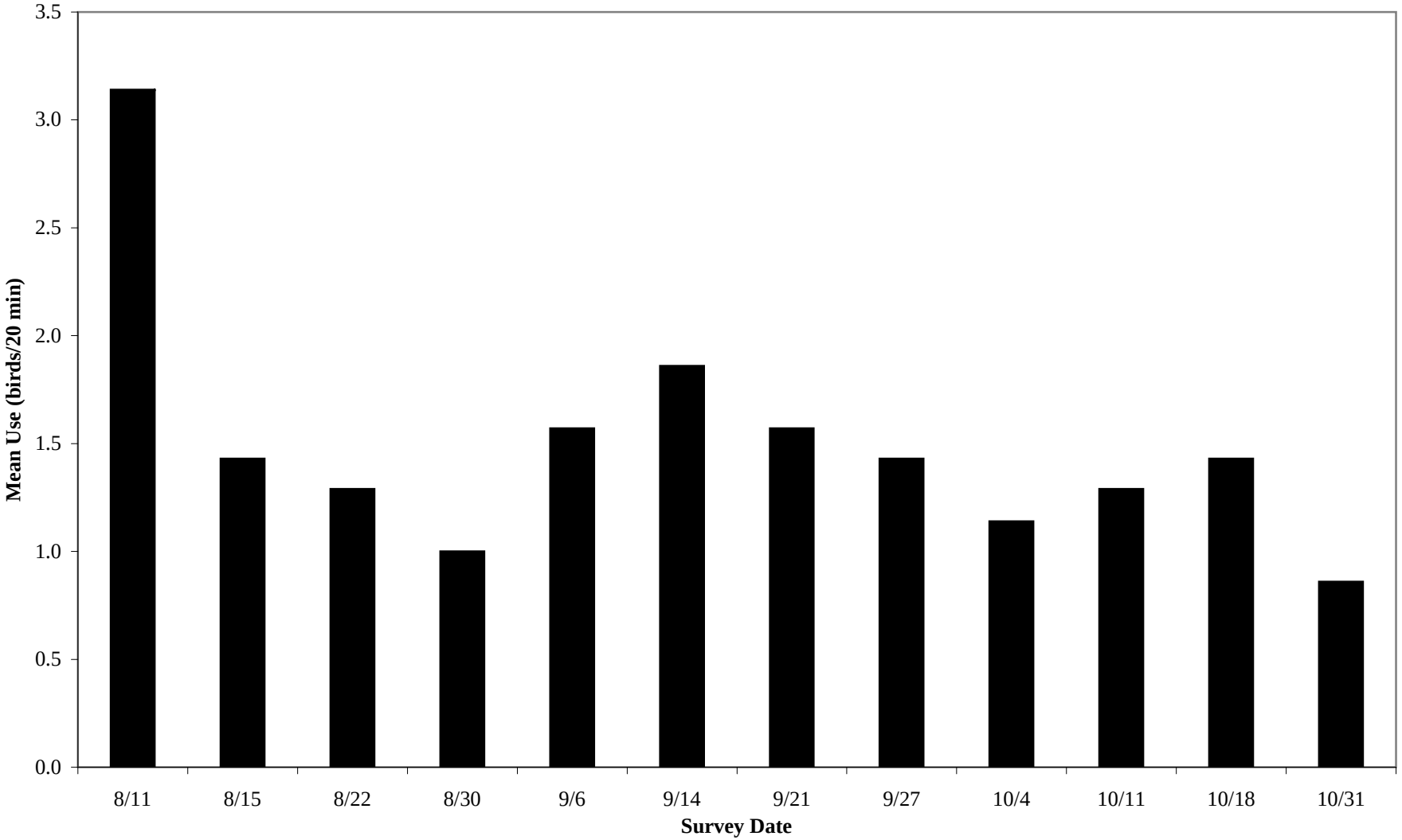


Figure 5. Mean raptor use by survey date (fall 2009).

