

**Appendix D – 2009 Fall and 2010 Spring Avian Surveys and Turbine  
Model Comparison**

## 2009 Fall Avian Survey

### Ashley Wind Energy Project McIntosh County, North Dakota



Prepared For:  Competitive  
Power Ventures, Inc.

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

Prepared By:  TETRA TECH EC, INC.

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

March 2010



**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
<b>Non-raptors</b>		
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 <sup>1</sup> species observed within the WEP	No	NA
State-listed species <sup>2</sup> 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)
<b>Raptors</b>		
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)
<b>Habitat</b>		
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

<sup>1</sup> Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.

<sup>2</sup> The North Dakota Game and Fish Department maintains a list of Species of Conservation Priority (NDGFD 2008).

**TABLE OF CONTENTS**

**EXECUTIVE SUMMARY ..... ES-1**

**1.0 INTRODUCTION..... 1**

    1.1 Wind Energy and Birds..... 1

    1.2 Study Description ..... 2

**2.0 METHODS ..... 2**

    2.1 Avian Surveys..... 3

        2.1.1 Fixed-point Surveys..... 3

        2.1.2 Incidental Observations ..... 3

        2.1.3 Listed Species Information ..... 4

        2.1.4 Data Quality Assurance/Quality Control ..... 4

    2.2 Analysis ..... 4

        2.2.1 Species Groupings ..... 4

        2.2.2 Avian Use ..... 4

        2.2.3 Flight Behavior ..... 5

        2.2.4 Encounter Rate..... 5

        2.2.5 Mortality Risk ..... 5

**3.0 RESULTS ..... 5**

    3.1 Avian Use and Frequency of Occurrence ..... 5

    3.2 Flight Height and Encounter Rate..... 6

    3.3 Incidental Observations ..... 7

**4.0 DISCUSSION..... 7**

    4.1 Non-Raptor Use and Encounter Rate..... 7

    4.2 Raptor Use and Encounter Rate..... 9

    4.3 Listed and Sensitive Species ..... 9

        4.3.1 Endangered Species Act ..... 9

        4.3.2 Bald and Golden Eagle Protection Act ..... 9

        4.3.3 North Dakota Species of Conservation Priority..... 9

    4.4 Ashley WEP Conclusions..... 10

**5.0 REFERENCES..... 11**

**TABLES**

Table ES-1. Fall avian use summary.

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

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

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

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

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

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

**FIGURES**

- Figure 1. Vicinity map.  
Figure 2. Point count location map (fall 2009).  
Figure 3. Mean non-raptor use by survey date (fall 2009).  
Figure 4. Non-raptor mean use by point count location (fall 2009).  
Figure 5. Mean raptor use by survey date (fall 2009).  
Figure 6. Raptor mean use by point count location (fall 2009).

**APPENDIX**

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

## 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://gfd.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:

$$\text{Encounter Rate} = A * P_f * P_t$$

$A$  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](http://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.npwr.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.npwr.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. Inigo-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 <sup>1</sup>	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
<b>Songbirds</b>							
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%
<b>Group Total</b>		<b>5965</b>	<b>149</b>	<b>71.01</b> (42.45-99.57)	<b>76.2</b>		<b>39.9%</b>
<b>Waterfowl</b>							
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 <sup>1</sup>	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%
<b>Group Total</b>		<b>4396</b>	<b>146</b>	<b>52.33</b> (29.61-75.05)	<b>66.7</b>		<b>29.4%</b>
<b>Waterbirds</b>							
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 <sup>1</sup>	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%
<b>Group Total</b>		<b>2148</b>	<b>118</b>	<b>25.57</b> (15.27-35.87)	<b>70.2</b>		<b>14.4%</b>
<b>Cranes/Rails</b>							
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%
<b>Group Total</b>		<b>1606</b>	<b>5</b>	<b>19.12</b> (0.00-50.55)	<b>2.4</b>		<b>10.7%</b>
<b>Gulls/Terns</b>							
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%
<b>Group Total</b>		<b>639</b>	<b>19</b>	<b>7.61</b> (0.00-16.84)	<b>17.9</b>		<b>4.3%</b>
<b>Raptors</b>							
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 <sup>1</sup>	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%
<b>Group Total</b>		<b>126</b>	<b>105</b>	<b>1.50</b> (1.24-1.76)	<b>73.8</b>		<b>0.8%</b>
<b>Pigeons/Doves</b>							
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%
<b>Group Total</b>		<b>45</b>	<b>8</b>	<b>0.54</b> (0.09-0.99)	<b>9.5</b>		<b>0.3%</b>
<b>Gamebirds</b>							
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%
<b>Group Total</b>		<b>20</b>	<b>5</b>	<b>0.24</b> (0.00-0.51)	<b>6.0</b>		<b>0.1%</b>
<b>Woodpeckers</b>							
northern flicker	63	5	2	0.06 (0.00-0.14)	2.4	100.0%	0.0%
<b>Group Total</b>		<b>5</b>	<b>2</b>	<b>0.06</b> (0.00-0.14)	<b>2.4</b>		<b>0.0%</b>
<b>Grand Total</b>		<b>14950</b>	<b>557</b>	<b>177.98</b> (124.17-231.78)			

<sup>1</sup> 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
pieb-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
<b>Grand Total</b>	<b>14950</b>	<b>557</b>	<b>1584</b>	<b>1109</b>	<b>1861</b>	<b>4934</b>	<b>1335</b>	<b>1456</b>	<b>2671</b>

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

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
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%
<b>Raptors</b>		
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%

<sup>1</sup>Includes only flying birds with flight height data

<sup>2</sup>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)<sup>1</sup> 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)<sup>1</sup> 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)<sup>1</sup> 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)<sup>1</sup> 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

<sup>1</sup>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.

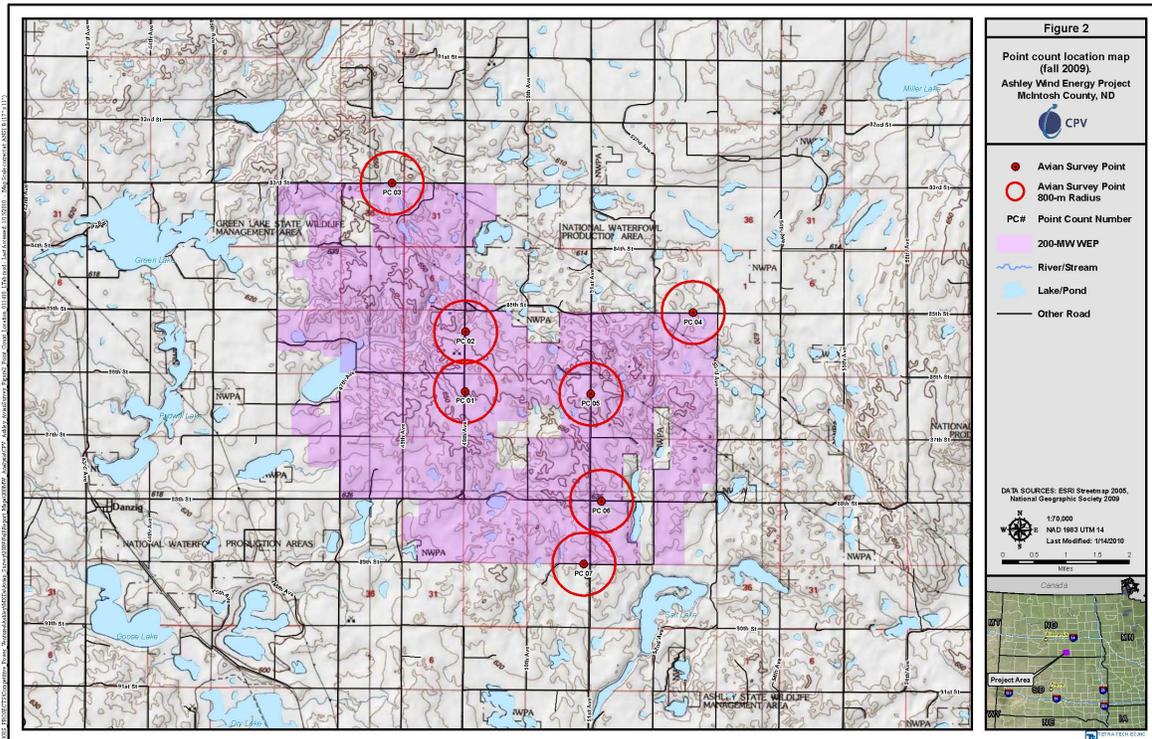
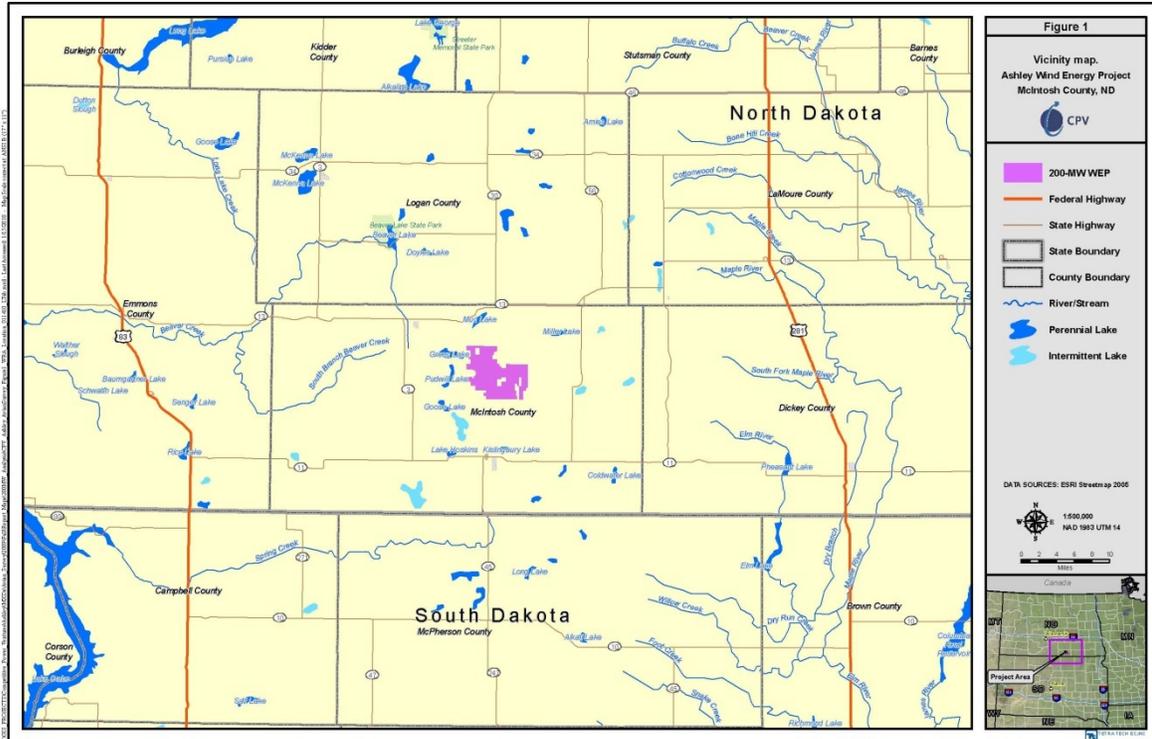
<b>Species</b>
American bittern
American coot
American goldfinch
American kestrel
American wigeon
American white pelican
bald eagle
bank swallow
barn swallow
black-crowned night-heron
brown-headed cowbird
black tern
bufflehead
blue-winged teal
cattle egret
Canada goose
canvasback
clay-colored sparrow
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.

<b>Species</b>
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

---



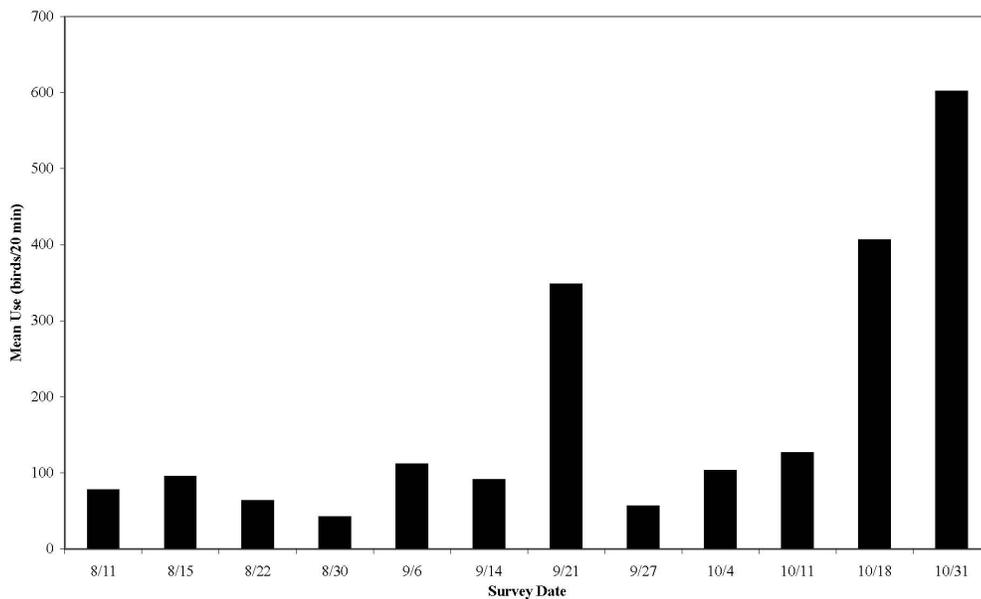
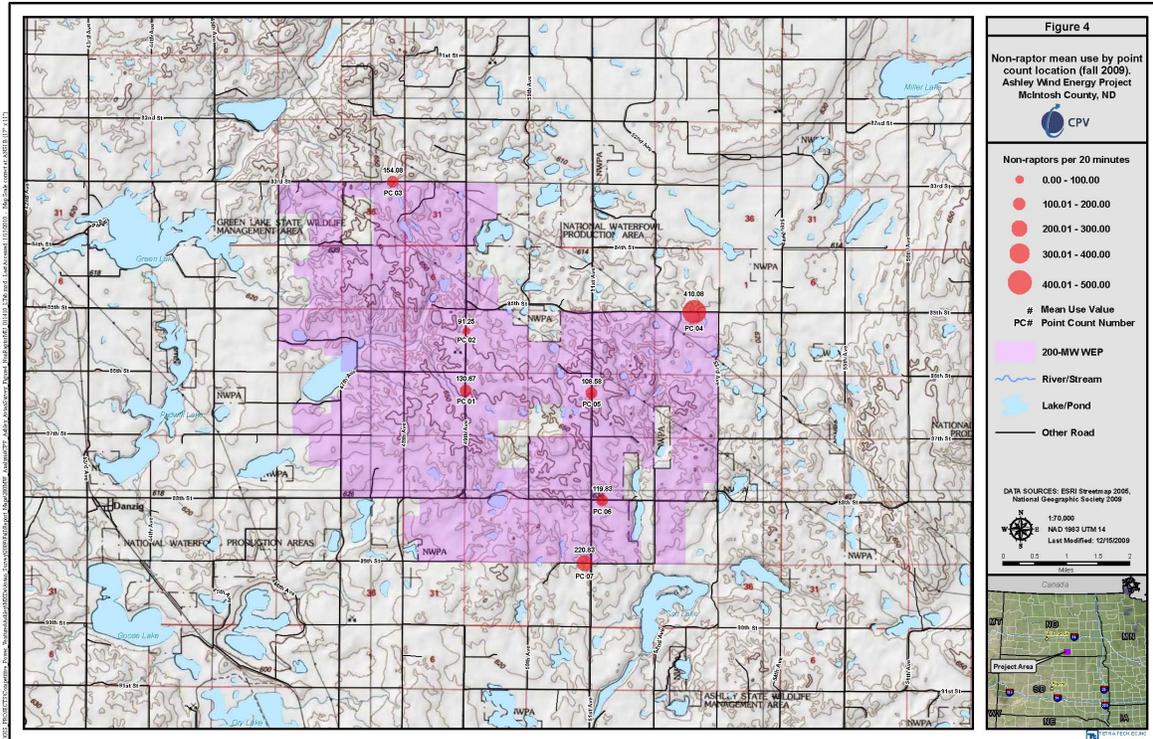


Figure 3. Mean non-raptor use by survey date (fall 2009).

