

**Avian Use Surveys for the
Prevailing Winds Wind Project
Bon Homme and Charles Mix Counties, South Dakota**

**Year One Final Draft Report
March 2015 – February 2016**

**Prepared for:
Prevailing Winds, LLC**

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EXECUTIVE SUMMARY

Prevailing Winds, LLC. (Prevailing Winds), has proposed a wind energy facility in Bon Homme and Charles Mix counties, South Dakota, referred to as the Prevailing Winds Wind Project (Project). Prevailing Winds contracted Western EcoSystems Technology, Inc. (WEST) to conduct field surveys developed in coordination with the United States (US) Fish and Wildlife Service (USFWS) and South Dakota Game Fish and Parks (SDGFP). Surveys were designed to assess wildlife resources in the Project area and assess risk to special-status species by addressing the issues posed under Tier 3 of the USFWS Final Land-Based Wind Energy Guidelines. The following document contains results for the general fixed-point bird use surveys and incidental wildlife observations. A summary of all data collected is contained in the document, but the overall body of the report focuses on a smaller group of species – diurnal raptors, eagles, state/federally listed species, and South Dakota Sensitive Species (State Species of Concern [SSC] and State Species of Greatest Conservation Need [SGCN]).

The principal objectives of the fixed-point bird use surveys were to: 1) assess the relative abundance and spatial distribution of species in the Project area during all seasons, and 2) identify and assess the potential risk of adverse impacts to species or groups.

Fixed-point bird use surveys were conducted at 16 survey points from March 25, 2015 – February 21, 2016. Each survey plot was surveyed for 60 minutes (min). Every bird and/or unique bird species group observed during the first 20 min of each fixed-point bird use survey was recorded using two viewsheds: 800-meter (m; 2,625-feet [ft]) radius plot for large birds and 100-m (328-ft) radius plot for small birds, observations beyond the radius plots were excluded from analysis. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens, magpies, and crows), and goatsuckers. Passerines (excluding large corvids), kingfishers, swifts/hummingbirds, woodpeckers, and most cuckoos were considered small birds. During the next 40 min of the survey period, only eagles and state/federally listed species were recorded out to the 800-m radius.

A total of 271 fixed-point bird use surveys were conducted during 18 visits. During all surveys and incidental observations, no federally or state-listed species were detected. Seven bird species (great blue heron, bald eagle, Cooper's hawk, ferruginous hawk, northern goshawk, sharp-shinned hawk, and Swainson's hawk) listed as South Dakota SGCN and/or SSC were observed during fixed-point surveys and incidentally.

Diurnal raptor use at the Project was low (was 0.31 raptors/800-m plot/20-min survey), compared to other US wind facilities and comparable to other wind energy facilities in the Midwest with publicly available data. Fatality monitoring data collected at wind projects in the Midwest suggest that some collision risk exists for individual raptors, but the level of impact is not likely to cause significant adverse impacts to overall species populations.

Significant adverse impacts to overall bird populations are not anticipated at the Project based on data collected at the site, review of available literature, and results of post-construction fatality monitoring at other wind energy facilities. Further post-construction survey effort should be determined in consultation with appropriate agencies to confirm the anticipated impacts.

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REPORT REFERENCE

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	i
INTRODUCTION	1
STUDY AREA.....	1
METHODS.....	4
Fixed-Point Bird Use Surveys	4
Survey Plots	4
Survey Methods	4
Observation Schedule	5
Statistical Analysis	5
Quality Assurance and Quality Control	5
Data Compilation and Storage.....	5
Fixed-Point Bird Use Surveys.....	5
Bird Diversity and Species Richness	5
Mean Use, Percent of Use, and Frequency of Occurrence	6
Bird Flight Height and Behavior	6
Spatial Use	6
RESULTS	6
Fixed-Point Bird Use Surveys	7
Bird Diversity and Species Richness	7
Mean Use, Percent of Use, and Frequency of Occurrence	10
State/Federally Listed Species and Sensitive Species Observations.....	11
Bird Flight Height and Behavior	12
Spatial Use	14
Eagle Use and Flight Paths	16
Incidental Observations.....	18
DISCUSSION.....	18
Diurnal Raptors	19
Species Specific Summaries.....	24
Great blue heron	24
Bald Eagle.....	24
Swainson's and Cooper's Hawks	25
Sharp-shinned and Ferruginous hawk	25
REFERENCES	25

LIST OF TABLES

Table 1. Number of visits, surveys, bird diversity (number of unique species for entire 60-minute [min] survey), and species richness (species/plot ^a /20-min survey) by season and overall, observed during the Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.	7
Table 2. Number of groups and individuals of diurnal raptors observed, regardless of distance from observer, during the first 20 minutes of the Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.....	9
Table 3. Seasonal bird mean use and frequency of occurrence for waterbirds, waterfowl, passerines, diurnal raptor species, and sensitive species observed during the first 20 minutes of Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.....	11
Table 4. Sensitive species observed during fixed-point bird use surveys (FP) ^a and Incidentally (Inc.) within the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.....	12
Table 5. Flight height (meters [m] above ground level) characteristics by bird types and raptor subtypes observed during Year One of the fixed-point bird use surveys ^a conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.	13
Table 6. Flight characteristics for sensitive species observed ^a during Year One of the fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.	14
Table 7. Mean use recorded at each survey point during the first 20 minutes of Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.	15
Table 8. Survey effort, number of eagle observations and groups, total eagle minutes, risk minutes, and eagle use by season, observed during the Year One of the 60-min bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.....	16
Table 9. Incidental wildlife observed while conducting all surveys at the at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.....	18
Table 10. Raptor use (number of raptors/plot/20-minute survey) and fatality (number of bird fatalities/megawatt/year) estimates for wind-energy facilities in the Midwest with publicly available data.	22

LIST OF FIGURES

Figure 1. Location of the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, for surveys conducted in 2015 – 2016.....	2
Figure 2. Land cover/Land use and location of the fixed-point plots selected for the Year One bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016 (USFWS NLCD 2011, Homer et al. 2015).....	3
Figure 3. Bald eagle flight paths observed during the Year One 60-minute fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.....	17
Figure 4. Comparison of estimated annual diurnal raptor use during the Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016, and diurnal raptor use at other US wind resource areas with comparable raptor use data.	21

LIST OF APPENDICES

Appendix A. Descriptive Statistics for Bird Species Recorded during Year One of Fixed-Point Bird Use Surveys Conducted at the Prairie Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016	
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INTRODUCTION

In 2015, Prevailing Winds LLC. (Prevailing Winds) contracted Western EcoSystems Technology, Inc. (WEST) to conduct field surveys in accordance with agency recommendations to quantify wildlife resources within the Prevailing Winds Wind Project (Project) in Bon Homme and Charles Mix counties, South Dakota. Year-round surveys were conducted by WEST in 2015 – 2016 to address the issues posed under Tier 3, following guidance in the United States (US) Fish and Wildlife Service (FWS) *Final Land-Based Wind Energy Guidelines* (Guidelines; USFWS 2012) and *Eagle Conservation Plan Guidance* (Guidance; USFWS 2013), within the Project area as delineated in 2015 (Figure 1).

Fixed-point bird use surveys were conducted to achieve these principal objectives: 1) assess the relative abundance and spatial distribution of species in the Project area during an entire year, with emphasis on eagles, non-eagle raptors, and state/federally listed species, and 2) identify and assess the potential risk of adverse impacts to special-status species or groups.

The following document contains results for the general fixed-point bird use surveys and incidental wildlife observations for the study period 2015 – 2016 (Year One), with focus on eagles, non-eagle diurnal raptors, state/federally listed species, and South Dakota special-status species (i.e., State Species of Greatest Conservation Need [SGCN] and State Species of Concern [SSC]). A second year of survey (Year Two) was conducted in 2016-2017 and is reported separately as the Project area changed.