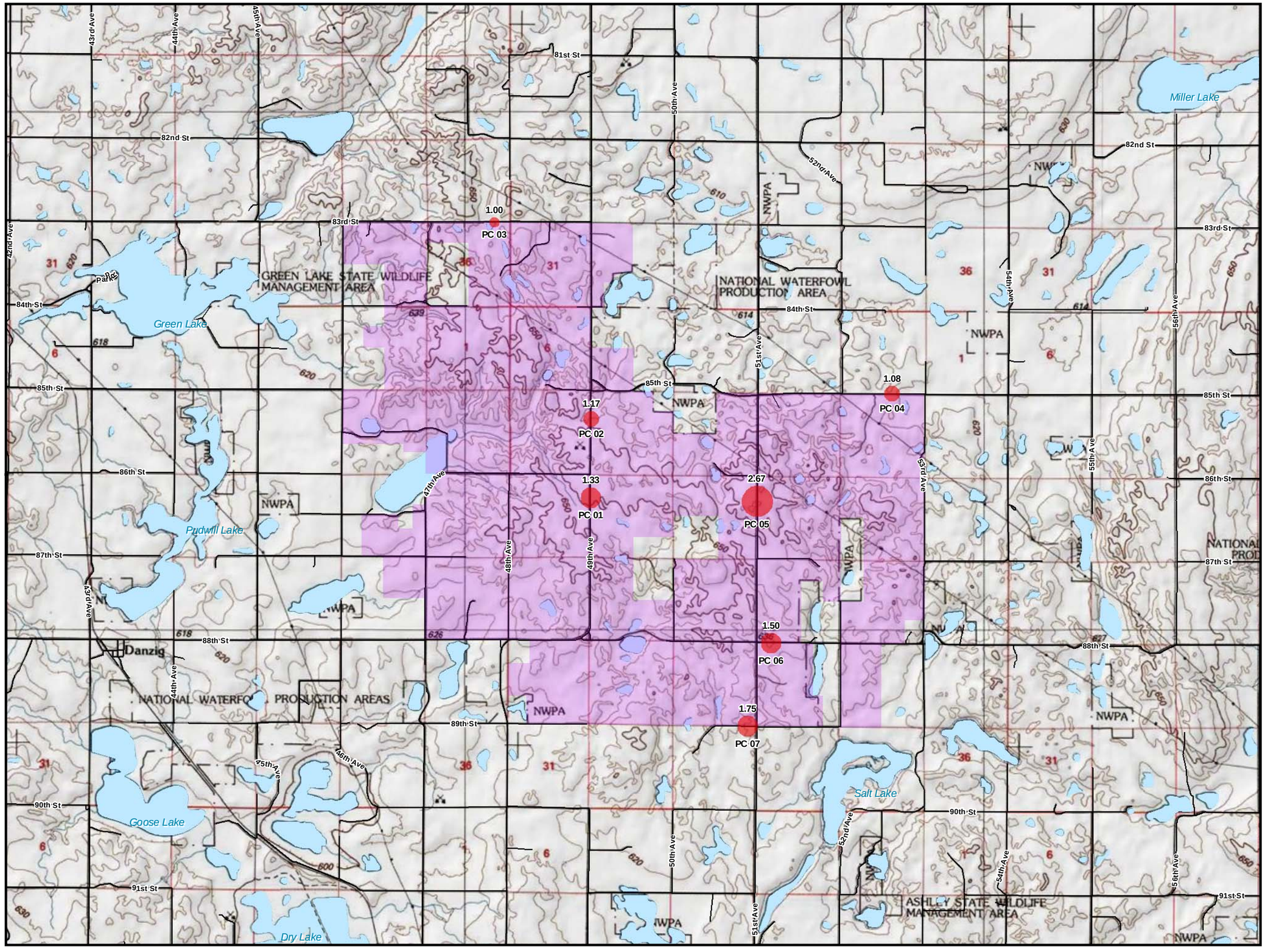


Figure 6

Raptor mean use by point count location (fall 2009).
Ashley Wind Energy Project
McIntosh County, ND

CPV

Raptors per 20 minutes

- 0.00 - 0.60
- 0.61 - 1.20
- 1.21 - 1.80
- 1.81 - 2.40
- 2.41 - 3.00

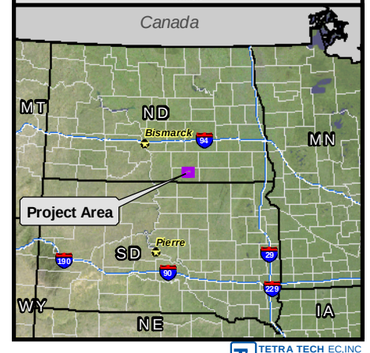
\# Mean Use Value
PC# Point Count Number