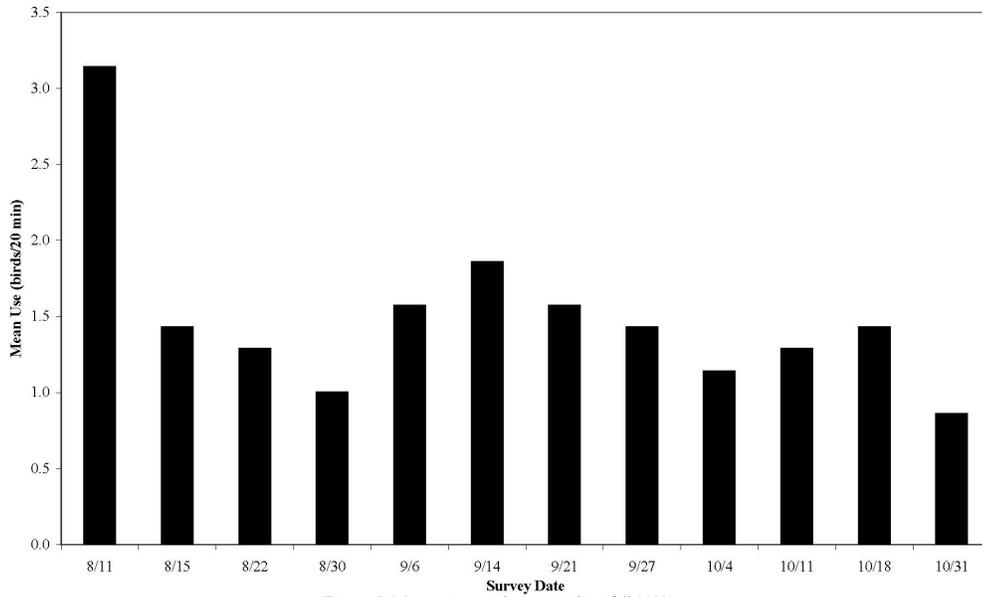
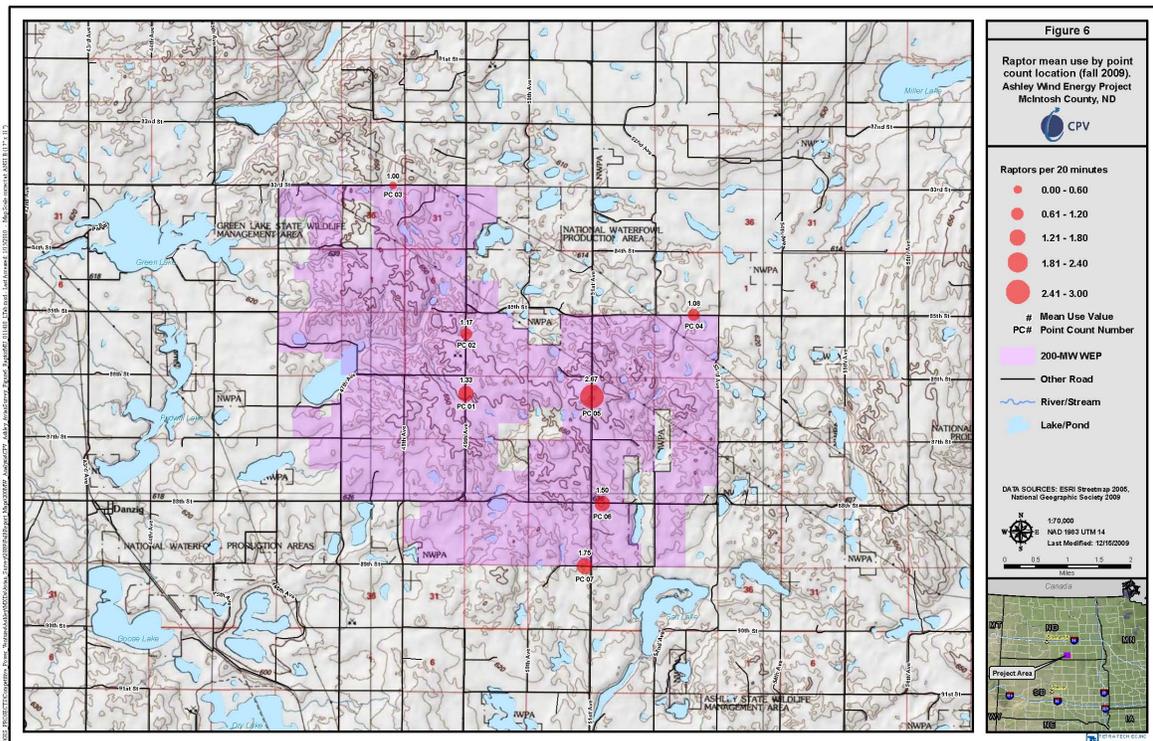


Figure 5. Mean raptor use by survey date (fall 2009).



*CPV Ashley Renewable Energy Company Business Confidential*

*2009 Fall Avian Survey*

## APPENDIX

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

Species	Number of Birds <sup>1</sup>	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 <sup>1</sup>	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
<b>Grand Total</b>	<b>11020</b>	<b>210</b>	<b>5.7</b>	<b>7.5</b>	<b>1.4</b>	<b>1.8</b>	<b>76.6</b>	<b>0.7</b>	<b>5.6</b>	<b>0.6</b>	<b>0.0</b>

<sup>1</sup> Includes only flying birds with flight directions

**Appendix 3.** Observations of sharp-tailed grouse at Ashley Wind Energy Project from 3/21/2010 thru 6/30/2010 .

Date	Obs. Pt.	Number of Individ.	Activity Type(s) <sup>1</sup>	Habitat Type(s) <sup>2</sup>		Heights		Aud/Vis	RSA info <sup>3</sup>
						Low	High		
3/30/2010	3	1	FL	GR		2	5	Y/Y	Below
3/30/2010	5	18	FL WA	GR	W	0	6	Y/Y	Below
4/14/2010	5	1	PE	GR				Y/N	na
4/14/2010	5	2	FL	GR		0	5	Y/Y	Below
4/19/2010	5	1	PE	GR				Y/N	na
4/19/2010	5	1	FL	GR		2	5	Y/Y	Below
6/8/2010	5	2	PE	AG	GR	1.5	20	Y/Y	na
6/8/2010	5	1	FL PE	GR		0	20	Y/Y	Below
6/13/2010	5	1	WA	GR		0	0	Y/Y	na
<b>Total</b>		<b>28</b>							

<sup>1</sup>Activity Types: PE=Perched, FL=Flying, WA=Walking

<sup>2</sup>Habitat Types: AG=Agriculture, GR=Grassland, W=Wetland

<sup>3</sup>The RSA info assumes a rotor diameter of 101 (m) and a hub height of 80 (m), or rotor low of 29.5 m and a rotor high of 130.5 m. An "na" indicates that either the bird was not observed flying or no height data was collected.

## 2010 Spring Avian Survey

### Ashley Wind Energy Project McIntosh County, North Dakota



Prepared For:  CPV  
Renewable Energy Company, LLC

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

Prepared By:  TETRA TECH EC, INC.

Tetra Tech EC, Inc.  
160 Federal Street, 3rd Floor  
Boston, Massachusetts 02110

August 2010



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

## EXECUTIVE SUMMARY

Tetra Tech EC, Inc. (Tetra Tech) was contracted by CPV Ashley Renewable Energy Company, LLC (CPV) to undertake spring avian use surveys for the proposed Ashley Wind Energy Project (Project) in McIntosh County, North Dakota. The studies were conducted to identify potential avian impacts associated with building and operating the wind conversion facility. Weekly surveys were performed at the Project Area from March 23 to June 13, 2010, which included the spring through early summer seasons. Fixed point count surveys (800-meter [m] radius) were conducted at 7 points distributed throughout the Project Area.

A total 5,611 birds were observed within the Project Area from 90 species. Overall mean bird use within the Project Area was 61.66 birds/20 minutes (min) and ranged from 0 to 311 birds/20 min. Songbirds and waterfowl had the highest mean use out of all species groups observed (26.73 and 25.02 birds/20 min respectively). Waterbirds ranked third (5.21 birds/20 min) and gulls/terns (2.29 birds/20 min) ranked fourth for mean use among species groups at the Project Area.

The species with the highest mean use were the lesser scaup (6.45 birds/20 min), common grackle (5.90 birds/20 min), red-winged blackbird (5.84 birds/20 min), yellow-headed blackbird (5.47 birds/20 min), and mallard (4.62 birds/20 min). Additionally, European starling and common grackle had highest encounter rates within the rotor swept area (RSA) at 1.38 and 1.82 birds flying at RSA height/20 min, respectively. All of these species are widespread and have relatively stable populations; as a result, local mortality, should it occur, is unlikely to have regional population-level consequences. European starlings, however, are not protected by any federal or state laws.

American coots had the highest mean use among waterbirds at 3.51 birds/20min and accounted for 67.3 percent of all the waterbirds seen. However all waterbirds had a very low encounter rate of <0.05 birds flying at RSA height/20 min, suggesting a low probability of turbine collisions.

For gulls/terns species group, ring-billed gull had the highest encounter rate of 1.20 birds flying at RSA height/20 min. There are no reported fatalities for ring-billed gulls at other wind energy facilities with publicly available data. Given the encounter rate, it is possible that some mortality of ring-billed gulls may occur. However, any mortality observed, should it occur in the Project Area, is not expect to impact the regional North Dakota population as the regional population of ring-billed gulls are large and increasing.

The Swainson's hawk had the highest mean use among raptors (0.35 birds/20 min) and was one of three raptor species (besides great-horned owl and red-tailed hawk) nesting in the Project Area. Great-horned owl and red-tailed hawk had the next highest mean use among raptors (0.16 and 0.15 birds/20 min respectively). Despite the observed nesting use of the Project Area, Swainson's hawk, great-horned owl, and red-tailed hawk had low encounter rates within the Project Area implying a low likelihood of turbine collisions.



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

Given the number of raptor nests in the Project Area the risk of turbine-related fatalities may increase for nesting raptors (Swainson's hawk, red-tailed hawk, and great-horned owl) in late spring to early fall as the young begin to fledge from the nests. Additionally, construction and maintenance of the Project could lead to disturbance of nesting raptors within the Project Area. Disturbance of nesting raptors can result in complete desertion of nest, eggs, or young. Most of the species listed above are protected by the Migratory Bird Treaty Act (MBTA).

#### **Listed and Sensitive Species**

The biologist did not record any species listed on the Endangered Species Act or any federal candidate species. The biologist did detect a single bald eagle approximately 1 mile to the southwest of the Project Area in early spring. The Bald and Golden Eagle Protection Act (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 (i.e., if the USFWS determines that the take is compatible with the preservation of the eagles and cannot be practicably avoided). The limited number of eagle observations in the vicinity of the Project suggests a low probability of negative interactions between eagles and Project facilities.

Twenty-three species were detected that are listed as North Dakota State Species of Conservation Priority. A permit is not required for the take of North Dakota state-sensitive species, but most of these species are protected under the MBTA. Sharp-tailed grouse were observed during regular point count surveys and incidental observations. One active lek was found approximately 300 m north of the Project Area during the survey. The probability of sharp-tailed grouse fatalities is low as they typically fly low to the ground and, therefore, are at low risk of collision with turbines. Sharp-tailed grouse are a State Species of Conservation Priority but are also managed as a gamebird in North Dakota. Although the potential exists for wind energy development to have a negative impact on grouse behavior and habitat use, the extent and duration of the impact is unknown for sharp-tailed grouse.



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

**Table ES-1. Spring Avian Use Summary**

Variable	Result	Details
<b>Non-raptors</b>		
Mean use	60.92 birds/20 min	
Number of species with high encounter rates (>2.0 birds at RSA height/20 min)	None	
Federally listed <sup>1</sup> species observed within the Project Area	No	
State-listed species <sup>2</sup> within the Project Area	Yes	20 state-sensitive species (Section 4.3)
State-listed species within RSA	No	
Grouse leks observed within the Project Area	No	sharp-tailed grouse lek identified just outside Project Area (Section 4.4)
<b>Raptors</b>		
Mean use	0.74 birds/20 min	
Number of species with high encounter rates (>2.0 birds at RSA height/20 min)	None	
Federally listed species observed within the Project Area	No	
State-listed species within the Project Area	Yes	Swainson's hawk, ferruginous hawk, bald eagle and short-eared owl (Section 4.3)
State-listed species observed nesting within the Project Area	Yes	Swainson's hawk
State-listed species within the RSA	No	
<b>Habitat</b>		
Native habitat likely to be affected by development	Yes	native prairie and wetlands
Lakes (waterfowl attractant)	Yes	numerous small ponds
Wetlands (attractant for cranes, waterfowl, and other water-based species)	Yes	scattered throughout
Cliffs (raptor nesting and traveling)	No	
River (permanent water source, migration corridor)	No	
Known refuges or habitat features that may funnel migrants	Yes	two waterfowl production areas

<sup>1</sup>Federally listed species include species listed as endangered, threatened, or candidate species in the Endangered Species Act.

<sup>2</sup>The North Dakota Game and Fish Department (NDGFD) maintains a list of Species of Conservation Priority (Hagen et al. 2005).



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

## TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY</b>	<b>ES-1</b>
<b>1.0 INTRODUCTION</b>	<b>1</b>
1.1 WIND ENERGY AND BIRDS	1
1.2 STUDY DESCRIPTION	2
<b>2.0 METHODS</b>	<b>3</b>
2.1 AVIAN SURVEYS	3
2.1.1 Fixed-point Surveys	3
2.1.2 Raptor Nest Surveys	4
2.1.3 Incidental Observations	5
2.1.4 Listed Species Information	5
2.1.5 Data Quality Assurance/Quality Control	5
2.2 ANALYSIS	6
2.2.1 Species Groupings	6
2.2.2 Avian Use of the Project Area	6
2.2.3 Flight Behavior	6
2.2.4 Encounter Rate	6
2.2.5 Mortality Risk	7
<b>3.0 RESULTS</b>	<b>7</b>
3.1 AVIAN USE AND FREQUENCY OF OCCURRENCE	7
3.2 FLIGHT HEIGHT AND ENCOUNTER RATE	9
3.3 RAPTOR NEST SURVEYS	9
3.4 INCIDENTAL OBSERVATIONS	9
<b>4.0 DISCUSSION AND RECOMMENDATIONS</b>	<b>9</b>
4.1 NON-RAPTOR USE AND ENCOUNTER RATE	9
4.2 RAPTOR USE AND ENCOUNTER RATE	10
4.3 LISTED AND SENSITIVE SPECIES	11
4.4 SPECIES OF INTEREST	12
4.5 COMPARISON OF THE SPRING 2010 AND THE FALL 2009 SURVEY	12
4.6 PROJECT CONCLUSIONS	13
<b>5.0 REFERENCES</b>	<b>13</b>



**TABLES**

Table ES-1.	Spring Avian Use Summary
Table 1.	Spring 2010 point count survey dates at Ashley Wind Energy Project.
Table 2.	Avian species, by species grouping, observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.
Table 3.	Avian species observed by point during Spring 2010 point count surveys at the Ashley Wind Energy Project.
Table 4.	Summary of avian flight heights in relation to the turbine rotor swept area (RSA) during Spring 2010 point count surveys at the Ashley Wind Energy Project.
Table 5.	Avian flight height characteristics in relation to the turbine rotor swept area (RSA) during Spring 2010 point count surveys at the Ashley Wind Energy Project.
Table 6.	Incidental observations of birds during Spring 2010 point counts at the Ashley Wind Energy Project.

**FIGURES**

Figure 1.	Ashley Wind Energy Project wind resource area location map
Figure 2.	Ashley Wind Energy Project point count location map
Figure 3.	Non-raptor mean use by survey date in Spring 2010 at the Ashley Wind Energy Project
Figure 4.	Non-raptor mean use by point count location map (Spring 2010)
Figure 5.	Raptor mean use by survey date in Spring 2010 at the Ashley Wind Energy Project
Figure 6.	Raptor mean use by point count location map (Spring 2010)
Figure 7.	Raptor nest and lek location map (Spring 2010)

**APPENDICES**

Appendix 1.	Flight directions of birds observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.
Appendix 2.	Raptor nests observed at the Ashley Wind Energy Project, 2010.
Appendix 3.	Observations of sharp-tailed grouse at the Ashley Wind Energy Project from 3/21/2010 through 6/30/10.



## 1.0 INTRODUCTION

### 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). 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 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 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. It was suggested 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 (Erickson et al. 2004). Recent research at two sites in North and South Dakota (Shaffer and Johnson 2008) suggests that certain grassland songbird species (2 of 4 studied) may



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

---

avoid turbines by as much as 200 m but these results have not been finalized nor verified at additional sites. None of these 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.

Particular concern over avoidance issues has been raised with respect to grouse species. Research studies are underway to evaluate the effects of wind energy development on lesser prairie-chickens, greater prairie-chickens, and greater sage-grouse. However, data from these studies has yet to be published. Conversely, several studies regarding the effects of other anthropogenic structures such as roads and buildings on grouse have been published (Pitman et al. 2005, Atamian et al. 2007, Lammers and Callopy 2007, Pruett et al. 2009).

Finally, most 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) has 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 energy company to protect itself from liability at wind energy facilities; however, the USFWS does not usually take action if good faith efforts have been made to minimize impacts. To date, no wind energy development company has been charged for violations of the MBTA; however utilities have been prosecuted successfully.

#### **Study Description**

CPV Ashley Renewable Energy Company, LLC (CPV) is developing an up to approximately 200.1 megawatt (MW) wind energy conversion facility in south central North Dakota in McIntosh County (Figure 1). The Ashley Wind Energy Project (Project) 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 spring avian surveys of the Project to quantify local avian use in the area and to identify potential avian impacts associated with building and/or operating the proposed facility.

The Project Area is 17,400 acres and is located in the Prairie Pothole Region. Although construction of a wind energy facility differs 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



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

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 Project Area. 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 important 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 Project Area. 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 Project Area, 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 Project Area to evaluate avian use, behavior, and species composition during spring migration (Figure 2). The biologist conducted weekly surveys from March 23 to June 13, 2010 (Table 1), thereby encompassing the spring to early summer seasons. Tetra Tech distributed the survey locations throughout the Project Area and chose locations that maximized the 360-degree sight distance for the observer and covered a diversity of habitats.

The 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 the biologist continuously recorded any visual or auditory observations. The biologist recorded the following data: species, number of birds, time of observation, height aboveground,



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

behavior, and flight directions (for those birds making non-localized flights). 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 line poles 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 spring and summer 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 Project Area 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 an individual 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 Raptor Nest Surveys**

The purpose of raptor nest surveys is to estimate the number of active and inactive raptor nests in the Project Area. The biologist conducted the raptor nest survey across the Project Area before trees began to leaf out. This helps to improve the detection of raptor nests. Where possible, the biologist also surveyed over an approximately 1-mile buffer around the Project Area. Once a nest was located, the biologist returned during the raptor breeding season to collect data on species, location, and activity status. The activity status (i.e., active or inactive) was determined by the presence of an adult or young, active territory defense by an individual, or the presence of feathers, egg shells or droppings underneath the nest. In addition, the biologist determined the nest condition and substrate. The biologist visited nests a minimum of two times, once to determine the location of the nest and once to determine if the nest was active. This second check also allowed biologist to detect late-nesting species, such as Swainson's hawks. Raptor nest surveys provide an estimate of the number and species of raptors that use stick nests in the area.



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

Results of the raptor nests monitored during the survey are in Appendix 2. Ground-nesting raptor species, such as northern harriers, were not surveyed.

### **2.1.3 Incidental Observations**

Incidental observations included observations in the vicinity (i.e., within approximately 1 mile) of the Project Area that occurred 1) during travel between points, 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.

### **2.1.4 Listed Species Information**

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

The North Dakota Game and Fish Department (NDGFD) have 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>.

### **2.1.5 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 Pro™ relational database for data storage and analysis. Prior to analysis, an independent reviewer conducted a 100-percent quality review of the data



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

entries. Any questions that arose at this time were directed toward and answered by the field biologist.