STUDY AREA

The Project area used for surveys conducted in 2015 – 2016 encompassed approximately 18,139.5 hectares (ha; 44,823.7 acres [ac]) in Bon Homme and Charles Mix counties, adjacent to the town of Avon in southeastern South Dakota (Figure 1). The Project, located in a higher elevated area within the greater landscape, is characterized by a generally flat topography, with elevation ranging from 432.0 meters (m; 1,417.3 feet [ft]) – 573.7 m (1,882.2 ft; US Geological Survey [USGS] Digital Elevation Model 2017). The Project area, historically dominated by grasslands, has extensively been converted to agricultural use, with crop production and livestock grazing the primary practices (Bryce et al. 1998). Approximately 40% of the proposed Project area is cropland followed by pasture/hay land (37%); grassland/herbaceous cover represents approximately 8% of the Project area while all other land cover/land use types compose less than 5% each of the Project area (USGS National Land Cover Database 2011). As evidenced during the site visit conducted by WEST in 2015, trees and woodlands are found mainly in planted shelter belts and within draws and on hillslopes; wetlands are scattered throughout the Project area (Figure 2), with the USFWS National Wetland Inventory (NWI) indicating approximately 676 ha (1,670 ac) of wetlands (USFWS NWI 2015).

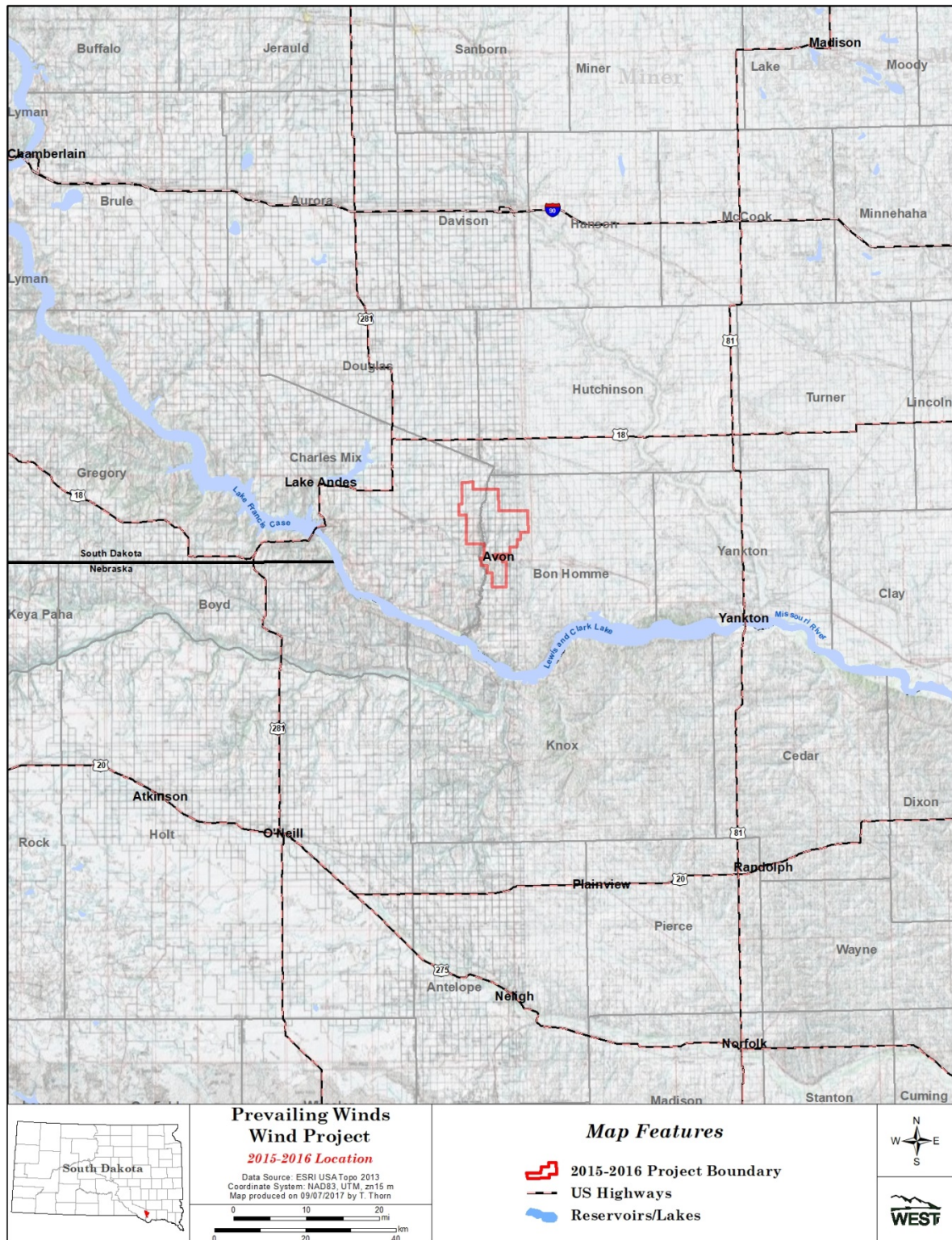


Figure 1. Location of the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, for surveys conducted in 2015 – 2016.

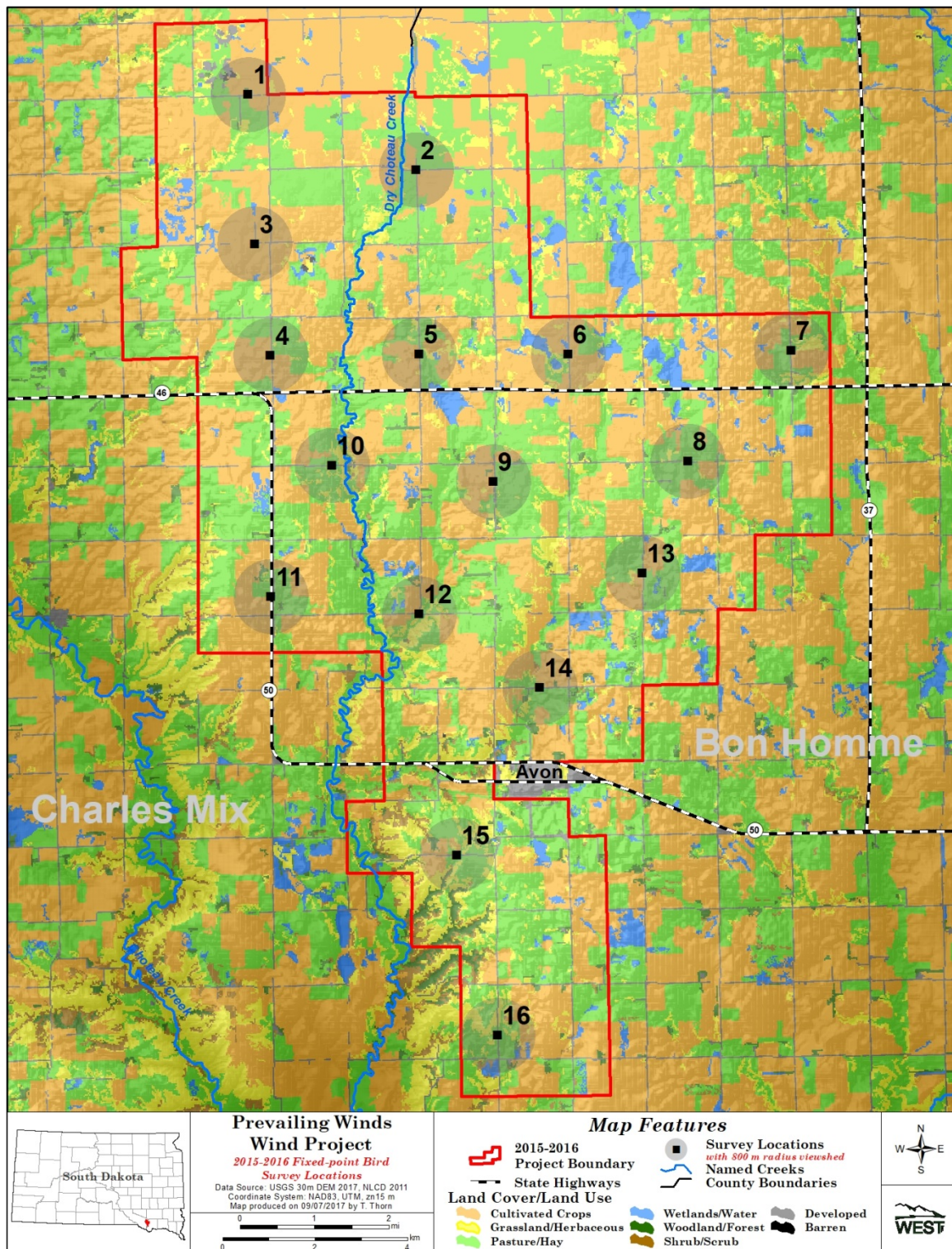


Figure 2. Land cover/Land use and location of the fixed-point plots selected for the Year One bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016 (USFWS NLCD 2011, Homer et al. 2015).