- 200-MW WEP
- Other Road
- River/Stream
- Lake/Pond

DATA SOURCES: ESRI Streetmap 2005, National Geographic Society 2009

1:70,000
NAD 1983 UTM 14
Last Modified: 12/15/2009

0 0.5 1 1.5 2
Miles



TETRA TECH EC,INC

P:\GIS_PROJECTS\Competitive_Power_Ventures\Ashley\MXDs\Avian_Survey\2009\FallReport_Maps\200MW_Analysis\CPV_Ashley_AvianSurvey_Figure6_RaptorMU_011410_LTab.mxd - Last Accessed: 1/15/2010 - Map Scale correct at: ANSI B (17" x 11")

APPENDIX

Appendix 1. Flight directions of birds observed during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
red-winged blackbird	3012	19	0.1	0.0	0.0	0.0	82.5	0.0	17.5	0.0	0.0
snow goose	2060	9	3.9	40.0	0.0	2.2	53.9	0.0	0.0	0.0	0.0
sandhill crane	1605	4	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
yellow-headed blackbird	823	4	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Canada goose	611	29	21.8	0.0	12.8	0.8	44.4	0.0	9.5	10.8	0.0
American white pelican	576	9	0.7	0.2	0.0	0.0	97.4	0.0	1.7	0.0	0.0
barn swallow	531	15	15.6	0.0	0.0	0.0	79.5	3.4	1.5	0.0	0.0
Lapland longspur	405	4	60.5	0.0	0.0	0.0	30.9	8.6	0.0	0.0	0.0
ring-billed gull	282	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Franklin's gull	275	2	0.0	0.0	0.0	34.5	65.5	0.0	0.0	0.0	0.0
northern rough-winged swallow	113	5	15.0	0.0	0.0	0.0	85.0	0.0	0.0	0.0	0.0
common grackle	104	3	0.0	0.0	57.7	0.0	42.3	0.0	0.0	0.0	0.0
pectoral sandpiper	70	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
double-crested cormorant	57	5	0.0	0.0	0.0	63.2	33.3	3.5	0.0	0.0	0.0
blue-winged teal	47	6	34.0	6.4	0.0	0.0	59.6	0.0	0.0	0.0	0.0
unidentified songbird	45	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
unidentified sandpiper	43	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
horned lark	42	2	0.0	0.0	0.0	0.0	95.2	0.0	4.8	0.0	0.0
canvasback	40	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
northern pintail	33	3	0.0	0.0	0.0	0.0	81.8	18.2	0.0	0.0	0.0
American goldfinch	33	4	0.0	0.0	24.2	0.0	75.8	0.0	0.0	0.0	0.0
unidentified duck	25	3	0.0	0.0	0.0	12.0	88.0	0.0	0.0	0.0	0.0
mourning dove	23	2	91.3	0.0	8.7	0.0	0.0	0.0	0.0	0.0	0.0
unidentified gull	18	2	11.1	0.0	0.0	0.0	88.9	0.0	0.0	0.0	0.0
northern harrier	15		0.0	0.0	13.3	6.7	46.7	6.7	20.0	6.7	0.0

Appendix 1. Flight directions of birds observed during fall 2009 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds[1]	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
great egret	15	4	6.7	0.0	0.0	6.7	6.7	80.0	0.0	0.0	0.0
American robin	15	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
sharp-tailed grouse	13	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
red-tailed hawk	11	9	18.2	9.1	0.0	0.0	54.5	0.0	18.2	0.0	0.0
western meadowlark	9	4	0.0	0.0	33.3	0.0	11.1	11.1	44.4	0.0	0.0
unidentified hawk	9	8	44.4	0.0	0.0	0.0	55.6	0.0	0.0	0.0	0.0
mallard	9	2	33.3	0.0	0.0	66.7	0.0	0.0	0.0	0.0	0.0
tundra swan	7	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
killdeer	7	2	0.0	0.0	0.0	0.0	57.1	0.0	0.0	42.9	0.0
great blue heron	7	6	28.6	0.0	0.0	0.0	28.6	14.3	14.3	14.3	0.0
Smith's longspur	5	1	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
northern flicker	5	2	0.0	0.0	80.0	0.0	0.0	0.0	20.0	0.0	0.0
broad-winged hawk	4	3	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
savannah sparrow	3	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Swainson’s hawk	2	2	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
rough-legged hawk	2	2	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
merlin	2	2	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0
ferruginous hawk	2	2	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
sharp-shinned hawk	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
prairie falcon	1	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
herring gull	1	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
black tern	1	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
brown-headed cowbird	1	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grand Total	**11020**	**210**	**5.7**	**7.5**	**1.4**	**1.8**	**76.6**	**0.7**	**5.6**	**0.6**	**0.0**

[1] Includes only flying birds with flight directions