## **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 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 of the Project Area**

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. Tetra Tech also calculated a measure of variability (90 percent confidence intervals) for all mean use values. To further evaluate the diversity and composition of avian species using the Project Area, Tetra Tech summarized the frequency of occurrence (percentage of surveys a species was observed) and percent composition (number of birds observed of a particular species divided by total number of birds observed). 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 Project Area on migration). Because individual birds are not uniquely marked and identified, actual population size or abundance cannot be determined. One individual may be counted more than once 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 Project. For the purposes of this report, the turbine type used to calculate the RSA at the Project was considered to have an 80-m hub height and up to a 101-m rotor diameter. 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 Project Area:

$$\text{Encounter Rate} = A * P_f * P_t$$



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

$A$  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 (e.g., > 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/20 min), but it does not mean that 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). 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 use. Based on the available data, raptor fatality rates generally are low at most wind energy developments with exceptions demonstrated at certain facilities in California with a predominance of older generation turbines (NWCC 2010). 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 contribute to uncertainty in predicting fatality rates (Arnett et al. 2007). To date, the most comprehensive source of regional information on avian fatality rates is the Avian and Bat Fact Sheet (NWCC 2010), which shows fatality rates range from 2.3 to 4.2 birds/MW/year in the Upper Midwest. As a result of uncertainty in predicting fatality rates, Tetra Tech did not attempt to derive mortality estimates from mean use data but 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 Project Area during point count surveys, covering 20 percent of the Project Area. The 7 point count locations were each surveyed 13 times, resulting in 91 total 20-min surveys. A total 5,611 birds from 90 species were observed within the Project Area during the fixed-point count surveys (Table 2). Overall mean bird use within the Project Area was 61.66 birds/20 min and ranged from 0 to 311 birds/20 min.

Overall mean use by non-raptors was 60.92 birds/20 min and, among species groups, mean use was highest for songbirds (26.73 birds/20 min) and waterfowl (25.02 birds/20



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

min; Table 2). Both songbirds and waterfowl were observed in the majority of surveys and were widely distributed throughout the Project Area. The non-raptors with the highest mean use were the lesser scaup (6.45 birds/20 min, observed in 41.8 percent of all surveys), common grackle (5.90 birds/20 min; 59.3 percent of all surveys), red-winged blackbird (5.84 birds/20 min; 71.4 percent of all surveys), yellow-headed blackbird (5.47 birds/20 min; 29.7 percent of all surveys), and mallard (4.62 birds/20 min; 78.0 percent of all surveys). Other frequently observed species were western meadowlark (64.8 percent), American coot (53.8 percent), ring-necked pheasant (52.7 percent), and blue-winged teal (51.6 percent of all surveys) occurred the most often (Table 2).

Within the songbird species grouping; common grackle (22.1 percent), red-winged blackbird (21.8 percent), yellow-headed blackbird (20.5 percent), and European starling (10.5 percent) accounted for 74.9 percent of birds (Table 2). Among waterfowl, the second highest species group, lesser scaup (25.8 percent), mallard (18.4 percent), and blue winged teal (11.5 percent) accounted for 55.7 percent of the birds in the waterfowl species group. Among the remaining species groups, waterbirds and gulls/terns had the next highest mean use values of 5.21 birds/20 min and 2.29 birds/20 min, respectively (Table 2).

Non-raptor mean use was highest on June 13 (96.43 birds/20 min) and June 1 (94.71 birds/20 min; Figure 3). The species that contributed to high mean use on June 13 were the yellow-headed blackbird (146 birds), common grackle (66 birds), lesser scaup (68 birds), and red-winged blackbird (55 birds). The species that contributed to the high mean use on June 1 were yellow-headed blackbird (112 birds), ring-billed gull (105 birds), red-winged blackbird (95 birds), and common grackle (81 birds). Mean use for non-raptors was highest at point 6 (100.54 birds/20 min) and point 5 (91.23 birds/20 min; Table 3 and Figure 4). Although the habitat at point 6 and point 5 consists large open ponds with associated wetlands surrounded by agriculture fields, this habitat is not unique to these points. Most of the species observed at points 5 and 6 were seen at other point count locations with the exception of the greater white-fronted geese that were observed as a single flock in flight over survey point 5 (Table 3).

Raptors are a group of special interest because of their propensity to fly at heights similar to a turbine's RSA. Overall mean use for raptors was 0.74 birds/20 min (Table 2). Raptors were not among the most frequently observed species groups during the spring surveys. The raptor with the highest use was the Swainson's hawk (0.35 birds/20 min; 22.0 percent of all surveys). Mean use for each other raptor species was less than 0.17 birds/20 min. Other raptor species observed during the surveys included great-horned owl, red-tailed hawk, northern harrier, and rough-legged hawk (Table 2).

Mean use by raptors was highest on June 13 (1.29 birds/20 min) and included 4 Swainson's hawks, 3 red-tailed hawks, and 2 great-horned owls (Figure 5). Mean use was also relatively high on May 11, May 26, and June 8 (1.0 birds/20 min on each day) with mostly red-tailed hawks and Swainson's hawks being observed on these days. Mean use by raptors was lower than 0.90 birds/20 min for all other survey dates. The highest mean use by raptors was at point count locations 9 and 7 and mostly included red-tailed



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

hawk, Swainson's hawk, and great-horned owls (Table 3, Figure 6). The high counts of red-tailed hawks Swainson's hawks and great-horned owls were most-likely due to active nests found in the vicinity of the count circles. Swainson's hawk and great-horned owls were not observed at all point count locations.

### 3.2 Flight Height and Encounter Rate

During spring avian use surveys, the biologist collected behavioral data for all of all birds observed during point count surveys. The biologist observed 49.4 percent of birds flying and collected flight height data for 100 percent. Of the birds observed flying, 24.9 percent made directional flights and the biologist collected flight direction for all of these birds (Appendix 1). Of non-raptors observed flying, 81.4 percent flew below the height of the anticipated RSA, 18.5 percent flew at the height of the anticipated RSA, and 0.1 percent flew above the anticipated RSA (Table 4). Of raptors observed flying, 23.5 percent flew below the height of the anticipated RSA and 76.5 percent flew at the height of the anticipated RSA.

The common grackle, European starling and ring-billed gull had the highest encounter rates (1.82, 1.38 and 1.20 birds flying at RSA height/20 min, respectively; Table 5). All other species had encounter rates of less than 0.45 birds flying at RSA height/20 min.

### 3.3 Raptor Nest Surveys

Twelve raptor nests of three species were found during the raptor nest surveys (Figure 7). Four red-tailed hawks, two great-horned owls, and six Swainson's hawk nest were identified and monitored on subsequent visits (Appendix 2). Four raptor nests (two red-tailed hawks and two Swainson's hawks) were noted to be inactive. All nests were located in either Siberian elm or cottonwood trees along windbreaks or around riparian corridors and nest heights ranged from 10 m to 30 m (Figure 7).

### 3.4 Incidental Observations

The biologist documented 98 species as incidental observations (Table 6), 22 of which were not detected during the point counts: sandhill crane, bank swallow, horned grebe, western grebe, cattle egret, great-blue heron, Virginia rail, short-eared owl, Forster's tern, ferruginous hawk, Say's phoebe, chestnut-collared longspur, white crowned sparrow, tree swallow, cliff swallow, northern shrike, northern goshawk, LeConte's sparrow, gray partridge, Bonaparte's gull, American kestrel, and bald eagle.

## 4.0 DISCUSSION AND RECOMMENDATIONS

### 4.1 Non-Raptor Use and Encounter Rate

Songbirds had the highest mean use out of all groups, a value which was driven by common grackle, red-winged blackbird, yellow-headed blackbird, European starling, and western meadowlark. Of these species, European starling and common grackle had the highest encounter rates. Common grackle (Jain et al. 2007) and European starling (Johnson et al. 2002; Kerns and Kerlinger 2004) mortality has been documented at other wind energy facilities. However, if fatalities occur at the Project, they are unlikely to have population-level impacts because regional populations (European starling: 120



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

million; common grackle: 97 million; Blancher et al. 2007) appear to be increasing (Sauer et al. 2008). Furthermore, European starlings are not protected by any state or federal laws although common grackles are protected by the MBTA. However, grackles are attracted to agricultural crops (corn, soybean, and sunflower) and are often targeted by agriculture industry as a nuisance species through take permits issued by the USFWS under the MBTA.

Waterfowl had the second highest mean use of all species groups at the Project. Eighteen species of waterfowl were observed at the Project Area, including most species that breed in the prairie pothole region of North America. There are designated WPAs around the Project Area, several large lakes to the west (Green and Pudwell Lakes) and the south (Salt Lake) of the Project Area that appear to attract waterfowl to the area. The majority of the waterfowl observed in the spring survey were lesser scaup, mallard, and blue-winged teal. However, each of these species had a low encounter rate (0.00, 0.42, and 0.02 birds flying at RSA height/20 min respectively). Lesser scaup (Young et al. 2003), mallard (Johnson et al. 2002; Erickson et al. 2004), and blue-winged teal (Johnson et al. 2002) mortality has been documented at other wind energy facilities but the overall numbers of fatalities are very low (i.e., fewer than 5 individuals per species). Furthermore, all three species have shown regional population increases in the eastern part of the Dakotas (Sauer 2008, USFWS 2009): greater and lesser scaup (266,000), mallard (463,000), and blue-winged teal (4 million). Any mortality at the Project, should it occur, is not expected to have regional population-level impacts.

Waterbirds ranked third in mean use among species groups (5.21 birds/20 min; Table 2). American coots had the highest mean use among waterbirds at 3.51 birds/20 min and accounted for 67.3 percent of all the waterbirds seen. However all waterbirds had an encounter rate of <0.05 birds flying at RSA height/20 min which is a very low. The results suggest a low probability for turbine-related fatalities.

Gulls/terns ranked fourth for mean use among species groups in the Project Area. The ring-billed gull had the highest encounter rate (1.20 birds flying at RSA height/20 min). There are no reported fatalities for ring-billed gulls at other wind energy facilities with publicly available data. However, given the encounter rate, it is possible that some mortality of ring-billed gulls may occur. Any mortality observed, should it occur at the Project, is not expect to impact the regional North Dakota population of ring-billed gulls as it is large and increasing (Sauer et al. 2008).

#### **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 <1.0 birds/20 min, which is the case for raptor use in the Project Area.

Swainson's hawk was the most commonly observed raptor species during avian surveys. Swainson's hawks were seen at all point count locations except point count five and were one of the most commonly observed nesting raptors within the vicinity of the Project



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

Area. Although Swainson's hawk have been reported as fatalities at existing wind farms in the United States (Erickson et al. 2004), the very low encounter rates (0.19 birds flying at RSA height/20 min) observed in the Project Area suggest that the probability of turbine-related fatalities for Swainson's hawk at the Project Area is low. Given the number of raptor nests in the area the risk of turbine-related fatalities may increase for nesting raptors (Swainson's hawk, red-tailed hawk, and great-horned owl) in late spring to early fall as the young begin to fledge from the nests.

Construction and maintenance of the Project could lead to disturbance of nesting raptors within the Project Area. Human activities are known to impact raptors in at least 3 ways: by causing mortality to eggs, young, or adults; by altering habitats; and by disrupting birds' normal behavior (Postovit and Postovit 1987). Disturbance of nesting raptors can result in complete desertion of the nest, eggs, and/or young. Even a temporary departure by adults can lead to exposure of eggs or young to the weather, increased predation risk on eggs or young, or missed feedings (Suter and Jones 1981).

The biologist also observed great-horned owl, northern harrier, red-tailed hawk, and rough-legged hawk within the Project Area during the point count surveys. Additionally, 6 Swainson's hawks, 2 great-horned owl and 4 red-tailed hawk nests were found within the Project Area (Appendix 2, Figure 7). All raptor species observed have low encounter rates, thereby minimizing the potential for negative turbine-related impacts to these species. Additional raptor species: American kestrel, bald eagle, ferruginous hawk, bald eagle, northern goshawk and short-eared owls were seen as incidental observations within the Project Area.

#### 4.3 Listed and Sensitive Species

The biologist did not detect any species listed on the Endangered Species Act or any federal candidate species. The biologist did detect a single bald eagle approximately 1 mile to the southwest of the Project Area in early spring. The Bald and Golden Eagle Protection Act (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 USFWS 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. The limited number of eagle observations in the vicinity of the Project suggests a low probability of negative interactions between eagles and Project facilities.

Twenty-four species were detected during avian surveys or as incidental observations that are listed as North Dakota State Species of Conservation Priority:

**Level I** – Horned grebe (incidental), American bittern, American white pelican, ferruginous hawk (incidental), Swainson's hawk, willet, upland sandpiper,



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

marbled godwit, Wilson's phalarope, Franklin's gull, black tern, grasshopper sparrow, Nelson's sharp-tailed sparrow, and chestnut-collared longspur (incidental).

**Level II** – bald eagle (incidental), northern pintail, canvasback, redhead, northern harrier, short-eared owl (incidental), sharp-tailed grouse, American avocet, LeConte's sparrow (incidental), and bobolink.

The designation of Species of Conservation Priority describes a species identified as in decline at the national, regional or state level, or a species whose population status is not well known, but thought to be in decline (Hagen et al. 2005). Species of Conservation Priority receive special attention from agencies, but do not require take permits or have other regulatory implications regardless of status (Level I or II); however, all but one of these species (sharp-tailed grouse) are protected under the MBTA. All species listed above had encounter rates of less than 0.25 birds/20 min flying within the RSA, primarily because of their low occurrence within the Project Area.

#### 4.4 Species of Interest

The sharp-tailed grouse is managed as a gamebird in North Dakota, and is also listed as a Level II State Species of Conservation Priority. Much of North Dakota currently provides suitable habitat for sharp-tailed grouse (Hagen et al. 2005). Sharp-tailed grouse were observed during regular point counts and incidentally (Appendix 3). One active lek was found just outside of the Project Area during the survey approximately 300 m to the northeast of point count 5 (Figure 7). The highest number observed (18 birds) was during the survey on March 30. All but one observation of sharp-tailed grouse (both survey and incidental observations) were associated with the lek. The probability of sharp-tailed grouse fatalities is low as they typically fly low to the ground and, therefore, are at low risk of collision with turbines. Although the potential exists for wind energy development to have an impact on grouse behavior and habitat use, the extent and duration is unknown for sharp-tailed grouse.

#### 4.5 Comparison of the Spring 2010 and the Fall 2009 Survey

Although the spring 2010 survey had one additional survey week, the fall 2009 survey had 14,950 birds of 91 species (with 209 unidentified birds) compared to the spring survey with 5,611 birds of 90 species (0 unidentified birds). The fall 2009 survey showed a higher overall mean use (177.98 birds/20 min) as compared to 61.66 birds/20 min observed in the spring 2010 survey. The five highest mean use species in the fall were (in order) red-winged blackbird, snow goose, sandhill crane, American coot and yellow-headed blackbird compared to the spring which had lesser scaup, common grackle, red-winged blackbird, yellow-headed blackbird and mallard. Birds were more frequently observed flying through the RSA during the fall surveys. Ring-billed gull had a high encounter rate during the fall surveys but not in the spring. Additionally, red-winged blackbird, snow geese, American white pelican, barn swallow, Franklin's gull, Lapland longspur, and Canada geese had high encounter rates in the fall and low encounter rates in the spring. One species that was not seen in the spring in the Project Area yet was seen in large numbers on a single day in the fall (with a high



2010 Spring Avian Survey  
Ashley Wind Energy Project

encounter rate) was the sandhill crane. A high encounter rate was considered  $\geq 2.0$  birds flying at RSA height/20 min.

#### 4.6 Project Conclusions

The biologist did not detect any species listed as candidate, threatened or endangered under the ESA. The point count surveys suggest that the Project Area is utilized by a wide number and diversity of bird species during the spring migratory period. However, the behavioral data (e.g., flight patterns) suggest that the probability of negative interactions between birds and turbines in the Project Area is generally low for most species. Spring non-raptor use was dominated by lesser scaup, common grackle, red-winged blackbird, yellow-headed blackbird, and mallard. The three species with the highest encounter rates (common grackle, European starling, and ring-billed gull) have increasing regional populations (Sauer et al. 2008); therefore, if fatalities do occur they are unlikely to have population-level consequences. European starlings are not protected by any state or federal laws. Nocturnal migrants (e.g., some songbirds) may pass through the Project Area and would not be detected by the survey methods used in this study if the birds did not stop-over within the Project Area. However, mortality of nocturnal migrants at the Project 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).

Spring raptor use in the Project Area was low. The level of raptor use in the Project Area suggests that raptor mortality is anticipated to be low, especially based on the results by Erickson 2007. Swainson's hawk was the most common raptor observed at the Project Area and fatalities of the species have occurred at wind farms (Kerns and Kerlinger 2004). However, the overall numbers and encounter rates of Swainson's hawk detected at the Project Area were low, thereby minimizing the probability of negative interactions with turbines.

Given the number of raptor nests in the Project Area the risk of turbine-related fatalities may increase for nesting raptors (Swainson's hawk, red-tailed hawk, and great-horned owl) in late spring to early fall as the young begin to fledge from the nests. Additionally, construction and maintenance of the Project could lead to disturbance of nesting raptors within the Project Area. Disturbance of nesting raptors can result in complete desertion of nest, eggs, or young.

#### 5.0 REFERENCES

- Arnett, E.B., D.B. Inkley, D.H. Johnson, R.P. Larkin, S. Manes, A.M. Manville, J.R. Mason, M.L. Morrison, M.D. Strickland, and R. Thresher. 2007. Impacts of wind energy facilities on wildlife and wildlife habitat. Wildlife Society Technical Review 07-2. The Wildlife Society, Bethesda, MA.
- Atamian, M., J. Sedinger, C. Frey. 2007. Dynamics of Greater Sage-Grouse (*Centrocercus urophasianus*) Populations in Response to Transmission Lines in



2010 Spring Avian Survey  
Ashley Wind Energy Project

- Central Nevada. Progress Report: Year 5. Department of Natural Resources and Environmental Sciences, University of Nevada – Reno.
- 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.
- Blancher, P.J., K.V. Rosenberg, A.O. Panjabi, B. Altman, J. Bart, C.J. Beardmore, G.S. Butcher, D. Demarest, R. Dettmers, E.H. Dunn, W. Easton, W.C. Hunter, E.E. Inigo-Elias, D.N. Pashley, C.J. Ralph, T.D. Rich, C.M. Rustay, J.M. Ruth, and T.C. Will. 2007. Guide to the Partners in Flight Population Estimates Database. Version: North American Landbird Conservation Plan 2004. Partners in Flight Technical Series No 5.
- 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>
- 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



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

and comparisons to other sources of avian collision mortality in the United States. National Wind Coordinating Committee, Washington, DC.