METHODS

Fixed-Point Bird Use Surveys

Fixed-point bird use surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980), to estimate the seasonal and spatial use of the study area by birds, particularly diurnal raptors (defined here as kites, accipiters, buteos, harriers, eagles, falcons, and osprey [*Pandion haliaetus*]). Methodologies employed during avian use surveys conducted at the Project are generally comparable to those used at past wind energy facilities in South Dakota.

Survey Plots

Sixteen points were selected to survey representative habitats and topography of the Project, while achieving relatively even coverage of the study area (Figure 2). Each survey plot was an 800-m (2,625-ft) radius circle centered on the point; for analysis purposes, only birds within the 800-m radius plot were considered for analysis to allow comparison to other projects that used similar analyses.

Survey Methods

Each survey plot was surveyed for 60 minutes (min). Every bird and/or unique bird species group observed during the first 20 min of each fixed-point bird use survey was recorded by a unique observation number. During the next 40 min of the survey period, only eagles and state/federally listed species and state species of concern were recorded out to the 800-m radius. In some cases, the tally of observations may represent repeated sightings of the same individual. Observations of large birds beyond the 800-m radius were recorded but were not included in statistical analyses. For small birds, observations beyond the 100-m (328-ft) radius were excluded. Large birds included waterbirds, waterfowl, rails and coots, grebes and loons, gulls and terns, shorebirds, diurnal raptors, owls, vultures, upland game birds, doves/pigeons, large corvids (e.g., ravens, magpies, and crows), and goatsuckers. Passerines (excluding large corvids), kingfishers, swifts/hummingbirds, woodpeckers, and most cuckoos were considered small birds.

The date, start and end time of the survey period, and weather information (e.g., temperature, wind speed and direction, and cloud cover) were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. Bird behavior and habitat type were recorded based on the point of first observation. Approximate flight height and distance from plot center at first observation were recorded to the nearest 5-m (16-ft) interval. Other information collected included whether the observation was auditory only and the 10-min interval of the survey in which the detection first occurred. Locations and flight paths, if applicable, of large birds were recorded during fixed-point bird use surveys on field maps by unique observation number. Data on eagle flight paths and habitat use (i.e., distance from observer, activity, and flight height)

were recorded on a per min basis; comments were made when appropriate. Incidental wildlife observations were recorded while conducting all surveys, moving between fixed-point locations, and traveling within the Project. All raptors, state and federal special-status bird species were documented.

Observation Schedule

Survey intensity (i.e., number of fixed-point circular plots and frequency of monitoring) was designed to document year-round use and behavior of birds in the Project area. Fixed-point bird use surveys were conducted approximately twice per month in the spring (March 4 – May 20) and fall (September 9 – November 28), and monthly during winter (November 29 – March 3) and summer (May 21 – September 8). Surveys were carried out during daylight hours and survey periods varied to approximately cover all daylight hours during a season. To the extent practicable, each point was surveyed roughly the same number of times.

Statistical Analysis

For analysis purposes, a visit was defined as the required length of time, in days, to survey all of the plots once within the Project area. Under certain circumstances, such as extreme weather conditions, all plots may not have been surveyed during a visit. In these cases, a visit might not have constituted a survey of all plots.

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, and/or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft® MSSQL database was developed to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined protocol to facilitate subsequent QA/QC and data analysis. All data forms and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species lists and counts, with the number of observations and the number of groups, were generated by season and included all observations of birds detected, regardless of their distance from the observer. In some cases, the tally of observations may represent repeated sightings of the same individual. Species richness was calculated for each season by first averaging the total number of species observed within each plot during a visit, then averaging across plots within each visit,

followed by averaging across visits within each season. Overall species richness was calculated as a weighted average of seasonal values by the number of days in each season.

Mean Use, Percent of Use, and Frequency of Occurrence

Large birds detected within the 800-m radius plot and small birds recorded within the 100-m radius plot were used to calculate mean use and frequency of occurrence. The metric used for mean bird use was number of birds per plot (100-m radius plot for small birds, 800-m radius plot for large birds) per 20-min survey. Seasonal mean use was calculated by first averaging the total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within each season. Overall mean use was calculated as a weighted average of seasonal values by the number of days in each season. Percent of use was calculated as the proportion of large or small bird use that was attributable to a particular bird type or species, and frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. Frequency of occurrence, calculated as the percent of surveys in which a particular bird type or species was observed, provides a relative measure of species exposure to the proposed Project.

Bird Flight Height and Behavior

Bird flight heights are important metrics to assess potential exposure. Flight height information was used to calculate the percentage of birds observed flying within the rotor-swept heights (RSH; estimated to be between 25 – 200 m [82 – 656 ft] above ground level). The flight height recorded during the initial observation was used to calculate the percentage of birds flying within the RSH and mean flight height. The percentage of birds flying within the RSH at any time was calculated using the lowest and highest flight heights recorded. Auditory only observations were excluded from flight height calculations.

Spatial Use

Spatial use of the Project area was evaluated using mean use by survey point. For each species and bird group, the number of individuals observed at each point during the 20-min survey was divided by the total number of surveys at that point.

RESULTS

Year 1 Surveys were completed within the Project area from March 25, 2015 – February 21, 2016. Summary statistics for the full suite of species observed in the Project area are presented in Appendix A. Results related to eagles, non-eagle raptors, federally/state-listed species (Endangered Species Act [ESA] 1973, South Dakota Game, Fish and Parks [SDGFP] 2016, USFWS 2017), and State non-listed special-status species (SGCN [SDGFP 2014] and SSC [SDGFP 2017]), are more thoroughly covered in the body of this report.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

A total of 271 fixed-point bird use surveys were conducted during 18 visits to the Project area during Year One of surveys: 63 surveys in spring, 77 in summer, 78 in fall, and 53 in winter (Table 1). Seventy-two unique bird species were observed during the entire duration (60 min) of the fixed-point bird use surveys (Table 1). Bird diversity (the number of unique species observed for entire 60-min survey) was highest during the summer (43 species), followed by fall (38), spring (36), and winter (23). Overall species richness (mean number of species/plot/20-min survey) was higher for small birds (1.64) compared to large birds (1.20), being lowest in the winter compared to all other seasons, for both large and small birds (0.96 and 0.54 species/plot/20-min survey, respectively).

Table 1. Number of visits, surveys, bird diversity (number of unique species for entire 60-minute [min] survey), and species richness (species/plot^a/20-min survey) by season and overall, observed during the Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Season	Number of Visits	Number of Surveys Conducted	Bird Diversity	Bird Species Richness	
				Large Birds	Small Birds
Spring	4	63	36	1.11	1.25
Summer	5	77	43	1.42	2.22
Fall	5	78	38	1.33	2.46
Winter	4	53	23	0.96	0.54
Overall	18	271	72	1.20	1.64

^a. 800-meter [m] radius plot for large birds and 100-m radius plot for small birds.