- Faanes, C.A., and R.E. Stewart. 1982. Revised checklist of North Dakota birds. *The Prairie Naturalist* 14(3):81-92. Jamestown, ND: Northern Prairie Wildlife Research Center Online. Available online at <http://www.npwrc.usgs.gov/resource/birds/chnbird/chnbird.htm> (Version 16JUL97).
- 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.
- 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.
- 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.
- Lammers, W.M., and M.W. Collopy. 2007. Effectiveness of Avian Predator Perch Deterrents on Electric Transmission Lines. *Journal of Wildlife Management* 71: 2752-2758.
- 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.
- NWCC (National Wind Coordinating Collaborative). 2010. Wind Turbine Interactions with Birds and Bats: A Summary of Research Results and Priority Questions. <http://www.nationalwind.org/publications/wildlife.htm>



---

*2010 Spring Avian Survey  
Ashley Wind Energy Project*

---

- 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.
- Pitman, J.C., C.A. Hagen, R.J. Robel, T.M. Loughin, and R.D. Applegate. 2005. Location and success of lesser prairie-chicken nests in relation to vegetation and human disturbance. *Journal of Wildlife Management* 69:1259-1269.
- Postovit, H.R. and B.C. Postovit. 1987. Impacts and Mitigation Techniques. Pages 183-208 in *Raptor Management Techniques Manual*, Institute for Wildlife Research, National Wildlife Federation, Scientific Technical Series No. 10.
- Pruett, C.L., M.A. Patten and D.H. Wolfe. 2009. Avoidance Behavior by Prairie Grouse: Implications for Development of Wind Energy. *Conservation Biology* 23:1253-1259.
- Sauer, J.R., J.E. Hines, and J. Fallon. 2008. The North American Breeding Bird Survey, results and analysis 1966 - 2006. Version 10.13.2007. USGS Patuxent Wildlife Research Center, Laurel, MD.
- Shaffer, J.A. 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. [http://www.nationalwind.org/assets/blog/Wind-Wildlife\\_Research\\_Mtg\\_VII\\_Proceedings\\_FINAL\\_with\\_revised\\_cover\\_and\\_title\\_page.pdf](http://www.nationalwind.org/assets/blog/Wind-Wildlife_Research_Mtg_VII_Proceedings_FINAL_with_revised_cover_and_title_page.pdf).
- 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.
- Suter, G.W. and J.L. Jones. 1981. Criteria for golden eagle, ferruginous hawk, and prairie falcon nest site protection. *Raptor Research* 15(1):12-18.
- 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). 2009. Waterfowl population status, 2009. U.S. Department of the Interior, Washington, D.C. USA.
- USFWS. 2008. Flyways. Retrieved from: <http://flyways.us/flyways/central>.

*2010 Spring Avian Survey  
Ashley Wind Energy Project*

---

- 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, North Dakota: November 1998 - June 2002. Technical Report prepared by WEST, Inc. for Pacificorp, Inc., SeaWest Windpower, Inc. and Bureau of Land Management.



*2010 Spring Avian Survey  
Ashley Wind Energy Project*

---

## TABLES



August 2010

**Table 1.** Spring 2010 point count survey dates at the Ashley Wind Energy Project.

Survey number	Date(s)
1	3/23-3/27
2	3/30
3	4/7
4	4/14
5	4/19
6	4/27
7	5/5
8	5/11
9	5/18
10	5/26
11	6/1
12	6/8
13	6/13

**Table 2.** Avian species, by species grouping, observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species Grouping	Overall Rank <sup>1</sup>	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
<b>Songbirds</b>							
common grackle	2	537	63	5.90 (4.14-7.66)	59.3	22.1%	9.6%
red-winged blackbird	3	531	78	5.84 (4.40-7.28)	71.4	21.8%	9.5%
yellow-headed blackbird	4	498	35	5.47 (2.80-8.14)	29.7	20.5%	8.9%
European starling	8	256	16	2.81 (0.85-4.77)	16.5	10.5%	4.6%
western meadowlark	12	151	95	1.66 (1.37-1.95)	64.8	6.2%	2.7%
Lapland longspur	19	76	4	0.84 (0.00-1.94)	3.3	3.1%	1.4%
brown-headed cowbird	20	66	19	0.73 (0.43-1.03)	20.9	2.7%	1.2%
horned lark	22	51	36	0.56 (0.37-0.75)	28.6	2.1%	0.9%
barn swallow	28	25	16	0.27 (0.14-0.40)	15.4	1.0%	0.4%
common yellowthroat	31	22	20	0.24 (0.13-0.35)	15.4	0.9%	0.4%
marsh wren	32	20	4	0.22 (0.00-0.45)	3.3	0.8%	0.4%
eastern kingbird	34	16	13	0.18 (0.09-0.27)	13.2	0.7%	0.3%
American goldfinch	34	16	14	0.18 (0.09-0.27)	13.2	0.7%	0.3%
western kingbird	37	15	11	0.16 (0.06-0.26)	9.9	0.6%	0.3%
house sparrow	37	15	8	0.16 (0.07-0.25)	8.8	0.6%	0.3%
savannah sparrow	40	14	9	0.15 (0.05-0.25)	8.8	0.6%	0.2%
Brewer's blackbird	40	14	4	0.15 (0.00-0.30)	4.4	0.6%	0.2%
bobolink	40	14	8	0.15 (0.05-0.25)	8.8	0.6%	0.2%
tree swallow	48	10	6	0.11 (0.04-0.18)	6.6	0.4%	0.2%
house wren	48	10	8	0.11 (0.02-0.20)	5.5	0.4%	0.2%
orchard oriole	51	9	8	0.10 (0.03-0.17)	7.7	0.4%	0.2%
American robin	51	9	8	0.10 (0.04-0.16)	8.8	0.4%	0.2%
yellow warbler	54	7	7	0.08 (0.03-0.13)	6.6	0.3%	0.1%
song sparrow	54	7	7	0.08 (0.03-0.13)	7.7	0.3%	0.1%
least flycatcher	54	7	6	0.08 (0.02-0.14)	5.5	0.3%	0.1%
willow flycatcher	57	6	5	0.07 (0.01-0.13)	3.3	0.2%	0.1%
American crow	59	5	3	0.05 (0.00-0.11)	3.3	0.2%	0.1%
vesper sparrow	63	4	2	0.04 (0.00-0.09)	2.2	0.2%	0.1%

**Table 2.** Avian species, by species grouping, observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species Grouping	Overall Rank <sup>1</sup>	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
clay-colored sparrow	65	3	2	0.03 (0.00-0.07)	2.2	0.1%	0.1%
warbling vireo	68	2	2	0.02 (0.00-0.05)	2.2	0.1%	0.0%
Swainson's thrush	68	2	1	0.02 (0.00-0.06)	1.1	0.1%	0.0%
red-eyed vireo	68	2	1	0.02 (0.00-0.06)	1.1	0.1%	0.0%
grasshopper sparrow	68	2	1	0.02 (0.00-0.06)	1.1	0.1%	0.0%
chipping sparrow	68	2	2	0.02 (0.00-0.05)	2.2	0.1%	0.0%
brown thrasher	68	2	2	0.02 (0.00-0.05)	2.2	0.1%	0.0%
yellow-rumped warbler	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
Nelson's sharp-tailed sparrow	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
Harris's sparrow	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
gray catbird	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
Baltimore oriole	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
alder flycatcher	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
<b>Group Total</b>		<b>2432</b>	<b>530</b>	<b>26.73</b> (21.21-32.25)	<b>97.8</b>		<b>43.3%</b>
<b>Waterfowl</b>							
lesser scaup	1	587	39	6.45 (4.44-8.46)	41.8	25.8%	10.5%
mallard	5	420	118	4.62 (3.63-5.61)	78.0	18.4%	7.5%
blue-winged teal	7	262	57	2.88 (2.11-3.65)	51.6	11.5%	4.7%
gadwall	10	155	48	1.70 (1.25-2.15)	42.9	6.8%	2.8%
northern pintail	11	154	62	1.69 (1.26-2.12)	46.2	6.8%	2.7%
snow goose	13	150	1	1.65 (0.00-4.36)	1.1	6.6%	2.7%
northern shoveler	14	142	40	1.56 (1.11-2.01)	37.4	6.2%	2.5%
Canada goose	15	101	43	1.11 (0.72-1.50)	39.6	4.4%	1.8%
redhead	16	98	24	1.08 (0.64-1.52)	19.8	4.3%	1.7%
greater white-fronted goose	18	80	1	0.88 (0.00-2.33)	1.1	3.5%	1.4%
ruddy duck	23	43	12	0.47 (0.23-0.71)	13.2	1.9%	0.8%
canvasback	28	25	6	0.27 (0.05-0.49)	6.6	1.1%	0.4%
bufflehead	33	19	6	0.21 (0.06-0.36)	6.6	0.8%	0.3%
common merganser	40	14	2	0.15 (0.00-0.34)	2.2	0.6%	0.2%

**Table 2.** Avian species, by species grouping, observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species Grouping	Overall Rank <sup>1</sup>	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
green-winged teal	45	12	5	0.13 (0.03-0.23)	5.5	0.5%	0.2%
American wigeon	45	12	8	0.13 (0.05-0.21)	8.8	0.5%	0.2%
ring-necked duck	68	2	1	0.02 (0.00-0.06)	1.1	0.1%	0.0%
red-breasted merganser	79	1	1	0.01 (0.00-0.03)	1.1	0.0%	0.0%
<b>Group Total</b>		<b>2277</b>	<b>474</b>	<b>25.02</b> (20.55-29.49)	<b>96.7</b>		<b>40.6%</b>
<b>Waterbirds</b>							
American coot	6	319	70	3.51 (2.53-4.49)	53.8	67.3%	5.7%
killdeer	21	60	44	0.66 (0.50-0.82)	45.1	12.7%	1.1%
pied-billed grebe	26	28	19	0.31 (0.18-0.44)	18.7	5.9%	0.5%
marbled godwit	30	24	22	0.26 (0.16-0.36)	20.9	5.1%	0.4%
Wilson's snipe	45	12	12	0.13 (0.07-0.19)	13.2	2.5%	0.2%
willet	48	10	7	0.11 (0.04-0.18)	7.7	2.1%	0.2%
double-crested cormorant	59	5	5	0.05 (0.01-0.09)	5.5	1.1%	0.1%
black-crowned night-heron	59	5	4	0.05 (0.00-0.10)	4.4	1.1%	0.1%
upland sandpiper	65	3	3	0.03 (0.00-0.06)	3.3	0.6%	0.1%
American white pelican	65	3	1	0.03 (0.00-0.08)	1.1	0.6%	0.1%
Baird's sandpiper	68	2	1	0.02 (0.00-0.06)	1.1	0.4%	0.0%
Wilson's phalarope	79	1	1	0.01 (0.00-0.03)	1.1	0.2%	0.0%
American bittern	79	1	1	0.01 (0.00-0.03)	1.1	0.2%	0.0%
American avocet	79	1	1	0.01 (0.00-0.03)	1.1	0.2%	0.0%
<b>Group Total</b>		<b>474</b>	<b>191</b>	<b>5.21</b> (4.08-6.34)	<b>78.0</b>		<b>8.4%</b>
<b>Gulls/Terns</b>							
ring-billed gull	9	168	23	1.85 (0.00-3.75)	23.1	80.8%	3.0%
Franklin's gull	24	32	2	0.35 (0.00-0.93)	1.1	15.4%	0.6%
black tern	57	6	4	0.07 (0.01-0.13)	4.4	2.9%	0.1%
California gull	68	2	1	0.02 (0.00-0.06)	1.1	1.0%	0.0%
<b>Group Total</b>		<b>208</b>	<b>30</b>	<b>2.29</b> (0.31-4.27)	<b>25.3</b>		<b>3.7%</b>
<b>Gamebirds</b>							
ring-necked pheasant	17	93	53	1.02 (0.79-1.25)	52.7	76.9%	1.7%

**Table 2.** Avian species, by species grouping, observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species Grouping	Overall Rank <sup>1</sup>	Number of Birds	Number of Observations	Mean Use # birds per 20 min. (90% confidence interval)	Frequency % of surveys detected	Percent Composition	
						Group	Overall
sharp-tailed grouse	26	28	9	0.31 (0.00-0.64)	6.6	23.1%	0.5%
<b>Group Total</b>		<b>121</b>	<b>62</b>	<b>1.33</b> (0.92-1.74)	<b>53.8</b>		<b>2.2%</b>
<b>Raptors</b>							
Swainson's hawk	24	32	29	0.35 (0.22-0.48)	22.0	47.8%	0.6%
great horned owl	37	15	9	0.16 (0.05-0.27)	6.6	22.4%	0.3%
red-tailed hawk	40	14	14	0.15 (0.07-0.23)	12.1	20.9%	0.2%
northern harrier	63	4	4	0.04 (0.00-0.08)	4.4	6.0%	0.1%
rough-legged hawk	68	2	1	0.02 (0.00-0.06)	1.1	3.0%	0.0%
<b>Group Total</b>		<b>67</b>	<b>57</b>	<b>0.74</b> (0.54-0.94)	<b>40.7</b>		<b>1.2%</b>
<b>Pigeons/Doves</b>							
mourning dove	34	16	13	0.18 (0.10-0.26)	14.3	76.2%	0.3%
rock pigeon	59	5	2	0.05 (0.00-0.12)	2.2	23.8%	0.1%
<b>Group Total</b>		<b>21</b>	<b>15</b>	<b>0.23</b> (0.12-0.34)	<b>16.5</b>		<b>0.4%</b>
<b>Cranes/Rails</b>							
sora	53	8	8	0.09 (0.03-0.15)	7.7	100.0%	0.1%
<b>Group Total</b>		<b>8</b>	<b>8</b>	<b>0.09</b> (0.03-0.15)	<b>7.7</b>		<b>0.1%</b>
<b>Woodpeckers</b>							
northern flicker	68	2	2	0.02 (0.00-0.05)	2.2	66.7%	0.0%
hairy woodpecker	79	1	1	0.01 (0.00-0.03)	1.1	33.3%	0.0%
<b>Group Total</b>		<b>3</b>	<b>3</b>	<b>0.03</b> (0.00-0.06)	<b>3.3</b>		<b>0.1%</b>
<b>Grand Total</b>		<b>5611</b>	<b>1370</b>	<b>61.66</b> (52.65-70.67)			

<sup>1</sup> A ranking of 1 indicates highest mean use

**Table 3.** Avian species observed by point during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds	Number of Obs.	Points						
			3	4	5	6	7	8	9
lesser scaup	587	39	0	0	148	100	164	24	151
common grackle	537	63	17	139	74	180	20	101	6
red-winged blackbird	531	78	59	2	104	196	12	129	29
yellow-headed blackbird	498	35	50	0	130	290	0	16	12
mallard	420	118	35	52	92	56	23	84	78
American coot	319	70	34	0	147	21	16	66	35
blue-winged teal	262	57	39	9	63	35	22	58	36
European starling	256	16	0	146	0	20	0	86	4
ring-billed gull	168	23	0	6	8	143	1	7	3
gadwall	155	48	22	17	31	30	6	29	20
northern pintail	154	62	22	22	38	9	11	27	25
western meadowlark	151	95	35	28	28	7	13	8	32
snow goose	150	1	150	0	0	0	0	0	0
northern shoveler	142	40	16	9	46	20	2	15	34
Canada goose	101	43	12	8	2	26	9	37	7
redhead	98	24	4	0	16	13	4	61	0
ring-necked pheasant	93	53	7	22	17	3	14	15	15
greater white-fronted goose	80	1	0	0	80	0	0	0	0
Lapland longspur	76	4	60	6	10	0	0	0	0
brown-headed cowbird	66	19	9	9	13	8	3	5	19
killdeer	60	44	12	7	12	15	0	7	7
horned lark	51	36	8	18	6	14	0	1	4
ruddy duck	43	12	3	0	33	5	0	2	0
Swainson's hawk	32	29	1	1	0	1	16	1	12
Franklin's gull	32	2	0	0	0	0	0	0	32
sharp-tailed grouse	28	9	1	0	27	0	0	0	0
pied-billed grebe	28	19	0	0	9	2	4	10	3
canvasback	25	6	0	2	4	19	0	0	0
barn swallow	25	16	1	6	2	4	0	2	10
marbled godwit	24	22	10	1	7	2	0	2	2
common yellowthroat	22	20	3	2	5	1	10	1	0
marsh wren	20	4	0	0	0	20	0	0	0
bufflehead	19	6	2	0	0	2	4	2	9
mourning dove	16	13	0	6	1	4	3	2	0
eastern kingbird	16	13	2	1	2	0	5	1	5
American goldfinch	16	14	0	4	0	2	8	2	0
western kingbird	15	11	0	5	0	1	8	1	0
house sparrow	15	8	0	7	0	6	0	0	2
great horned owl	15	9	0	2	0	0	0	0	13
savannah sparrow	14	9	5	0	5	0	0	0	4

**Table 3.** Avian species observed by point during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds	Number of Obs.	Points						
			3	4	5	6	7	8	9
red-tailed hawk	14	14	4	4	1	1	3	0	1
common merganser	14	2	0	0	0	14	0	0	0
Brewer's blackbird	14	4	6	2	0	1	0	5	0
bobolink	14	8	1	0	5	0	0	4	4
Wilson's snipe	12	12	2	2	1	0	1	1	5
green-winged teal	12	5	4	2	0	2	0	2	2
American wigeon	12	8	2	2	2	2	0	1	3
willet	10	7	4	0	5	1	0	0	0
tree swallow	10	6	0	2	0	2	2	2	2
house wren	10	8	0	0	0	1	9	0	0
orchard oriole	9	8	0	1	0	3	4	0	1
American robin	9	8	0	5	0	1	2	1	0
sora	8	8	2	0	0	4	0	2	0
yellow warbler	7	7	0	0	0	0	6	1	0
song sparrow	7	7	0	0	0	1	5	0	1
least flycatcher	7	6	0	0	0	1	6	0	0
willow flycatcher	6	5	0	0	0	0	6	0	0
black tern	6	4	0	0	2	4	0	0	0
rock pigeon	5	2	0	5	0	0	0	0	0
double-crested cormorant	5	5	0	1	1	1	0	1	1
black-crowned night-heron	5	4	0	0	0	1	1	2	1
American crow	5	3	0	1	1	0	0	0	3
vesper sparrow	4	2	0	2	0	2	0	0	0
northern harrier	4	4	0	1	1	0	0	2	0
upland sandpiper	3	3	3	0	0	0	0	0	0
clay-colored sparrow	3	2	0	1	2	0	0	0	0
American white pelican	3	1	0	0	0	0	0	0	3
warbling vireo	2	2	0	0	0	1	1	0	0
Swainson's thrush	2	1	0	0	0	2	0	0	0
ring-necked duck	2	1	0	0	2	0	0	0	0
rough-legged hawk	2	1	0	0	0	0	0	0	2
red-eyed vireo	2	1	0	0	0	0	2	0	0
northern flicker	2	2	0	0	0	0	2	0	0
grasshopper sparrow	2	1	0	0	2	0	0	0	0
chipping sparrow	2	2	0	0	0	0	2	0	0
California gull	2	1	0	0	0	2	0	0	0
brown thrasher	2	2	0	1	0	1	0	0	0
Baird's sandpiper	2	1	0	0	2	0	0	0	0
yellow-rumped warbler	1	1	1	0	0	0	0	0	0
Wilson's phalarope	1	1	0	0	0	1	0	0	0

**Table 3.** Avian species observed by point during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds	Number of Obs.	Points						
			3	4	5	6	7	8	9
red-breasted merganser	1	1	0	0	0	1	0	0	0
Nelson's sharp-tailed sparrow	1	1	0	0	0	1	0	0	0
hairy woodpecker	1	1	0	0	0	0	0	0	1
Harris's sparrow	1	1	0	0	0	1	0	0	0
gray catbird	1	1	0	0	0	0	1	0	0
Baltimore oriole	1	1	0	0	0	1	0	0	0
American bittern	1	1	0	0	1	0	0	0	0
American avocet	1	1	0	0	0	1	0	0	0
alder flycatcher	1	1	0	0	0	0	1	0	0
<b>Grand Total</b>	<b>5611</b>	<b>1370</b>	<b>648</b>	<b>569</b>	<b>1188</b>	<b>1309</b>	<b>432</b>	<b>826</b>	<b>639</b>

**Table 4.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Spring 2010 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
Above RSA height (>130.5m)	3	0.1%
At RSA height (29.5m–130.5m)	506	18.5%
Below RSA height (<29.5m)	2231	81.4%
<b>Raptors</b>		
At RSA height (29.5m–130.5m)	26	76.5%
Below RSA height (<29.5m)	8	23.5%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> 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)<sup>1</sup> during Spring 2010 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
common grackle	1.82	5.90 (4.14 - 7.66)	95.7	0.0	32.3	67.7
European starling	1.38	2.81 (0.85 - 4.77)	100.0	0.0	49.2	50.8
ring-billed gull	1.20	1.85 (0.00 - 3.75)	88.1	0.0	73.6	26.4
mallard	0.42	4.62 (3.63 - 5.61)	33.8	1.4	26.8	71.8
northern pintail	0.24	1.69 (1.26 - 2.12)	48.1	0.0	29.7	70.3
Swainson's hawk	0.19	0.35 (0.22 - 0.48)	59.4	0.0	89.5	10.5
gadwall	0.12	1.70 (1.25 - 2.15)	8.4	0.0	84.6	15.4
Canada goose	0.09	1.11 (0.72 - 1.50)	30.7	0.0	25.8	74.2
red-tailed hawk	0.09	0.15 (0.07 - 0.23)	64.3	0.0	88.9	11.1
tree swallow	0.06	0.11 (0.04 - 0.18)	100.0	0.0	50.0	50.0
redhead	0.04	1.08 (0.64 - 1.52)	10.2	0.0	40.0	60.0
marbled godwit	0.04	0.26 (0.16 - 0.36)	25.0	0.0	66.7	33.3
American white pelican	0.03	0.03 (0.00 - 0.08)	100.0	0.0	100.0	0.0
mourning dove	0.02	0.18 (0.10 - 0.26)	37.5	0.0	33.3	66.7
eastern kingbird	0.02	0.18 (0.09 - 0.27)	56.3	0.0	22.2	77.8
blue-winged teal	0.02	2.88 (2.11 - 3.65)	1.5	0.0	50.0	50.0
willet	0.01	0.11 (0.04 - 0.18)	80.0	0.0	12.5	87.5
red-winged blackbird	0.01	5.84 (4.40 - 7.28)	87.9	0.0	0.2	99.8
northern shoveler	0.01	1.56 (1.11 - 2.01)	0.7	0.0	100.0	0.0
northern harrier	0.01	0.04 (0.00 - 0.08)	100.0	0.0	25.0	75.0
double-crested cormorant	0.01	0.05 (0.01 - 0.09)	80.0	25.0	25.0	50.0
yellow warbler	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
yellow-rumped warbler	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
yellow-headed blackbird	0.00	5.47 (2.80 - 8.14)	97.4	0.0	0.0	100.0
Wilson's snipe	0.00	0.13 (0.07 - 0.19)	0.0	0.0	0.0	0.0
Wilson's phalarope	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

**Table 5.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
willow flycatcher	0.00	0.07 (0.01 - 0.13)	0.0	0.0	0.0	0.0
western meadowlark	0.00	1.66 (1.37 - 1.95)	3.3	0.0	0.0	100.0
western kingbird	0.00	0.16 (0.06 - 0.26)	80.0	0.0	0.0	100.0
warbling vireo	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
vesper sparrow	0.00	0.04 (0.00 - 0.09)	0.0	0.0	0.0	0.0
upland sandpiper	0.00	0.03 (0.00 - 0.06)	0.0	0.0	0.0	0.0
Swainson's thrush	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
sharp-tailed grouse	0.00	0.31 (0.00 - 0.64)	82.1	0.0	0.0	100.0
song sparrow	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
sora	0.00	0.09 (0.03 - 0.15)	0.0	0.0	0.0	0.0
snow goose	0.00	1.65 (0.00 - 4.36)	100.0	0.0	0.0	100.0
savannah sparrow	0.00	0.15 (0.05 - 0.25)	7.1	0.0	0.0	100.0
ruddy duck	0.00	0.47 (0.23 - 0.71)	0.0	0.0	0.0	0.0
rock pigeon	0.00	0.05 (0.00 - 0.12)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	1.02 (0.79 - 1.25)	0.0	0.0	0.0	0.0
ring-necked duck	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
rough-legged hawk	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
red-eyed vireo	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
red-breasted merganser	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
pied-billed grebe	0.00	0.31 (0.18 - 0.44)	0.0	0.0	0.0	0.0
orchard oriole	0.00	0.10 (0.03 - 0.17)	11.1	0.0	0.0	100.0
Nelson's sharp-tailed sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
northern flicker	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
marsh wren	0.00	0.22 (0.00 - 0.45)	0.0	0.0	0.0	0.0
lesser scaup	0.00	6.45 (4.44 - 8.46)	0.3	0.0	0.0	100.0
least flycatcher	0.00	0.08 (0.02 - 0.14)	28.6	0.0	0.0	100.0

**Table 5.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
Lapland longspur	0.00	0.84 (0.00 - 1.94)	100.0	0.0	0.0	100.0
killdeer	0.00	0.66 (0.50 - 0.82)	48.3	0.0	0.0	100.0
house wren	0.00	0.11 (0.02 - 0.20)	0.0	0.0	0.0	0.0
house sparrow	0.00	0.16 (0.07 - 0.25)	13.3	0.0	0.0	100.0
horned lark	0.00	0.56 (0.37 - 0.75)	29.4	0.0	0.0	100.0
hairy woodpecker	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
Harris's sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
green-winged teal	0.00	0.13 (0.03 - 0.23)	0.0	0.0	0.0	0.0
greater white-fronted goose	0.00	0.88 (0.00 - 2.33)	100.0	0.0	0.0	100.0
grasshopper sparrow	0.00	0.02 (0.00 - 0.06)	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
great horned owl	0.00	0.16 (0.05 - 0.27)	0.0	0.0	0.0	0.0
Franklin's gull	0.00	0.35 (0.00 - 0.93)	100.0	0.0	0.0	100.0
common yellowthroat	0.00	0.24 (0.13 - 0.35)	0.0	0.0	0.0	0.0
common merganser	0.00	0.15 (0.00 - 0.34)	0.0	0.0	0.0	0.0
chipping sparrow	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
clay-colored sparrow	0.00	0.03 (0.00 - 0.07)	0.0	0.0	0.0	0.0
canvasback	0.00	0.27 (0.05 - 0.49)	0.0	0.0	0.0	0.0
California gull	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
bufflehead	0.00	0.21 (0.06 - 0.36)	0.0	0.0	0.0	0.0
brown thrasher	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
Brewer's blackbird	0.00	0.15 (0.00 - 0.30)	78.6	0.0	0.0	100.0
bobolink	0.00	0.15 (0.05 - 0.25)	57.1	0.0	0.0	100.0
black tern	0.00	0.07 (0.01 - 0.13)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.73 (0.43 - 1.03)	74.2	0.0	0.0	100.0
black-crowned night-heron	0.00	0.05 (0.00 - 0.10)	0.0	0.0	0.0	0.0

**Table 5.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.27 (0.14 - 0.40)	100.0	0.0	0.0	100.0
Baltimore oriole	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American wigeon	0.00	0.13 (0.05 - 0.21)	8.3	0.0	0.0	100.0
American robin	0.00	0.10 (0.04 - 0.16)	22.2	0.0	0.0	100.0
American goldfinch	0.00	0.18 (0.09 - 0.27)	12.5	0.0	0.0	100.0
American crow	0.00	0.05 (0.00 - 0.11)	60.0	0.0	0.0	100.0
American coot	0.00	3.51 (2.53 - 4.49)	0.6	0.0	0.0	100.0
American bittern	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American avocet	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
alder flycatcher	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

<sup>1</sup>These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

**Table 6.** Incidental observations of birds during Spring 2010 point count surveys at the Ashley Wind Energy Project.

<b>Species</b>
American avocet
American bittern
American coot
American crow
American goldfinch
American kestrel
American robin
American wigeon
American white pelican
bald eagle
bank swallow
barn swallow
black-crowned night-heron
brown-headed cowbird
black tern
bobolink
Bonaparte's gull
Brewer's blackbird
brown thrasher
bufflehead
blue-winged teal
cattle egret
California gull
Canada goose
canvasback
chestnut-collared longspur
clay-colored sparrow
cliff swallow
common grackle
common merganser
common yellowthroat
double-crested cormorant
eastern kingbird
European starling
ferruginous hawk
Forster's tern
Franklin's gull

**Table 6.** Incidental observations of birds during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species
gadwall
great blue heron
great horned owl
gray partridge
grasshopper sparrow
green-winged teal
hairy woodpecker
horned grebe
horned lark
house sparrow
house wren
killdeer
Le Conte's sparrow
least flycatcher
lesser scaup
marbled godwit
mallard
marsh wren
mourning dove
northern flicker
northern goshawk
northern harrier
northern pintail
northern shoveler
northern shrike
orchard oriole
pied-billed grebe
ring-billed gull
redhead
rough-legged hawk
ring-necked duck
ring-necked pheasant
rock pigeon
red-tailed hawk
ruddy duck
red-winged blackbird
sandhill crane

**Table 6.** Incidental observations of birds during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species
Say's phoebe
savannah sparrow
short-eared owl
snow goose
sora
song sparrow
sharp-tailed grouse
Swainson's hawk
tree swallow
upland sandpiper
vesper sparrow
Virginia rail
warbling vireo
white-crowned sparrow
western grebe
western kingbird
western meadowlark
willow flycatcher
willet
Wilson's phalarope
Wilson's snipe
yellow-headed blackbird
yellow-rumped warbler
yellow warbler

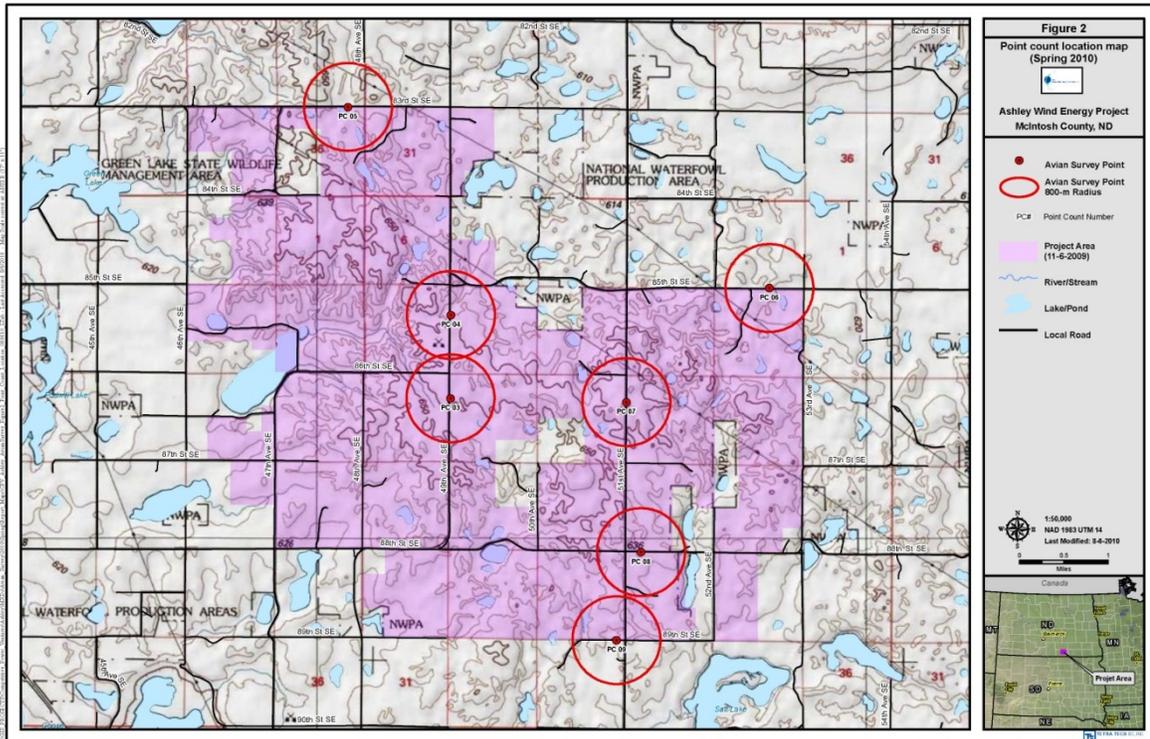
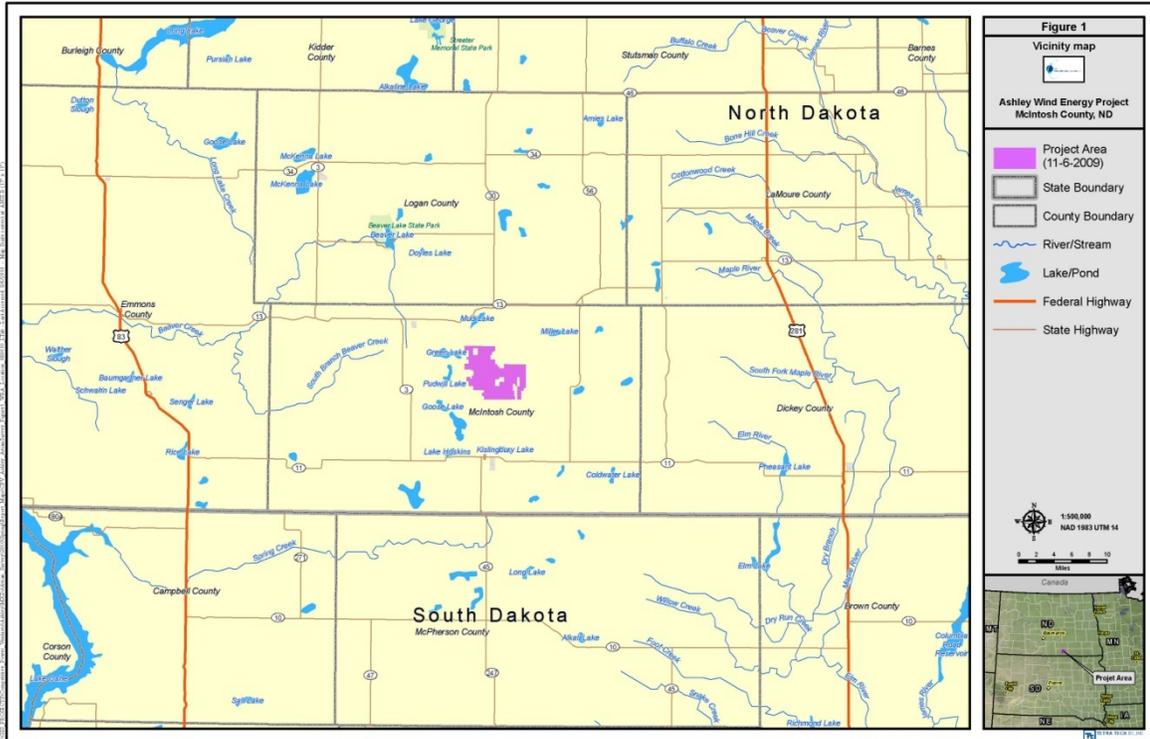
*2010 Spring Avian Survey  
Ashley Wind Energy Project*

---

## FIGURES



August 2010



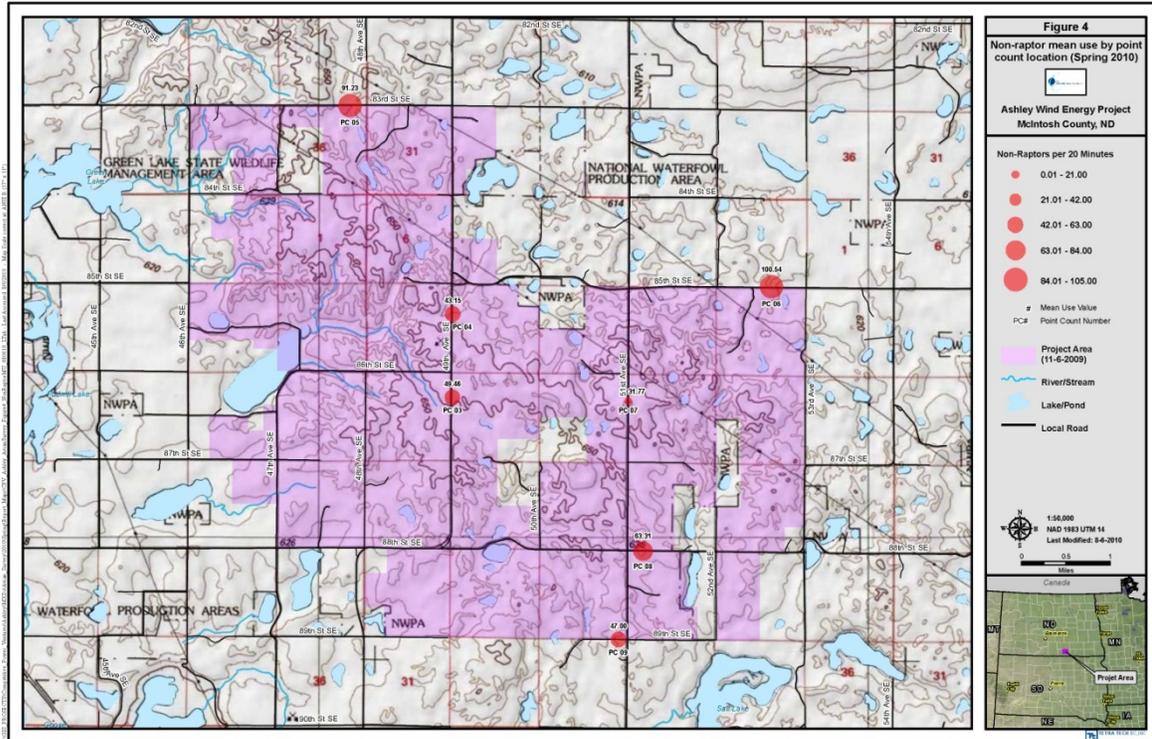


Figure 3. Non-raptor mean use by survey date in Spring 2010 at the Ashley Wind Energy Project.