A total of 8,194 observations in 914 separate groups (defined as one or more individuals) were recorded during the first 20 min of the Year One of the fixed-point bird use surveys (Appendix A1). Regardless of bird size, six identified species (8.3% of all species) accounted for approximately half (52%) of all observations: Canada goose (*Branta canadensis*; 858 observations in 10 groups), European starling (*Sturnus vulgaris*; 787 observations in 13 groups), sandhill crane (*Antigone canadensis*; 735 observations in four groups), Franklin's gull (*Leucophaeus pipixcan*; 713 observations in five groups), snow goose (*Chen caerulescens*; 590 observations in four groups), and red-winged blackbird (*Agelaius phoeniceus*; 574 observations in 42 groups). All other species each accounted for less than 6% of the total observations.

Waterfowl accounted for the majority (2,145 observations within 44 groups) of large bird observations, with Canada goose being the most abundant waterfowl species; waterbirds composed 9% (736 observations) of the total bird observations, with only two waterbird species (sandhill cranes and great blue herons) being recorded during bird use surveys (Appendix A1). Passerines accounted for the majority (3,890 observations within 532 groups) of small bird observations, with European starling being the most abundant passerine species.

Eighty-nine diurnal raptor observations within 83 groups were recorded during the first 20 min of the Year One fixed-point bird use surveys conducted at the Project, representing eight unique species (Table 2; Appendix A1). Red-tailed hawk (*Buteo jamaicensis*; 55 observations in 51 groups) and northern harrier (*Circus cyaneus*; 11 observations within 11 groups) were the most commonly observed raptor species, accounting for 61.8% and 12.4% of all raptor observations, respectively. No federally (ESA 1973) or state-listed (SDGFP 2016) species were observed during Year One fixed-point bird use surveys conducted at the Project.

Table 2. Number of groups and individuals of diurnal raptors observed, regardless of distance from observer, during the first 20 minutes of the Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Raptor Subtype/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
<u>Accipiters</u>		0	0	0	0	2	2	3	3	5	5
Cooper's hawk ^a	<i>Accipiter cooperii</i>	0	0	0	0	2	2	2	2	4	4
northern goshawk ^{a,b}	<i>Accipiter gentilis</i>	0	0	0	0	0	0	1	1	1	1
<u>Buteos</u>		6	7	8	8	30	34	13	14	57	63
red-tailed hawk	<i>Buteo jamaicensis</i>	6	7	8	8	28	30	9	10	51	55
rough-legged hawk	<i>Buteo lagopus</i>	0	0	0	0	0	0	3	3	3	3
Swainson's hawk ^a	<i>Buteo swainsoni</i>	0	0	0	0	2	4	0	0	2	4
unidentified buteo	<i>Buteo spp</i>	0	0	0	0	0	0	1	1	1	1
<u>Northern Harrier</u>		2	2	4	4	5	5	0	0	11	11
northern harrier	<i>Circus cyaneus</i>	2	2	4	4	5	5	0	0	11	11
<u>Eagles</u>		0	0	0	0	0	0	1	1	1	1
bald eagle ^{a,b}	<i>Haliaeetus leucocephalus</i>	0	0	0	0	0	0	1	1	1	1
<u>Falcons</u>		0	0	0	0	0	0	2	2	2	2
American kestrel	<i>Falco sparverius</i>	0	0	0	0	0	0	2	2	2	2
<u>Other Raptors</u>		1	1	2	2	4	4	0	0	7	7
unidentified hawk		1	1	1	1	2	2	0	0	4	4
unidentified raptor		0	0	1	1	2	2	0	0	3	3
Overall Diurnal Raptors		9	10	14	14	41	45	19	20	83	89

Grps = Number of groups, # Obs = Number of observations

^a. State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

^b. State Species of Greatest Conservation Need (SDGFP 2014)

Mean Use, Percent of Use, and Frequency of Occurrence

Mean bird use, percent of use, and frequency of occurrence by season for all bird types and species observed during the first 20 min of surveys are shown in Appendix A2; Table 3 shows a summary of mean use and frequency of occurrence by major bird type and species of concern. The highest overall large bird use occurred during spring (30.43 birds/800-m plot/20-min survey), followed by winter (14.56), fall (8.43), and summer (2.40; Appendix A2). In general, seasonal use by large bird use was primarily driven by waterfowl use (Appendix A2). Small bird use was highest in the fall and winter (15.71 and 11.53 birds/100-m plot/20-min survey, respectively), compared to summer and spring (6.90 and 6.01, respectively); seasonal small bird use was largely driven by passerine use (Appendix A3).

Waterbird use was restricted to the migration periods (10.17 and 0.44 birds/800-m plot/20-min survey for spring and fall surveys, respectively; Table 3), with two species (sandhill crane and great blue heron [*Ardea herodias*]) comprising the totality of observations recorded during the study period (Appendix A2). Great blue heron, a SSC, was observed in spring only (0.02 birds/800-m plot/20-min survey); sandhill cranes were observed in both spring (10.16 birds/800-m plot/20-min survey) and fall (0.44). Waterbirds were observed more frequently during the spring (3.2%) compared to fall (1.2%; Table 3).

Diurnal raptor use was highest in the fall at 0.52 raptors/800-m plot/20-min survey, followed by winter (0.45), summer (0.18), and spring (0.10; Table 3). Higher raptor use during the fall was primarily due to relatively high use of the Project area by red-tailed hawks (0.36). Red-tailed hawks were observed year round and had the highest use of any other diurnal raptor species during all seasons (0.05, 0.10, and 0.21 during spring, summer, and winter, respectively); northern harrier use was observed in all seasons but winter, ranging from 0.03 – 0.06 birds/800-m plot/20-min survey; Table 3).

Use by Cooper's hawk (*Accipiter cooperii*; a SSC) was observed during fall (0.03 birds/800-m plot/20-min survey) and winter (0.06). Use by American kestrel (*Falco sparverius*), rough-legged hawk (*Buteo lagopus*), northern goshawk (*Accipiter gentilis*; SSC and SGCN), and bald eagle (*Haliaeetus leucocephalus*; SGCN), was observed exclusively during the winter during the first 20 min of fixed-point bird use surveys, ranging from 0.02 – 0.07 birds/800-m plot/20-min survey (Table 3). Bald eagle was the only eagle observed during surveys conducted at the Project (Appendix A1 and A2). Bald eagles were observed during 1.6% of winter surveys (Table 3). Diurnal raptors were observed during 37.4% of winter and 35.9% of fall surveys compared to 13.9% of summer and 7.9% of spring surveys (Table 3; Appendix A2).

Passerine use was higher during the fall and winter (15.59 and 11.48 birds/100-m plot/20-min survey, respectively), compared to the summer and spring (6.83 and 5.88, respectively; Table 3). Brown-headed cowbird (*Molothrus ater*) had the highest passerine use during the spring (1.52 birds/100-m plot/20-min survey; Appendix A3); red-winged blackbird (*Agelaius phoeniceus*) had the highest use (1.54) of passerine species observed in summer; unidentified blackbirds had the

highest use in the fall (5.50); and horned lark (*Eremophila alpestris*) had the highest use in the winter (7.15; Appendix A3).

Passerines were observed during 90.6% of the surveys during spring, 90.0% during summer, 65.0% during fall, and 39.6% during winter (Table 3).