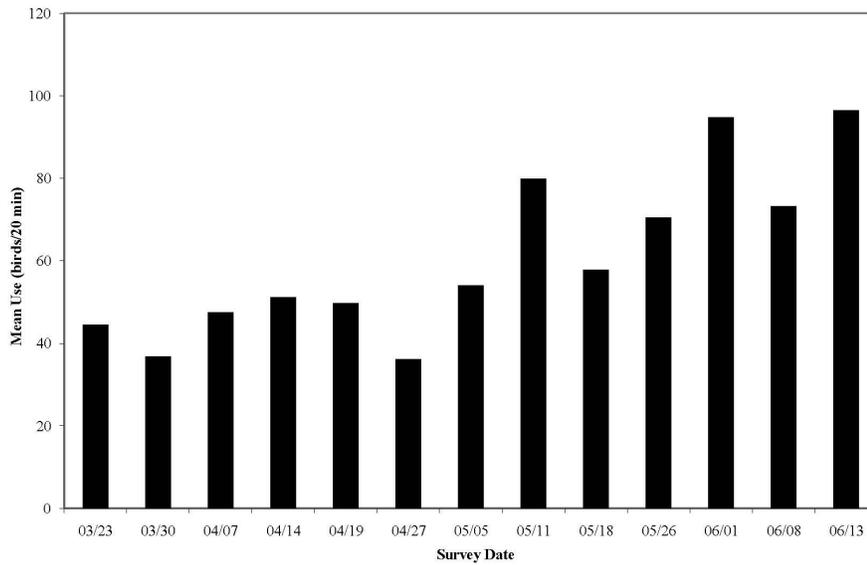
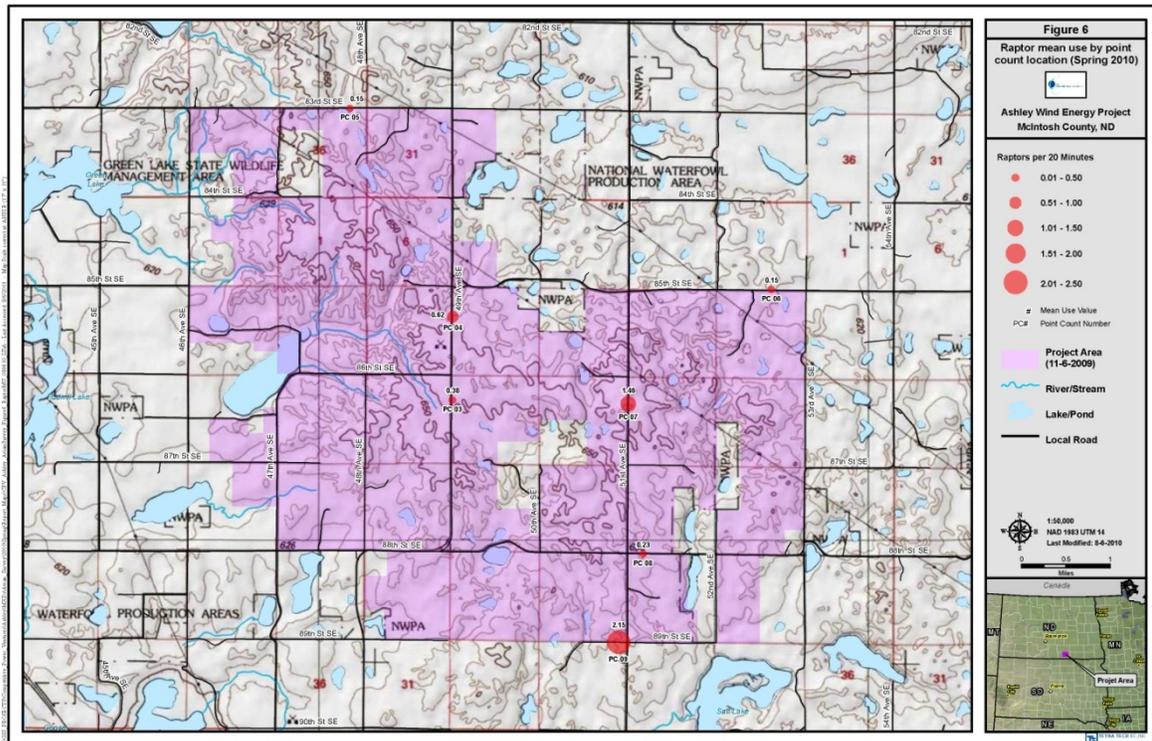
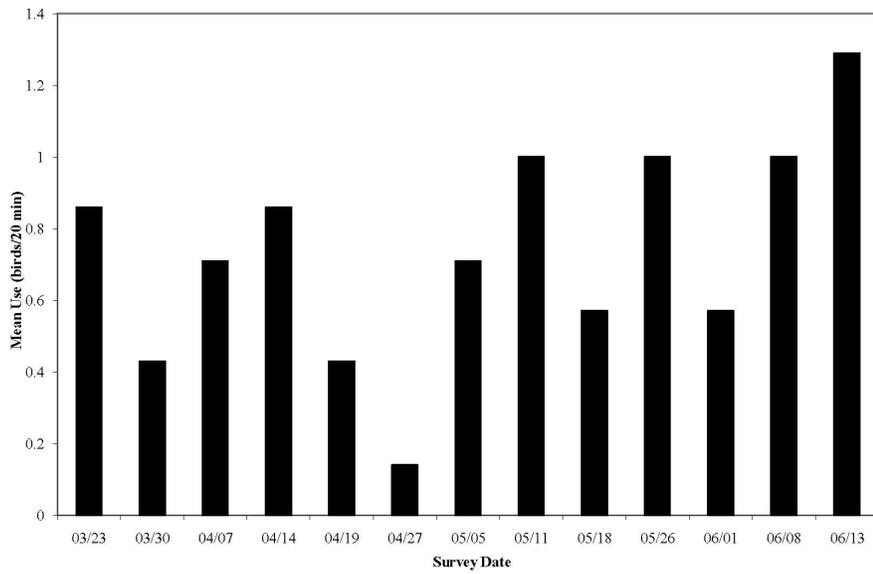
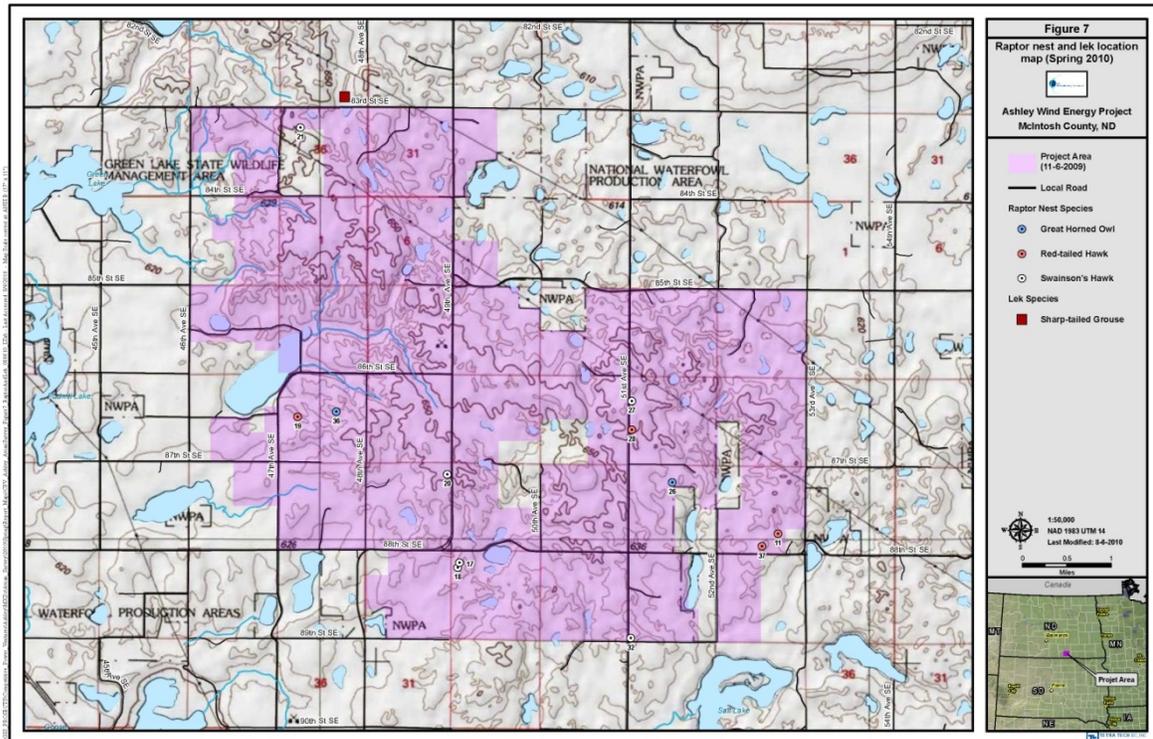


Figure 5. Raptor mean use by survey date in Spring 2010 at the Ashley Wind Energy Project.





*2010 Spring Avian Survey  
Ashley Wind Energy Project*

---

## APPENDICES



August 2010

Appendix 1. Flight directions of birds observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds <sup>1</sup>	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
snow goose	150	1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0
mallard	102	39	12.7	8.8	17.6	2.9	15.7	20.6	15.7	5.9	0.0
greater white-fronted goose	80	1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lapland longspur	76	4	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
northern pintail	68	24	0.0	7.4	11.8	0.0	20.6	11.8	36.8	11.8	0.0
ring-billed gull	40	9	82.5	0.0	10.0	2.5	0.0	5.0	0.0	0.0	0.0
Franklin's gull	32	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Canada goose	29	12	13.8	31.0	3.4	6.9	37.9	0.0	0.0	6.9	0.0
sharp-tailed grouse	23	5	13.0	0.0	4.3	0.0	82.6	0.0	0.0	0.0	0.0
red-winged blackbird	13	2	92.3	0.0	0.0	0.0	7.7	0.0	0.0	0.0	0.0
gadwall	12	5	0.0	0.0	58.3	8.3	33.3	0.0	0.0	0.0	0.0
Swainson's hawk	10	10	10.0	20.0	30.0	0.0	0.0	0.0	40.0	0.0	0.0
redhead	10	2	0.0	0.0	0.0	0.0	60.0	0.0	0.0	40.0	0.0
red-tailed hawk	8	8	12.5	0.0	12.5	0.0	37.5	12.5	25.0	0.0	0.0
common grackle	6	2	0.0	0.0	0.0	0.0	50.0	0.0	50.0	0.0	0.0
northern harrier	4	4	50.0	25.0	0.0	0.0	0.0	0.0	25.0	0.0	0.0
double-crested cormorant	4	4	0.0	25.0	50.0	0.0	0.0	25.0	0.0	0.0	0.0
blue-winged teal	4	2	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
willet	3	2	66.7	0.0	0.0	0.0	0.0	33.3	0.0	0.0	0.0
American white pelican	3	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
American crow	3	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
rough-legged hawk	2	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
lesser scaup	2	1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0

**Appendix 1.** Flight directions of birds observed during Spring 2010 point count surveys at the Ashley Wind Energy Project.

Species	Number of Birds <sup>1</sup>	Number of Observations	Percentage of Flights								
			N	NE	E	SE	S	SW	W	NW	Variable
European starling	2	1	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
black tern	2	2	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
northern shoveler	1	1	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
American wigeon	1	1	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0
<b>Grand Total</b>	<b>690</b>	<b>147</b>	<b>33.5</b>	<b>4.8</b>	<b>7.1</b>	<b>1.6</b>	<b>11.4</b>	<b>4.9</b>	<b>29.1</b>	<b>7.5</b>	<b>0.0</b>

<sup>1</sup> Includes only flying birds with flight directions

**Appendix 2.** Raptor nests observed at the Ashley Wind Energy Project, 2010.

<b>Nest Number</b>	<b>Dates Surveyed</b>	<b>Species</b>	<b>Status</b>	<b>Substrate</b>	<b>Nest Height (m)</b>	<b>Nest Condition</b>
RTHA-2010-11	04/20/2010	NA	Inactive	Siberian Elm	25	Good
	05/05/2010	NA	Inactive			
	05/18/2010	red-tailed hawk	Active			
SWHA-2010-17	04/19/2010	NA	Inactive	Siberian Elm	20	Fair
	04/27/2010	NA	Inactive			
SWHA-2010-18	04/09/2010	NA	Inactive	Siberian Elm	20	Good
	05/05/2010	NA	Inactive			
	05/18/2010	Swainson's hawk	Active			
RTHA-2010-19	04/19/2010	NA	Inactive	Siberian Elm	20	Excellent
	05/05/2010	red-tailed hawk	Active			
SWHA-2010-20	04/20/2010	NA	Inactive	Cottonwood	28	Good
	05/05/2010	NA	Inactive			
SWHA-2010-21	5/11/2010	NA	Inactive	Siberian Elm	30	Good
	05/18/2010	Swainson's hawk	Active			
GHOW-2010-26	04/20/2010	great horned owl	Active	Siberian Elm	30	Good
	04/27/2010	great horned owl	Active			
	05/11/2010	great horned owl	Active			
SWHA-2010-27	04/20/2010	NA	Inactive	Siberian Elm	30	Good
	04/27/2010	Swainson's hawk	Active			
	05/05/2010	Swainson's hawk	Active			
RTHA-2010-28	04/20/2010	NA	Inactive		30	Good
	04/27/2010	NA	Inactive			
	05/05/2010	NA	Inactive			
SWHA-2010-32	04/20/2010	Swainson's hawk	Inactive	Siberian Elm	10	Excellent
	05/05/2010	Swainson's hawk	Inactive			
	05/11/2010	Swainson's hawk	Active			
GHOW-2010-36	05/11/2010	great horned owl	Active	Siberian Elm	25	Fair
	05/18/2010	NA	Inactive			
RTHA-2010-37	05/12/2010	NA	Inactive	Siberian Elm	20	Good

NA means not applicable

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.27 (0.14 - 0.40)	100.0	0.0	0.0	100.0
Baltimore oriole	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American wigeon	0.00	0.13 (0.05 - 0.21)	8.3	0.0	0.0	100.0
American robin	0.00	0.10 (0.04 - 0.16)	22.2	0.0	0.0	100.0
American goldfinch	0.00	0.18 (0.09 - 0.27)	12.5	0.0	0.0	100.0
American crow	0.00	0.05 (0.00 - 0.11)	60.0	0.0	0.0	100.0
American coot	0.00	3.51 (2.53 - 4.49)	0.6	0.0	0.0	100.0
American bittern	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American avocet	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
alder flycatcher	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

<sup>1</sup>These values assume a rotor diameter of 103 (m) and a hub height of 85 (m)

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.27 (0.14 - 0.40)	100.0	0.0	0.0	100.0
Baltimore oriole	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American wigeon	0.00	0.13 (0.05 - 0.21)	8.3	0.0	0.0	100.0
American robin	0.00	0.10 (0.04 - 0.16)	22.2	0.0	0.0	100.0
American goldfinch	0.00	0.18 (0.09 - 0.27)	12.5	0.0	0.0	100.0
American crow	0.00	0.05 (0.00 - 0.11)	60.0	0.0	0.0	100.0
American coot	0.00	3.51 (2.53 - 4.49)	0.6	0.0	0.0	100.0
American bittern	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American avocet	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
alder flycatcher	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

<sup>1</sup>These values assume a rotor diameter of 103 (m) and a hub height of 85 (m)

## Turbine Model Comparison for the Fall 2009 and Spring 2010 Avian Surveys

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.  
160 Federal Street, 3rd Floor  
Boston, Massachusetts 02110

September 2010



*Turbine Model Comparison  
Ashley Wind Energy Project*

### 1.0 Introduction

Currently, CPV Ashley Renewable Energy Company (CPV) is considering three different wind turbine models to be used at the Ashley Wind Energy Project (the Project) as presented in Table 1. The wind turbine models under consideration (as listed below) are representative of the same turbine class. Additionally, Project permitting and design reflect the use of any of these three wind turbine models. The only design element that is dependent upon the final wind turbine model selected is the number of turbines utilized at the Project (87 for Turbine A versus 80 for Turbines B or C).

<b>Turbine</b>	<b>Turbine Model</b>	<b>Hub Height (m)</b>	<b>Rotor Diameter (m)</b>	<b>RSA Low (m)</b>	<b>RSA High (m)</b>
A	Siemens SWT 2.3-101	80	101	29.5	130.5
B	GE 2.5xl	85	100	35	135
C	GE 2.5xl	85	103	33.5	136.5

Siemens = Siemens Energy, Inc.

GE = General Electric

m = meters

RSA = rotor swept area

The Siemens turbine (Turbine A) has a slightly lower hub height and a RSA slightly lower to the ground. The two GE turbine models (Turbine B and C) have equivalent hub heights with Turbine C having a slightly longer rotor diameter and therefore a slightly taller RSA.

In the 2009 Fall Avian Survey (Tetra Tech 2010a) and 2010 Spring Avian Survey (Tetra Tech 2010b) for the Project, results of the point count surveys were considered in relation to the proposed Turbine A only. This supplemental Turbine Model Comparison for Fall 2009 and Spring 2010 Avian Surveys provides a comparison of the comprehensive point count results against all three potential turbine models under consideration by CPV for the Project.

### 2.0 Fall 2009 Data

Comparing the fall 2009 avian survey data with the three turbine types shows no difference between Turbine B and C. Turbine A has a lower hub height and a slightly lower RSA range. The slightly higher hub height for Turbines B and C increases the high point of the RSA for these two turbine models. As a result, 810 non-raptor birds are included in the RSA for Turbine A that are not included in the RSAs for Turbines B and C (Table 2). Raptors remained relatively unchanged between Turbine A and Turbines B and C.



*Turbine Model Comparison  
Ashley Wind Energy Project*

	Turbine A		Turbine B		Turbine C	
	Numbers of Birds	Percent	Numbers of Birds	Percent	Numbers of Birds	Percent
<b>Non-raptors</b>						
Above RSA height	1,192	9.80	1,192	9.80	1,192	9.80
At RSA height	6,920	56.70	6,110	50.10	6,110	50.10
Below RSA height	4,087	33.50	4,897	40.10	4,897	40.10
<b>Raptors</b>						
Above RSA height	6	5.30	6	5.30	6	5.30
At RSA height	61	53.50	60	52.60	60	52.60
Below RSA height	47	41.20	48	42.10	48	42.10

A comparison of the top 10 species encounter rates shows minimal differences (Table 3) between the turbine models under consideration. Turbines B and C have identical encounter rates for the top 10 species. The major difference between Turbines B and C and Turbine A is the encounter rates for red-winged blackbirds (17.63 for Turbine A, and 8.68 for Turbine B and C; Table 3). Red-winged blackbirds had the second highest encounter rate with Turbine A and the third highest with Turbines B and C. The remaining order of encounter rates did not change among turbine types. More non-raptors such as red-winged blackbird, barn swallow, Canada goose, and northern rough winged swallow flew at the height of the RSA for Turbine A, which factored into the encounter rate calculations. Higher flying migrating birds such as sandhill crane and snow goose remained unchanged with respect to encounter rate. Other species remained unchanged between turbine types with encounter rates below 0.05 birds flying at RSA height/20 minutes (min).

Turbine A		Turbine B		Turbine C	
Species	Encounter Rate	Species	Encounter Rate	Species	Encounter Rate
sandhill crane	19.11	sandhill crane	19.11	sandhill crane	19.11
red-winged blackbird	17.63	snow goose	14.7	snow goose	14.7
snow goose	14.7	red-winged blackbird	8.68	red-winged blackbird	8.68
American white pelican	6.78	American white pelican	6.78	American white pelican	6.78
barn swallow	5.72	barn swallow	5.43	barn swallow	5.43
ring-billed gull	3.33	ring-billed gull	3.33	ring-billed gull	3.33
Franklin's gull	3.27	Franklin's gull	3.27	Franklin's gull	3.27
Lapland longspur	2.92	Lapland longspur	2.92	Lapland longspur	2.92
Canada goose	2.33	Canada goose	2.15	Canada goose	2.15
northern rough-winged swallow	1.32	northern rough-winged swallow	1.15	northern rough-winged swallow	1.15



*Turbine Model Comparison  
Ashley Wind Energy Project*

A complete listing of all avian survey RSA and encounter data for the fall 2009 can be found in Appendix 1 presented as revised Tables 4 and 5 from the fall 2009 avian survey report for Turbines A, B, and C.

### 3.0 Spring 2010 Data

Comparing the spring 2010 avian survey data with the three turbine types shows no difference between Turbine B and C (Table 4), consistent with the fall 2010 comparison. The slightly higher hub height increases the high point of the RSA for Turbine B and C which results in 231 fewer non-raptor birds in the RSA than in Turbine A's RSA. Raptors remained relatively unchanged between Turbine A and Turbines B and C with 3 Swainson's hawks and 1 red-tailed hawk in the RSA of Turbine A that are below the RSA for Turbines B and C.

	Turbine A		Turbine B		Turbine C	
	Numbers of Birds	Percent	Numbers of Birds	Percent	Numbers of Birds	Percent
<b>Non-raptors</b>						
Above RSA height	3	0.10	3	0.10	3	0.10
At RSA height	506	18.50	275	10.00	275	10.00
Below RSA height	2,231	81.40	2,462	89.90	2,462	89.90
<b>Raptors</b>						
Above RSA height	0	0.00	0	0.00	0	0.00
At RSA height	26	76.50	22	64.70	22	64.70
Below RSA height	8	23.50	12	35.30	12	35.30

Encounter rates for all species were slightly lower for Turbines B and C when compared to the encounter rates for Turbine A (Table 5). Redhead had the same encounter rate of 0.04 birds flying at RSA height/20 min for all three turbine models, but was not in the top 10 for Turbine A. Gadwall had an encounter rate of 0.01 birds flying at RSA height/20 min for Turbine B and C, but was only in the top 10 for Turbine A. Other species remained unchanged between turbine models with encounter rates below 0.03 birds flying at RSA height/20 min.



*Turbine Model Comparison  
Ashley Wind Energy Project*

Turbine A		Turbine B		Turbine C	
Species	Encounter Rate	Species	Encounter Rate	Species	Encounter Rate
common grackle	1.82	ring-billed gull	1.12	ring-billed gull	1.12
European starling	1.38	common grackle	1.09	common grackle	1.09
ring-billed gull	1.2	mallard	0.27	mallard	0.27
mallard	0.42	Swainson's hawk	0.16	Swainson's hawk	0.16
northern pintail	0.24	northern pintail	0.15	northern pintail	0.15
Swainson's hawk	0.19	European starling	0.11	European starling	0.11
gadwall	0.12	Canada goose	0.09	Canada goose	0.09
Canada goose	0.09	red-tailed hawk	0.07	red-tailed hawk	0.07
red-tailed hawk	0.09	redhead	0.04	redhead	0.04
tree swallow	0.06	tree swallow	0.03	tree swallow	0.03

A complete listing of all avian survey RSA and encounter data for the spring 2010 can be found in Appendix 2 presented as revised Tables 4 and 5 from the spring 2010 avian survey report for Turbines A, B, and C.

#### 4.0 Conclusions

In comparing the 3 turbine models being considered by CPV for the Project, there is not a significant difference between the number of birds documented within each RSA nor is there a significant difference in the encounter rates calculated for the birds within those differing RSAs. In both fall 2009 and spring 2010 there were slightly more birds within the Turbine A RSA and Turbine A had a slightly greater encounter rate than Turbines B and C. No differences in the number of birds documented in the RSAs or encounter rates by species was found between Turbines B and C in either the fall or spring. Consistent with the results of the fall 2009 and spring 2010 avian survey reports, regardless of the turbine type selected of the 3 under consideration, behavioral data (e.g., flight patterns) suggest that the probability of negative interactions between birds and turbines at the Project is generally low for most species. Species with the higher encounter rates as reported in these surveys have stable regional populations (Tetra Tech 2010a, 2010b), therefore if fatalities do occur they are unlikely to have population-level consequences.

In conclusion, the survey results indicate that the final selection of a wind turbine model between Turbines A, B, and C does not make a significant difference in the encounter rates and there is a low probability of negative interactions with birds for most species with any of the turbine types under consideration.



---

*Turbine Model Comparison  
Ashley Wind Energy Project*

---

### **5.0 References**

Tetra Tech EC, Inc. (Tetra Tech). 2010a. 2009 Fall Avian Survey – Ashley Wind Energy Project, McIntosh County, North Dakota. Prepared for CPV Ashley Renewable Company, LLC. Prepared by Tetra Tech EC, Inc. March 2010.

Tetra Tech EC, Inc. (Tetra Tech). 2010b. 2010 Spring Avian Survey – Ashley Wind Energy Project, McIntosh County, North Dakota. Prepared for CPV Ashley Renewable Company, LLC. Prepared by Tetra Tech EC, Inc. August 2010.



*Turbine Model Comparison  
Ashley Wind Energy Project*

---

## APPENDIX 1



September 2010

**Table 4a.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Fall 2009 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
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%
<b>Raptors</b>		
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%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

**Table 4b.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Fall 2009 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
Above RSA height (>135m)	1192	9.8%
At RSA height (35m–135m)	6110	50.1%
Below RSA height (<35m)	4897	40.1%
<b>Raptors</b>		
Above RSA height (>135m)	6	5.3%
At RSA height (35m–135m)	60	52.6%
Below RSA height (<35m)	48	42.1%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> These values assume a rotor diameter of 100 (m) and a hub height of 85 (m)

**Table 4c.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Fall 2009 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
Above RSA height (>136.5m)	1192	9.8%
At RSA height (33.5m–136.5m)	6110	50.1%
Below RSA height (<33.5m)	4897	40.1%
<b>Raptors</b>		
Above RSA height (>136.5m)	6	5.3%
At RSA height (33.5m–136.5m)	60	52.6%
Below RSA height (<33.5m)	48	42.1%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> These values assume a rotor diameter of 103 (m) and a hub height of 85 (m)

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
green-winged teal	0.07	1.29 (0.20 - 2.38)	5.6	0.0	100.0	0.0

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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
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

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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
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

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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

<sup>1</sup>These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
snow goose	14.70	24.52 (3.04 - 46.00)	100.0	40.0	60.0	0.0
red-winged blackbird	8.68	38.42 (13.74 - 63.10)	99.7	6.8	22.7	70.5
American white pelican	6.78	6.93 (0.00 - 15.72)	100.0	0.0	97.8	2.2
barn swallow	5.43	9.65 (5.58 - 13.72)	100.0	0.0	56.2	43.8
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	2.15	8.71 (4.80 - 12.62)	94.7	19.5	26.1	54.4
northern rough-winged swallow	1.15	2.29 (0.68 - 3.90)	100.0	0.0	50.0	50.0
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
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
double-crested cormorant	0.45	0.87 (0.11 - 1.63)	80.8	20.3	64.4	15.3
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	0.24	0.43 (0.29 - 0.57)	83.3	3.3	66.7	30.0
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
green-winged teal	0.07	1.29 (0.20 - 2.38)	5.6	0.0	100.0	0.0

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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
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

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
pectoral sandpiper	0.00	1.68 (0.58 - 2.78)	55.3	0.0	0.0	100.0
pie-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
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

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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

<sup>1</sup>These values assume a rotor diameter of 100 (m) and a hub height of 85 (m)

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
snow goose	14.70	24.52 (3.04 - 46.00)	100.0	40.0	60.0	0.0
red-winged blackbird	8.68	38.42 (13.74 - 63.10)	99.7	6.8	22.7	70.5
American white pelican	6.78	6.93 (0.00 - 15.72)	100.0	0.0	97.8	2.2
barn swallow	5.43	9.65 (5.58 - 13.72)	100.0	0.0	56.2	43.8
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	2.15	8.71 (4.80 - 12.62)	94.7	19.5	26.1	54.4
northern rough-winged swallow	1.15	2.29 (0.68 - 3.90)	100.0	0.0	50.0	50.0
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
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
double-crested cormorant	0.45	0.87 (0.11 - 1.63)	80.8	20.3	64.4	15.3
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	0.24	0.43 (0.29 - 0.57)	83.3	3.3	66.7	30.0
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
green-winged teal	0.07	1.29 (0.20 - 2.38)	5.6	0.0	100.0	0.0

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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
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

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
pectoral sandpiper	0.00	1.68 (0.58 - 2.78)	55.3	0.0	0.0	100.0
pie-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
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

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> 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
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

<sup>1</sup>These values assume a rotor diameter of 103 (m) and a hub height of 85 (m)

*Turbine Model Comparison  
Ashley Wind Energy Project*

---

## APPENDIX 2



September 2010

**Table 4a.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Spring 2010 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
Above RSA height (>130.5m)	3	0.1%
At RSA height (29.5m–130.5m)	506	18.5%
Below RSA height (<29.5m)	2231	81.4%
<b>Raptors</b>		
At RSA height (29.5m–130.5m)	26	76.5%
Below RSA height (<29.5m)	8	23.5%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

**Table 4b.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Spring 2010 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
Above RSA height (>135m)	3	0.1%
At RSA height (35m–135m)	275	10.0%
Below RSA height (<35m)	2462	89.9%
<b>Raptors</b>		
At RSA height (35m–135m)	22	64.7%
Below RSA height (<35m)	12	35.3%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> These values assume a rotor diameter of 100 (m) and a hub height of 85 (m)

**Table 4c.** Summary of avian flight heights<sup>1</sup> in relation to the turbine rotor swept area (RSA)<sup>2</sup> during Spring 2010 point count surveys at the Ashley Wind Energy Project.

	Birds	
	Number	Percentage
<b>Non-raptors</b>		
Above RSA height (>136.5m)	3	0.1%
At RSA height (33.5m–136.5m)	275	10.0%
Below RSA height (<33.5m)	2462	89.9%
<b>Raptors</b>		
At RSA height (33.5m–136.5m)	22	64.7%
Below RSA height (<33.5m)	12	35.3%

<sup>1</sup> Includes only flying birds with flight height data

<sup>2</sup> These values assume a rotor diameter of 103 (m) and a hub height of 85 (m)

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
common grackle	1.82	5.90 (4.14 - 7.66)	95.7	0.0	32.3	67.7
European starling	1.38	2.81 (0.85 - 4.77)	100.0	0.0	49.2	50.8
ring-billed gull	1.20	1.85 (0.00 - 3.75)	88.1	0.0	73.6	26.4
mallard	0.42	4.62 (3.63 - 5.61)	33.8	1.4	26.8	71.8
northern pintail	0.24	1.69 (1.26 - 2.12)	48.1	0.0	29.7	70.3
Swainson's hawk	0.19	0.35 (0.22 - 0.48)	59.4	0.0	89.5	10.5
gadwall	0.12	1.70 (1.25 - 2.15)	8.4	0.0	84.6	15.4
Canada goose	0.09	1.11 (0.72 - 1.50)	30.7	0.0	25.8	74.2
red-tailed hawk	0.09	0.15 (0.07 - 0.23)	64.3	0.0	88.9	11.1
tree swallow	0.06	0.11 (0.04 - 0.18)	100.0	0.0	50.0	50.0
redhead	0.04	1.08 (0.64 - 1.52)	10.2	0.0	40.0	60.0
marbled godwit	0.04	0.26 (0.16 - 0.36)	25.0	0.0	66.7	33.3
American white pelican	0.03	0.03 (0.00 - 0.08)	100.0	0.0	100.0	0.0
mourning dove	0.02	0.18 (0.10 - 0.26)	37.5	0.0	33.3	66.7
eastern kingbird	0.02	0.18 (0.09 - 0.27)	56.3	0.0	22.2	77.8
blue-winged teal	0.02	2.88 (2.11 - 3.65)	1.5	0.0	50.0	50.0
willet	0.01	0.11 (0.04 - 0.18)	80.0	0.0	12.5	87.5
red-winged blackbird	0.01	5.84 (4.40 - 7.28)	87.9	0.0	0.2	99.8
northern shoveler	0.01	1.56 (1.11 - 2.01)	0.7	0.0	100.0	0.0
northern harrier	0.01	0.04 (0.00 - 0.08)	100.0	0.0	25.0	75.0
double-crested cormorant	0.01	0.05 (0.01 - 0.09)	80.0	25.0	25.0	50.0
yellow warbler	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
yellow-rumped warbler	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
yellow-headed blackbird	0.00	5.47 (2.80 - 8.14)	97.4	0.0	0.0	100.0
Wilson's snipe	0.00	0.13 (0.07 - 0.19)	0.0	0.0	0.0	0.0
Wilson's phalarope	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
willow flycatcher	0.00	0.07 (0.01 - 0.13)	0.0	0.0	0.0	0.0
western meadowlark	0.00	1.66 (1.37 - 1.95)	3.3	0.0	0.0	100.0
western kingbird	0.00	0.16 (0.06 - 0.26)	80.0	0.0	0.0	100.0
warbling vireo	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
vesper sparrow	0.00	0.04 (0.00 - 0.09)	0.0	0.0	0.0	0.0
upland sandpiper	0.00	0.03 (0.00 - 0.06)	0.0	0.0	0.0	0.0
Swainson's thrush	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
sharp-tailed grouse	0.00	0.31 (0.00 - 0.64)	82.1	0.0	0.0	100.0
song sparrow	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
sora	0.00	0.09 (0.03 - 0.15)	0.0	0.0	0.0	0.0
snow goose	0.00	1.65 (0.00 - 4.36)	100.0	0.0	0.0	100.0
savannah sparrow	0.00	0.15 (0.05 - 0.25)	7.1	0.0	0.0	100.0
ruddy duck	0.00	0.47 (0.23 - 0.71)	0.0	0.0	0.0	0.0
rock pigeon	0.00	0.05 (0.00 - 0.12)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	1.02 (0.79 - 1.25)	0.0	0.0	0.0	0.0
ring-necked duck	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
rough-legged hawk	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
red-eyed vireo	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
red-breasted merganser	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
pied-billed grebe	0.00	0.31 (0.18 - 0.44)	0.0	0.0	0.0	0.0
orchard oriole	0.00	0.10 (0.03 - 0.17)	11.1	0.0	0.0	100.0
Nelson's sharp-tailed sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
northern flicker	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
marsh wren	0.00	0.22 (0.00 - 0.45)	0.0	0.0	0.0	0.0
lesser scaup	0.00	6.45 (4.44 - 8.46)	0.3	0.0	0.0	100.0
least flycatcher	0.00	0.08 (0.02 - 0.14)	28.6	0.0	0.0	100.0