Table 3. Seasonal bird mean use and frequency of occurrence for waterbirds, waterfowl, passerines, diurnal raptor species, and special-status species observed during the first 20 minutes of Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Mean Use ¹				Frequency of Occurrence (%)			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	10.17	0	0.44	0	3.2	0	1.2	0
great blue heron ^a	0.02	0	0	0	1.7	0	0	0
Waterfowl	8.21	0.18	4.01	11.66	22.1	5.5	5.2	7.8
Diurnal Raptors	0.10	0.18	0.52	0.45	7.9	13.9	35.9	37.4
<i>Accipiters</i>	0	0	0.03	0.1	0	0	2.7	10
Cooper's hawk ^a	0	0	0.03	0.06	0	0	2.7	5.8
northern goshawk ^{a,b}	0	0	0	0.04	0	0	0	4.2
<i>Buteos</i>	0.05	0.10	0.41	0.3	4.7	8.9	32	24.2
red-tailed hawk	0.05	0.10	0.36	0.21	4.7	8.9	29.3	15.2
rough-legged hawk	0	0	0	0.07	0	0	0	7.4
Swainson's hawk ^a	0	0	0.06	0	0	0	2.7	0
unidentified buteo	0	0	0	0.02	0	0	0	1.6
<i>Northern Harrier</i>	0.03	0.05	0.06	0	3.2	5	6.4	0
northern harrier	0.03	0.05	0.06	0	3.2	5	6.4	0
<i>Eagles</i>	0	0	0	0.02	0	0	0	1.6
bald eagle ^{a,b}	0	0	0	0.02	0	0	0	1.6
<i>Falcons</i>	0	0	0	0.03	0	0	0	3.3
American kestrel	0	0	0	0.03	0	0	0	3.3
<i>Other Raptors</i>	0.02	0.02	0.01	0	1.7	2.5	1.4	0
unidentified hawk	0.02	0.01	0.01	0	1.7	1.2	1.4	0
unidentified raptor	0	0.01	0	0	0	1.2	0	0
Passerines	5.88	6.83	15.59	11.48	90.6	90.0	65.0	39.6

Note: Totals by bird type and overall might not correspond to the sum of individual species due to rounding

¹. 800-meter (m; 2,625-foot [ft]) radius plot for large birds; 100-m (328-ft) radius plot for small birds

^a. State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

^b. State Species of Greatest Conservation Need (SDGFP 2014)

State and Federal Special-status Species Observations

No federally (ESA 1973) or state-listed (SDGFP 2016) species were observed during Year One of bird use surveys conducted in the Project area from March 25, 2015 – February 21, 2016 (Table 4). Seven non-listed special-status species were recorded during fixed-point bird use surveys and incidentally, including seven bald eagles within six groups (Table 4). The bald eagle, a State SGCN and SSC, is further protected under the Bald and Golden Eagle Protection Act (1940). Two additional South Dakota SGCN were observed, both of which were raptors (one incidental ferruginous hawk [*Buteo regalis*] observation, and one northern goshawk observation during fixed-point surveys). The other five non-listed special-status species were three SSC raptors (five Cooper's hawk observations [one incidental, four during fixed-point surveys], one

incidental sharp-shinned hawk [*Accipiter striatus*] observation, and six Swainson's hawk [*Buteo swainsoni*] observations [two incidental, four during fixed-point surveys]), and one SSC waterbird (one great blue heron observation during fixed-point surveys); see Species Specific Summaries section for a detailed discussion of these species..

Table 4. Non-listed special-status species observed during fixed-point bird use surveys (FP)^a and Incidentally (Inc.) within the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Species	Scientific Name	Status	FP		Inc.		Total	
			# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
great blue heron	<i>Ardea herodias</i>	SSC	1	1	0	0	1	1
	<i>Haliaeetus</i>	SGCN, SSC,						
bald eagle	<i>leucocephalus</i>	BGEPA	4	4	2	3	6	7
Cooper's hawk	<i>Accipiter cooperii</i>	SSC	4	4	1	1	5	5
ferruginous hawk	<i>Buteo regalis</i>	SGCN	0	0	1	1	1	1
northern goshawk	<i>Accipiter gentilis</i>	SGCN; SSC	1	1	0	0	1	1
sharp-shinned hawk	<i>Accipiter striatus</i>	SSC	0	0	1	1	1	1
Swainson's hawk	<i>Buteo swainsoni</i>	SSC	2	4	2	2	4	6

Grps = Number of groups, # Obs = Number of observations

^a Within 60-minute (min) survey for large birds and 20-min survey for small birds

BGEPA = Bald and Eagle Protection Act (1940)

SGCN = State Species of Greatest Conservation Need (SDGFP 2014)

SSC = State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

Bird Flight Height and Behavior

Flight height characteristics, based on initial flight height observations (i.e., only observations with the first activity not equal to perched were included) and estimated use, were estimated for both bird types and species (Tables 5 and 6). During the 60-min fixed-point bird use surveys, 182 groups of large birds were observed flying within the 800-m radius plot, totaling 2,313 individuals. Overall, 53.8% of flying large birds were recorded within the RSH, 18.1% were below the RSH, and 28.1% were flying above the RSH for collision with turbine blades of 25 – 200 m (82 – 656 ft) above ground level. The majority (94.8%) of waterbirds observed were recorded flying above the estimated RSH, while most (96.4%) of the waterfowl observations were recorded flying within the estimated RSH (Table 5). More than half (58.2%) of flying diurnal raptors were observed below the RSH, while 41.8% were within the RSH and none were above the RSH (Table 5). Eagles and other raptors represented the highest percentage of flying diurnal raptors recorded within the RSH (66.7%), followed by buteos (51.4%).

During the first 20 min of the fixed-point bird use surveys, 218 groups of small birds were observed flying within the 100-m radius plot, totaling 1,660 individuals, mostly passerines (Table 5). Overall, 91.9% of flying small birds were recorded below the RSH (Table 5).

Table 5. Flight height (meters [m] above ground level), based on initial observation, characteristics by bird types and raptor subtypes observed during Year One of the fixed-point bird use surveys^a conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Bird Type/Subtype	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% Within Flight Height Categories		
					< 25 m	25 - 200 m ^b	> 200 m
Waterbirds	4	686	476.00	100	5.20	0	94.80
Waterfowl	30	1,075	45.27	67.0	3.60	96.40	0
Shorebirds	28	108	8.39	66.7	77.80	22.20	0
Gulls/Terns	4	184	43.75	25.0	33.70	66.30	0
Diurnal Raptors	50	55	29.90	66.3	58.20	41.80	0
<i>Accipiters</i>	3	3	10.67	60.0	100.00	0	0
<i>Buteos</i>	30	35	34.00	61.4	48.60	51.40	0
<i>Northern Harrier</i>	11	11	8.73	100	90.90	9.10	0
<i>Eagles</i>	3	3	43.33	75.0	33.30	66.70	0
<i>Falcons</i>	0	0	0.00	0	0	0	0
<i>Unidentified Raptors</i>	3	3	72.33	75.0	33.30	66.70	0
Vultures	8	17	68.12	89.5	5.90	94.10	0
Upland Game Birds	1	1	1.00	1.4	100.00	0	0
Doves/Pigeons	46	141	8.35	59.0	90.80	9.20	0
Large Corvids	9	44	15.78	64.7	81.80	18.20	0
Goatsuckers	2	2	25.00	66.7	0	100.00	0
Large Birds Overall	182	2,313	34.55	63.0	18.10	53.80	28.10
Passerines^c	212	1,653	5.58	62.0	91.80	8.20	0
Woodpeckers	6	7	4.00	28.0	100.00	0	0
Small Birds Overall	218	1,660	5.54	61.7	91.90	8.10	0

Obs = Observations

^a. 800-meter (m; 2,625-foot [ft]) radius plot and 60-minute (min) survey for large birds; 100-m (328-ft) radius plot and 20 min survey for small birds

^b. The likely rotor-swept height for potential collision with a turbine blade, or 25 – 200 m (82 – 656 ft) above ground level

^c. Excluding large corvids

Three of four total bald eagles observed were first observed in flight. Based on initial observation, the majority (66.7%) of bald eagle groups observed during the full 60-min survey were observed within the RSH. No other special-status species were observed flying within the RSH at any time (Table 6).

Table 6. Flight characteristics for special-status species observed^a during Year One of the fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within RSH^b Based on Initial Observation	% Within RSH at Anytime
bald eagle	3	0.01	75.0	66.7	66.7
Cooper's hawk	3	0.02	75.0	0	0
great blue heron	1	<0.01	100	0	0
northern goshawk	0	0.01	0	0	0
Swainson's hawk	1	0.01	75.0	0	0

^a 800-meter (m; 2,625-foot [ft]) radius plot and 60-minute (min) survey for large birds; 100-m (328-ft) radius plot and 20 min survey for small birds

^b The likely rotor-swept height (RSH) for potential collision with a turbine blade, or 25 – 200 m (82-656 ft) above ground level

Spatial Use

For all large bird species combined, use (focused within 800 m) was highest at Point 1 (73.35 birds/20-min survey) largely due to high waterbird use at this point (38.24 birds/20-min survey); waterbirds were observed at two other points, with use ranging from 0.06 – 1.94 (Table 7). Large bird use at other points ranged from 1.41 – 34.11 birds/20-min survey. Diurnal raptors were observed at all points with use largely driven by buteos and harriers (Table 7). Waterfowl use was recorded at all but two points, ranging from 0.06 – 29.88 birds/20-min survey, and shorebird use was recorded at all points, ranging from 0.06 – 2.28 birds/20-min survey. Diurnal raptor use was highest at Point 10 (0.50 birds/20-min survey), and ranged from 0.12 – 0.47 birds/20-min survey at other points. Eagle use (for the observations included in the overall avian analysis that includes just the first 20-min of survey at each point) occurred at Point 2 only (0.06 birds/20-min survey), while falcons were only observed at Points 11 and 16 (0.06 birds/20-min survey at each point). Small bird use (focused within 100 m), was highest at Point 6 (28.28 birds/20-min survey), and ranged from 4 – 14.71 birds/20-min surveys at all other points; small bird use at all points was largely due to use by passerines (Table 7).

Table 7. Mean use recorded at each survey point during the first 20 minutes of Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Bird Type	Mean Use (number of birds/20-minute survey) ^a by Survey Point															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Waterbirds	38.24	0	0	0	0	1.94	0	0	0	0	0	0	0	0.06	0	0
Waterfowl	0.12	11.78	0.12	0.28	0.12	28.61	2.00	29.88	0	0.17	0.35	0.06	0.27	18.06	0	1.11
Shorebirds	0.47	0.17	0.59	0.39	0.29	2.28	0.20	0.31	0.71	0.28	0.29	0.38	0.60	1.61	0.06	0.72
Gulls/Terns	33.65	0	0	0	3.65	0	0	0	0.06	0	0	1.25	0	0	5	0
Diurnal Raptors	0.18	0.22	0.12	0.39	0.12	0.22	0.33	0.38	0.12	0.50	0.24	0.38	0.47	0.33	0.38	0.39
<i>Accipiters</i>	0	0	0	0	0.06	0	0.07	0	0	0.06	0	0	0	0.06	0	0.06
<i>Buteos</i>	0.12	0.17	0	0.28	0	0.22	0.27	0.19	0.12	0.39	0.18	0.38	0.47	0.22	0.25	0.17
<i>Northern Harrier</i>	0.06	0	0.06	0.11	0.06	0	0	0.12	0	0.06	0	0	0	0.06	0	0.11
<i>Eagles</i>	0	0.06	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<i>Falcons</i>	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0	0	0.06
<i>Other Raptors</i>	0	0	0.06	0	0	0	0	0.06	0	0	0	0	0	0	0.12	0
Vultures	0	0.11	0	0.17	0.06	0.17	0	0	0.06	0.06	0	0.25	0	0.06	0	0.17
Upland Game Birds	0.29	0.11	0.18	0.17	0.12	0.06	0.07	0.12	0.18	0.33	0	0.06	0.07	0.67	1.69	0
Doves/Pigeons	0.41	0.06	0.06	0.61	1	0.83	0.47	0.81	0.29	3.78	0.53	0.81	0.6	1.28	0.19	2.06
Large Corvids	0	0	0.35	0.06	0.47	0	0.13	0	0.18	0	0.06	0.06	0.07	0.11	1.75	0.83
Goatsuckers	0	0	0	0	0.06	0	0.07	0.06	0	0	0	0	0	0	0	0
Overall large birds	73.35	12.44	1.41	2.06	5.88	34.11	3.27	31.56	1.59	5.11	1.47	3.25	2.07	22.17	9.06	5.28
Passerines	14.71	10.39	5.35	12.28	6.06	28	7.93	4.94	11.47	8.44	4	7.81	7.4	3.17	10.19	13.44
Woodpeckers	0.06	0.06	0	0.06	0.06	0.28	0.07	0	0.35	0.06	0	0.12	0	0.22	0.06	0.06
Overall small birds	14.76	10.44	5.35	12.33	6.12	28.28	8.00	4.94	11.82	8.50	4.00	7.94	7.40	3.39	10.25	13.50

^a 800-m (m; 2,625-foot [ft]) radius plot for large birds; 100-m (328-ft) radius plot for small birds

Eagle Use and Flight Paths

Overall, there were 271 hours (16,260 min) of eagle fixed-point use surveys (60-min surveys) conducted at the Project (Table 8). During this time, four bald eagles (only eagle species recorded) were visible for 15 min regardless of behavior (e.g., perching, flying, etc); 11 of those total minutes were risk minutes (i.e., within 800 m and below 200 m; Table 8). The bald eagles recorded at points 6 and 14 were observed after the initial 20-min survey period. The individual recorded at Point 14 was perched when first observed, and then flew within 800 m and below 200 m (Figure 4); this individual was not included in Tables 5 and 6 due to its behavior when first observed, but was included in the eagle risk minutes analysis (Table 8). Of the two bald eagles recorded at Point 2, one was observed after the initial 20-min survey period. The few flight paths for bald eagles at the Project showed no apparent pattern (Figure 3).

Table 8. Survey effort, number of bald eagle observations and groups, total eagle minutes, risk minutes, and eagle use by season, observed during the Year One of the 60-min bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Season	Survey Effort (hours)	Number of Eagle Observations	Number of Groups	Total Eagle Minutes	Risk Minutes^a	Eagle Use^b
Spring	63	0	0	0	0	0
Summer	77	1	1	5	5	0.01
Fall	78	2	2	8	5	0.02
Winter	53	1	1	2	1	0.02
Overall	271	4	4	15	11	

^a Where eagles flew below 200 meters (m) above ground level and within 800 m of the observer