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
Lapland longspur	0.00	0.84 (0.00 - 1.94)	100.0	0.0	0.0	100.0
killdeer	0.00	0.66 (0.50 - 0.82)	48.3	0.0	0.0	100.0
house wren	0.00	0.11 (0.02 - 0.20)	0.0	0.0	0.0	0.0
house sparrow	0.00	0.16 (0.07 - 0.25)	13.3	0.0	0.0	100.0
horned lark	0.00	0.56 (0.37 - 0.75)	29.4	0.0	0.0	100.0
hairy woodpecker	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
Harris's sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
green-winged teal	0.00	0.13 (0.03 - 0.23)	0.0	0.0	0.0	0.0
greater white-fronted goose	0.00	0.88 (0.00 - 2.33)	100.0	0.0	0.0	100.0
grasshopper sparrow	0.00	0.02 (0.00 - 0.06)	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
great horned owl	0.00	0.16 (0.05 - 0.27)	0.0	0.0	0.0	0.0
Franklin's gull	0.00	0.35 (0.00 - 0.93)	100.0	0.0	0.0	100.0
common yellowthroat	0.00	0.24 (0.13 - 0.35)	0.0	0.0	0.0	0.0
common merganser	0.00	0.15 (0.00 - 0.34)	0.0	0.0	0.0	0.0
chipping sparrow	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
clay-colored sparrow	0.00	0.03 (0.00 - 0.07)	0.0	0.0	0.0	0.0
canvasback	0.00	0.27 (0.05 - 0.49)	0.0	0.0	0.0	0.0
California gull	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
bufflehead	0.00	0.21 (0.06 - 0.36)	0.0	0.0	0.0	0.0
brown thrasher	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
Brewer's blackbird	0.00	0.15 (0.00 - 0.30)	78.6	0.0	0.0	100.0
bobolink	0.00	0.15 (0.05 - 0.25)	57.1	0.0	0.0	100.0
black tern	0.00	0.07 (0.01 - 0.13)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.73 (0.43 - 1.03)	74.2	0.0	0.0	100.0
black-crowned night-heron	0.00	0.05 (0.00 - 0.10)	0.0	0.0	0.0	0.0

**Table 5a.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.27 (0.14 - 0.40)	100.0	0.0	0.0	100.0
Baltimore oriole	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American wigeon	0.00	0.13 (0.05 - 0.21)	8.3	0.0	0.0	100.0
American robin	0.00	0.10 (0.04 - 0.16)	22.2	0.0	0.0	100.0
American goldfinch	0.00	0.18 (0.09 - 0.27)	12.5	0.0	0.0	100.0
American crow	0.00	0.05 (0.00 - 0.11)	60.0	0.0	0.0	100.0
American coot	0.00	3.51 (2.53 - 4.49)	0.6	0.0	0.0	100.0
American bittern	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American avocet	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
alder flycatcher	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

<sup>1</sup>These values assume a rotor diameter of 101 (m) and a hub height of 80 (m)

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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-billed gull	1.12	1.85 (0.00 - 3.75)	88.1	0.0	68.9	31.1
common grackle	1.09	5.90 (4.14 - 7.66)	95.7	0.0	19.3	80.7
mallard	0.27	4.62 (3.63 - 5.61)	33.8	1.4	17.6	81.0
Swainson's hawk	0.16	0.35 (0.22 - 0.48)	59.4	0.0	78.9	21.1
northern pintail	0.15	1.69 (1.26 - 2.12)	48.1	0.0	18.9	81.1
European starling	0.11	2.81 (0.85 - 4.77)	100.0	0.0	3.9	96.1
Canada goose	0.09	1.11 (0.72 - 1.50)	30.7	0.0	25.8	74.2
red-tailed hawk	0.07	0.15 (0.07 - 0.23)	64.3	0.0	77.8	22.2
redhead	0.04	1.08 (0.64 - 1.52)	10.2	0.0	40.0	60.0
tree swallow	0.03	0.11 (0.04 - 0.18)	100.0	0.0	30.0	70.0
American white pelican	0.03	0.03 (0.00 - 0.08)	100.0	0.0	100.0	0.0
blue-winged teal	0.02	2.88 (2.11 - 3.65)	1.5	0.0	50.0	50.0
marbled godwit	0.02	0.26 (0.16 - 0.36)	25.0	0.0	33.3	66.7
northern shoveler	0.01	1.56 (1.11 - 2.01)	0.7	0.0	100.0	0.0
gadwall	0.01	1.70 (1.25 - 2.15)	8.4	0.0	7.7	92.3
double-crested cormorant	0.01	0.05 (0.01 - 0.09)	80.0	25.0	25.0	50.0
yellow warbler	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
yellow-rumped warbler	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
yellow-headed blackbird	0.00	5.47 (2.80 - 8.14)	97.4	0.0	0.0	100.0
Wilson's snipe	0.00	0.13 (0.07 - 0.19)	0.0	0.0	0.0	0.0
Wilson's phalarope	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
willet	0.00	0.11 (0.04 - 0.18)	80.0	0.0	0.0	100.0
willow flycatcher	0.00	0.07 (0.01 - 0.13)	0.0	0.0	0.0	0.0
western meadowlark	0.00	1.66 (1.37 - 1.95)	3.3	0.0	0.0	100.0
western kingbird	0.00	0.16 (0.06 - 0.26)	80.0	0.0	0.0	100.0
warbling vireo	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
vesper sparrow	0.00	0.04 (0.00 - 0.09)	0.0	0.0	0.0	0.0
upland sandpiper	0.00	0.03 (0.00 - 0.06)	0.0	0.0	0.0	0.0
Swainson's thrush	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
sharp-tailed grouse	0.00	0.31 (0.00 - 0.64)	82.1	0.0	0.0	100.0
song sparrow	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
sora	0.00	0.09 (0.03 - 0.15)	0.0	0.0	0.0	0.0
snow goose	0.00	1.65 (0.00 - 4.36)	100.0	0.0	0.0	100.0
savannah sparrow	0.00	0.15 (0.05 - 0.25)	7.1	0.0	0.0	100.0
red-winged blackbird	0.00	5.84 (4.40 - 7.28)	87.9	0.0	0.0	100.0
ruddy duck	0.00	0.47 (0.23 - 0.71)	0.0	0.0	0.0	0.0
rock pigeon	0.00	0.05 (0.00 - 0.12)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	1.02 (0.79 - 1.25)	0.0	0.0	0.0	0.0
ring-necked duck	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
rough-legged hawk	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
red-eyed vireo	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
red-breasted merganser	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
pieb-billed grebe	0.00	0.31 (0.18 - 0.44)	0.0	0.0	0.0	0.0
orchard oriole	0.00	0.10 (0.03 - 0.17)	11.1	0.0	0.0	100.0
Nelson's sharp-tailed sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
northern harrier	0.00	0.04 (0.00 - 0.08)	100.0	0.0	0.0	100.0
northern flicker	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
mourning dove	0.00	0.18 (0.10 - 0.26)	37.5	0.0	0.0	100.0
marsh wren	0.00	0.22 (0.00 - 0.45)	0.0	0.0	0.0	0.0
lesser scaup	0.00	6.45 (4.44 - 8.46)	0.3	0.0	0.0	100.0
least flycatcher	0.00	0.08 (0.02 - 0.14)	28.6	0.0	0.0	100.0
Lapland longspur	0.00	0.84 (0.00 - 1.94)	100.0	0.0	0.0	100.0

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
killdeer	0.00	0.66 (0.50 - 0.82)	48.3	0.0	0.0	100.0
house wren	0.00	0.11 (0.02 - 0.20)	0.0	0.0	0.0	0.0
house sparrow	0.00	0.16 (0.07 - 0.25)	13.3	0.0	0.0	100.0
horned lark	0.00	0.56 (0.37 - 0.75)	29.4	0.0	0.0	100.0
hairy woodpecker	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
Harris's sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
green-winged teal	0.00	0.13 (0.03 - 0.23)	0.0	0.0	0.0	0.0
greater white-fronted goose	0.00	0.88 (0.00 - 2.33)	100.0	0.0	0.0	100.0
grasshopper sparrow	0.00	0.02 (0.00 - 0.06)	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
great horned owl	0.00	0.16 (0.05 - 0.27)	0.0	0.0	0.0	0.0
Franklin's gull	0.00	0.35 (0.00 - 0.93)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.18 (0.09 - 0.27)	56.3	0.0	0.0	100.0
common yellowthroat	0.00	0.24 (0.13 - 0.35)	0.0	0.0	0.0	0.0
common merganser	0.00	0.15 (0.00 - 0.34)	0.0	0.0	0.0	0.0
chipping sparrow	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
clay-colored sparrow	0.00	0.03 (0.00 - 0.07)	0.0	0.0	0.0	0.0
canvasback	0.00	0.27 (0.05 - 0.49)	0.0	0.0	0.0	0.0
California gull	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
bufflehead	0.00	0.21 (0.06 - 0.36)	0.0	0.0	0.0	0.0
brown thrasher	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
Brewer's blackbird	0.00	0.15 (0.00 - 0.30)	78.6	0.0	0.0	100.0
bobolink	0.00	0.15 (0.05 - 0.25)	57.1	0.0	0.0	100.0
black tern	0.00	0.07 (0.01 - 0.13)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.73 (0.43 - 1.03)	74.2	0.0	0.0	100.0
black-crowned night-heron	0.00	0.05 (0.00 - 0.10)	0.0	0.0	0.0	0.0

**Table 5b.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
barn swallow	0.00	0.27 (0.14 - 0.40)	100.0	0.0	0.0	100.0
Baltimore oriole	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American wigeon	0.00	0.13 (0.05 - 0.21)	8.3	0.0	0.0	100.0
American robin	0.00	0.10 (0.04 - 0.16)	22.2	0.0	0.0	100.0
American goldfinch	0.00	0.18 (0.09 - 0.27)	12.5	0.0	0.0	100.0
American crow	0.00	0.05 (0.00 - 0.11)	60.0	0.0	0.0	100.0
American coot	0.00	3.51 (2.53 - 4.49)	0.6	0.0	0.0	100.0
American bittern	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
American avocet	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
alder flycatcher	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0

<sup>1</sup>These values assume a rotor diameter of 100 (m) and a hub height of 85 (m)

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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-billed gull	1.12	1.85 (0.00 - 3.75)	88.1	0.0	68.9	31.1
common grackle	1.09	5.90 (4.14 - 7.66)	95.7	0.0	19.3	80.7
mallard	0.27	4.62 (3.63 - 5.61)	33.8	1.4	17.6	81.0
Swainson's hawk	0.16	0.35 (0.22 - 0.48)	59.4	0.0	78.9	21.1
northern pintail	0.15	1.69 (1.26 - 2.12)	48.1	0.0	18.9	81.1
European starling	0.11	2.81 (0.85 - 4.77)	100.0	0.0	3.9	96.1
Canada goose	0.09	1.11 (0.72 - 1.50)	30.7	0.0	25.8	74.2
red-tailed hawk	0.07	0.15 (0.07 - 0.23)	64.3	0.0	77.8	22.2
redhead	0.04	1.08 (0.64 - 1.52)	10.2	0.0	40.0	60.0
tree swallow	0.03	0.11 (0.04 - 0.18)	100.0	0.0	30.0	70.0
American white pelican	0.03	0.03 (0.00 - 0.08)	100.0	0.0	100.0	0.0
blue-winged teal	0.02	2.88 (2.11 - 3.65)	1.5	0.0	50.0	50.0
marbled godwit	0.02	0.26 (0.16 - 0.36)	25.0	0.0	33.3	66.7
northern shoveler	0.01	1.56 (1.11 - 2.01)	0.7	0.0	100.0	0.0
gadwall	0.01	1.70 (1.25 - 2.15)	8.4	0.0	7.7	92.3
double-crested cormorant	0.01	0.05 (0.01 - 0.09)	80.0	25.0	25.0	50.0
yellow warbler	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
yellow-rumped warbler	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
yellow-headed blackbird	0.00	5.47 (2.80 - 8.14)	97.4	0.0	0.0	100.0
Wilson's snipe	0.00	0.13 (0.07 - 0.19)	0.0	0.0	0.0	0.0
Wilson's phalarope	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
willet	0.00	0.11 (0.04 - 0.18)	80.0	0.0	0.0	100.0
willow flycatcher	0.00	0.07 (0.01 - 0.13)	0.0	0.0	0.0	0.0
western meadowlark	0.00	1.66 (1.37 - 1.95)	3.3	0.0	0.0	100.0
western kingbird	0.00	0.16 (0.06 - 0.26)	80.0	0.0	0.0	100.0
warbling vireo	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
vesper sparrow	0.00	0.04 (0.00 - 0.09)	0.0	0.0	0.0	0.0
upland sandpiper	0.00	0.03 (0.00 - 0.06)	0.0	0.0	0.0	0.0
Swainson's thrush	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
sharp-tailed grouse	0.00	0.31 (0.00 - 0.64)	82.1	0.0	0.0	100.0
song sparrow	0.00	0.08 (0.03 - 0.13)	0.0	0.0	0.0	0.0
sora	0.00	0.09 (0.03 - 0.15)	0.0	0.0	0.0	0.0
snow goose	0.00	1.65 (0.00 - 4.36)	100.0	0.0	0.0	100.0
savannah sparrow	0.00	0.15 (0.05 - 0.25)	7.1	0.0	0.0	100.0
red-winged blackbird	0.00	5.84 (4.40 - 7.28)	87.9	0.0	0.0	100.0
ruddy duck	0.00	0.47 (0.23 - 0.71)	0.0	0.0	0.0	0.0
rock pigeon	0.00	0.05 (0.00 - 0.12)	100.0	0.0	0.0	100.0
ring-necked pheasant	0.00	1.02 (0.79 - 1.25)	0.0	0.0	0.0	0.0
ring-necked duck	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
rough-legged hawk	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
red-eyed vireo	0.00	0.02 (0.00 - 0.06)	0.0	0.0	0.0	0.0
red-breasted merganser	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
pieb-billed grebe	0.00	0.31 (0.18 - 0.44)	0.0	0.0	0.0	0.0
orchard oriole	0.00	0.10 (0.03 - 0.17)	11.1	0.0	0.0	100.0
Nelson's sharp-tailed sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
northern harrier	0.00	0.04 (0.00 - 0.08)	100.0	0.0	0.0	100.0
northern flicker	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
mourning dove	0.00	0.18 (0.10 - 0.26)	37.5	0.0	0.0	100.0
marsh wren	0.00	0.22 (0.00 - 0.45)	0.0	0.0	0.0	0.0
lesser scaup	0.00	6.45 (4.44 - 8.46)	0.3	0.0	0.0	100.0
least flycatcher	0.00	0.08 (0.02 - 0.14)	28.6	0.0	0.0	100.0
Lapland longspur	0.00	0.84 (0.00 - 1.94)	100.0	0.0	0.0	100.0

**Table 5c.** Avian flight height characteristics in relation to the turbine rotor swept area (RSA)<sup>1</sup> during Spring 2010 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
killdeer	0.00	0.66 (0.50 - 0.82)	48.3	0.0	0.0	100.0
house wren	0.00	0.11 (0.02 - 0.20)	0.0	0.0	0.0	0.0
house sparrow	0.00	0.16 (0.07 - 0.25)	13.3	0.0	0.0	100.0
horned lark	0.00	0.56 (0.37 - 0.75)	29.4	0.0	0.0	100.0
hairy woodpecker	0.00	0.01 (0.00 - 0.03)	100.0	0.0	0.0	100.0
Harris's sparrow	0.00	0.01 (0.00 - 0.03)	0.0	0.0	0.0	0.0
green-winged teal	0.00	0.13 (0.03 - 0.23)	0.0	0.0	0.0	0.0
greater white-fronted goose	0.00	0.88 (0.00 - 2.33)	100.0	0.0	0.0	100.0
grasshopper sparrow	0.00	0.02 (0.00 - 0.06)	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
great horned owl	0.00	0.16 (0.05 - 0.27)	0.0	0.0	0.0	0.0
Franklin's gull	0.00	0.35 (0.00 - 0.93)	100.0	0.0	0.0	100.0
eastern kingbird	0.00	0.18 (0.09 - 0.27)	56.3	0.0	0.0	100.0
common yellowthroat	0.00	0.24 (0.13 - 0.35)	0.0	0.0	0.0	0.0
common merganser	0.00	0.15 (0.00 - 0.34)	0.0	0.0	0.0	0.0
chipping sparrow	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
clay-colored sparrow	0.00	0.03 (0.00 - 0.07)	0.0	0.0	0.0	0.0
canvasback	0.00	0.27 (0.05 - 0.49)	0.0	0.0	0.0	0.0
California gull	0.00	0.02 (0.00 - 0.06)	100.0	0.0	0.0	100.0
bufflehead	0.00	0.21 (0.06 - 0.36)	0.0	0.0	0.0	0.0
brown thrasher	0.00	0.02 (0.00 - 0.05)	0.0	0.0	0.0	0.0
Brewer's blackbird	0.00	0.15 (0.00 - 0.30)	78.6	0.0	0.0	100.0
bobolink	0.00	0.15 (0.05 - 0.25)	57.1	0.0	0.0	100.0
black tern	0.00	0.07 (0.01 - 0.13)	100.0	0.0	0.0	100.0
brown-headed cowbird	0.00	0.73 (0.43 - 1.03)	74.2	0.0	0.0	100.0
black-crowned night-heron	0.00	0.05 (0.00 - 0.10)	0.0	0.0	0.0	0.0