^b Eagles/800-m plot/60 minutes

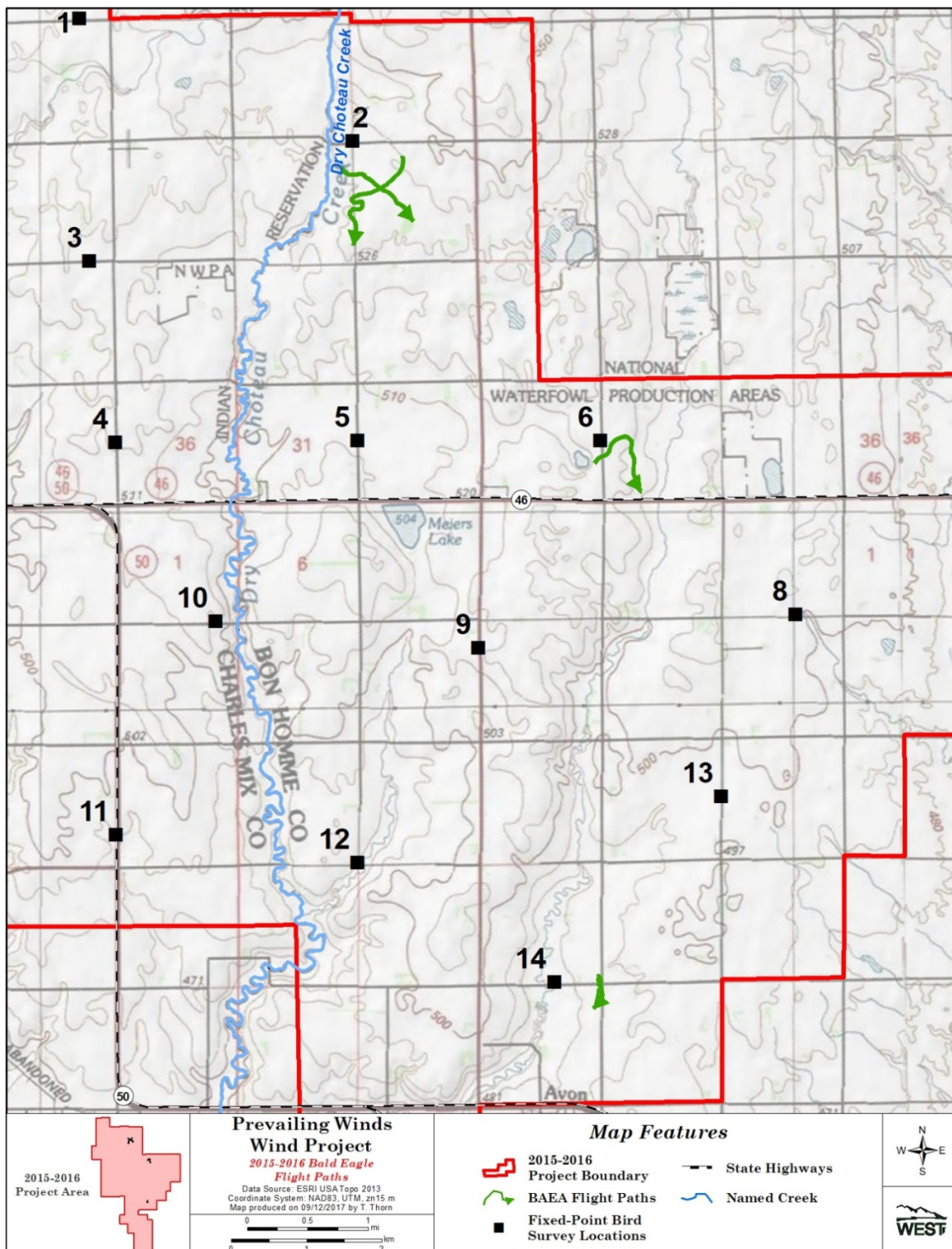


Figure 3. Bald eagle flight paths observed during the Year One 60-minute fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Incidental Observations

Sixteen unique bird species and two unidentified species were observed incidentally at the Project, totaling 2,153 birds within 73 separate groups (Table 9). Sandhill crane (1,054 birds within eight groups) and snow goose (950 birds within three groups) were the most abundant incidental species observed at the Project (Table 9). Eight unique and two unidentified diurnal raptor species were recorded incidentally, totaling 51 observations within 47 groups. Red-tailed hawk was the most abundant raptor species observed incidentally at the Project (29 birds within 27 groups); ferruginous hawk, sharp-shinned hawk, great horned owl (*Bubo virginianus*), and snowy owl (*Bubo scandiacus*) were only observed incidentally within the Project area.

Table 9. Incidental wildlife observed while conducting all surveys at the at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Species	Scientific Name	#Groups	# Individuals
sandhill crane	<i>Antigone canadensis</i>	8	1,054
snow goose	<i>Chen caerulescens</i>	3	950
Franklin's gull	<i>Leucophaeus pipixcan</i>	1	75
bald eagle	<i>Haliaeetus leucocephalus</i>	2	3
Cooper's hawk	<i>Accipiter cooperii</i>	1	1
ferruginous hawk ^a	<i>Buteo regalis</i>	1	1
northern harrier	<i>Circus cyaneus</i>	7	8
rough-legged hawk	<i>Buteo lagopus</i>	1	1
red-tailed hawk	<i>Buteo jamaicensis</i>	27	29
sharp-shinned hawk ^a	<i>Accipiter striatus</i>	1	1
Swainson's hawk	<i>Buteo swainsoni</i>	2	2
unidentified buteo	<i>Buteo spp</i>	1	1
unidentified hawk		4	4
great horned owl ^a	<i>Bubo virginianus</i>	1	1
snowy owl ^a	<i>Bubo scandiacus</i>	1	1
turkey vulture	<i>Cathartes aura</i>	8	13
wild turkey	<i>Meleagris gallopavo</i>	2	5
American crow	<i>Corvus brachyrhynchos</i>	2	3
Total		73	2,153

^a. Observed incidentally only

DISCUSSION

The Guidelines use a tiered approach to assess impacts to species and their habitats, and avian use surveys are one of a suite of Tier 3 studies used to inform risk at the Project. Tier 3 studies were targeted to address questions regarding impact that could not be sufficiently addressed using available literature (i.e., Tiers 1 and 2 desktop analyses). These studies provide additional data that, when combined with available literature reviewed in previous Tiers, allow for a confident assessment of the risk of significant population-level adverse impacts to special-status species; identify measures to mitigate significant adverse impacts, if necessary; and/or identify a need for more field studies, if the current survey effort did not provide sufficient data to adequately characterize the potential for significant adverse impacts to such species. While the avian use surveys reported herein were conducted across all species observed, the report

focuses on a smaller group of species – diurnal raptors, eagles, listed species, and State non-listed special-status species.

The impact of wind energy development on birds can be direct or indirect. Direct impacts include fatalities or injury associated with facility infrastructure and the loss of habitat where infrastructure is placed. Indirect impacts include the displacement of wildlife and rendering habitat unsuitable through fragmentation of the landscape.

The focus of this study was mainly to document large bird use with an emphasis on eagles and diurnal raptors. Approximately two thirds of all bird observations during this study were waterfowl or passerine species. The most common waterfowl species were snow and Canada geese, while the most common passerine species were European starling and red-winged blackbird. Waterbirds composed a small percentage of the total bird observations, with only two waterbird species (sandhill cranes and great blue herons) being recorded during bird use surveys. Relatively few (89 observations) diurnal raptors were observed during standardized surveys and 51 were recorded incidentally. The most common diurnal raptor species recorded was red-tailed hawk, documented both incidentally and during scheduled surveys; bald eagle was the only eagle species documented during surveys conducted at the Project. Diurnal raptors and non-listed special-status species are discussed in more detail below; no federally or state-listed species were documented during the Year One survey period.

Diurnal Raptors

Annual mean diurnal raptor use at the Project was 0.31 raptors/800-m plot/20-min survey, with highest use in the fall, likely from an influx of migrating raptors. Mean raptor use was compared with other wind energy facilities that implemented similar protocols and had data covering similar seasons, ranking 34th from the highest use compared to the 47 other wind energy facilities in North America (Figure 4).

Publicly available data containing both mean raptor use and raptor fatality information in the Midwest is scarce, while data having this information for four seasons is even rarer (Table 10). The Beethoven Project, immediately adjacent to the Project, had a mean raptor use of 0.103 raptors/800-m plot/20-min survey (Derby and Thorn 2014) and a raptor fatality rate of 0.07 fatalities/MW/year (WEST 2016; Table 10). The Wessington Springs Project, approximately 80 miles north of the project, in South Dakota had a mean raptor use of 0.23 raptors/800-m plot/20-min survey and raptor fatality rates of 0.06 and 0.07 fatalities/MW/year during two separate years of fatality monitoring (Derby et al. 2010f, 2011d). Raptor fatality rates reported at other South Dakota wind energy facilities have ranged from 0 – 0.20 fatalities/MW/year (Table 10). Raptor fatality rates throughout the Midwest have ranged from zero at numerous facilities to 0.47 fatalities/MW/year at Buffalo Ridge, Phase I (Johnson et al. 2000a).

In the Midwest states, 55 diurnal raptor fatalities representing seven species have been documented at wind energy facilities in publicly available fatality studies. Red-tailed hawks represented most of the fatalities (38 fatalities; 69.1% of raptor fatalities), followed by American kestrel (five fatalities; 9.1% of raptor fatalities), sharp-shinned hawk (four fatalities; 7.3% of

raptor fatalities), rough-legged hawk (three fatalities; 5.5% of raptor fatalities), and Cooper's hawk (two fatalities; 3.6% of raptor fatalities). Each of the remaining species (merlin [*Falco columbarius*], Swainson's hawk, and unidentified raptor) accounted for one fatality each. These are unadjusted, raw data. Cumulative fatalities and species are from data compiled by WEST from publicly available fatality studies (a list of facilities and references are available from WEST). Based on the currently available data, raptor fatality rates in the Project will likely be similar to other wind energy facilities in the Midwest that also have low raptor use and are likely to consist of the relatively common and widespread species documented in this survey.

Diurnal Raptors

Wind Energy Facility	Mean use (#birds/plot/20-min survey)
High Winds, CA	2.3
Diablo Winds, CA	2.1
Altamont Pass, CA	1.6
Elkhorn, OR	1.1
Big Smile, OK	0.9
Cotterel Mtn., ID	0.9
Swauk Ridge, WA	0.8
Golden Hills, OR	0.8
Windy Flats, WA	0.8
Combine Hills, OR	0.7
Desert Claim, WA	0.7
Hopkins Ridge, WA	0.7
Reardon, WA	0.7
Stateline Reference, OR	0.7
Buffalo Ridge, MN	0.6
White Creek, WA	0.6
Footie Creek Rim, WY	0.5
Roosevelt, WA	0.5
Leaning Juniper, OR	0.5
Dunlap, WY	0.5
Klondike, OR	0.5
Stateline, WA/OR	0.5
Antelope Ridge, OR	0.5
Condon, OR	0.5
High Plains, WY	0.4
Zintel Canyon, WA	0.4
Nine Canyon, WA	0.4
Maiden, WA	0.4
Hatchet Ridge, CA	0.4
Bitter Root, MN	0.4
Timber Road (Phase II), OH	0.4
Biglow Canyon, OR	0.4
Prevailing Winds, SD	0.3
Wild Horse, WA	0.3
North Sky River, CA	0.3
AOCM (CPC Proper), CA	0.3
Biglow Reference, OR	0.3
Simpson Ridge, WY	0.3
Prairie Winds SD, SD	0.3
Vantage, WA	0.3
Grand Ridge, IL	0.2
Tehachapi Pass, CA	0.2
Sunshine, AZ	0.2
Dry Lake, AZ	0.2
Alta East (2011), CA	0.2
Beethoven, SD	0.1
Alta East (2010), CA	0.1
San Geronio, CA	0.1
AOCM (CPC East), CA	0.1

Figure 4. Comparison of estimated annual diurnal raptor use during the Year One fixed-point bird use surveys conducted at the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016, and diurnal raptor use at other US wind resource areas with comparable raptor use data.

Data from the following sources:

Study and Location	Reference	Study and Location	Reference	Study and Location	Reference
Prevailing Winds, SD	This study.				
High Winds, CA	Kerlinger et al. 2005	Footie Creek Rim, WY	Johnson et al. 2000b	Wild Horse, WA	Erickson et al. 2003d
Diablo Winds, CA	WEST 2006	Roosevelt, WA	NWC and WEST 2004	North Sky River, CA	Erickson et al. 2011
Altamont Pass, CA	Orloff and Flannery 1992	Leaning Juniper, OR	Kronner et al. 2005	AOCM (CPC Proper), CA	Chatfield et al. 2010
Elkhorn, OR	WEST 2005a	Dunlap, WY	Johnson et al. 2009a	Biglow Reference, OR	WEST 2005c
Big Smile (Dempsey), OK	Derby et al. 2010a	Klondike, OR	Johnson et al. 2002	Simpson Ridge, WY	Johnson et al. 2000b
Cotterel Mtn., ID	BLM 2006	Stateline, WA/OR	Erickson et al. 2003a	Vantage, WA	Jeffrey et al. 2007
Swauk Ridge, WA	Erickson et al. 2003b	Antelope Ridge, OR	WEST 2009	Grand Ridge, IL	Derby et al. 2009
Golden Hills, OR	Jeffrey et al. 2008	Condon, OR	Erickson et al. 2002b	Tehachapi Pass, CA	Anderson et al. 2000, Erickson et al. 2002b
Windy Flats, WA	Johnson et al. 2007	High Plains, WY	Johnson et al. 2009b	Sunshine, AZ	WEST and the CPRS 2006
Combine Hills, OR	Young et al. 2003c	Zintel Canyon, WA	Erickson et al. 2002a, 2003c	Dry Lake, AZ	Young et al. 2007b
Desert Claim, WA	Young et al. 2003b	Nine Canyon, WA	Erickson et al. 2001	Alta East (2011), CA	Chatfield et al. 2011
Hopkins Ridge, WA	Young et al. 2003a	Maiden, WA	Young et al. 2002	Alta East (2010), CA	Chatfield et al. 2011
Reardon, WA	WEST 2005b	Hatchet Ridge, CA	Young et al. 2007a	San Geronio, CA	Anderson et al. 2000, Erickson et al. 2002b
Stateline Reference, OR	URS et al. 2001	Bitter Root, MN	Derby and Dahl 2009	AOCM (CPC East), CA	Chatfield et al. 2010
Buffalo Ridge, MN	Johnson et al. 2000a	Timber Road (Phase II), OH	Good et al. 2010	Beethoven, SD	Derby and Thorn 2014
White Creek, WA	NWC and WEST 2005	Biglow Canyon, OR	WEST 2005c		

WEST, Inc.

21

February 16, 2018

Table 10. Raptor use (number of raptors/plot/20-minute survey) and fatality (number of bird fatalities/megawatt/year) estimates for wind-energy facilities in the Midwest with publicly available data.

Project Name	Raptor Use Estimate	Raptor Fatality Estimate	Total #of Turbines	Total MW	Use Reference	Fatality Reference
Barton I & II, IA (2010-2011)	NA	0	80	160.0	Derby and Thorn 2014	Derby et al. 2011a
Beethoven (2016-2016)	0.103	0.07	43	80.0		WEST 2016
Big Blue, MN (2013)	NA	0	18	36.0		Fagen Engineering 2014
Big Blue, MN (2014)	NA	0	18	36.0		Fagen Engineering 2015
Blue Sky Green Field, WI (2008; 2009)	NA	0	88	145.0		Gruver et al. 2009
Buffalo Ridge I, SD (2009-2010)	NA	0.20	24	50.4		Derby et al. 2010b
Buffalo Ridge II, SD (2011-2012)	NA	0	105	210.0		Derby et al. 2012a
Buffalo Ridge, MN (Phase I; 1996)	NA	0	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1997)	NA	0	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1998)	NA	0	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase I; 1999)	NA	0.47	73	25.0		Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1998)	NA	0	143	107.3		Johnson et al. 2000a
Buffalo Ridge, MN (Phase II; 1999)	NA	0	143	107.3		Johnson et al. 2000a
Buffalo Ridge, MN (Phase III; 1999)	NA	0	138	103.5		Johnson et al. 2000a
Cedar Ridge, WI (2009)	NA	0.18	41	67.6		BHE Environmental 2010
Cedar Ridge, WI (2010)	NA	0.13	41	68.0		BHE Environmental 2011
Elm Creek II, MN (2009-2010)	NA	0	67	100.0		Derby et al. 2010c
Elm Creek, MN (20011-2012)	NA	0	62	148.8		Derby et al. 2012b
Fowler I, IN (2009)	NA	0	162	301.0		Johnson et al. 2010
Grand Ridge I, IL (2009-2010)	0.2	0	66	99.0	Derby et al. 2009	Derby et al. 2010g
Kewaunee County, WI (1999-2001)	NA	0	31	20.5		Howe et al. 2002
Moraine II, MN (2009)	NA	0.37	33	49.5		Derby et al. 2010d
NPPD Ainsworth, NE (2006)	NA	0.06	36	20.5		Derby et al. 2007
Pioneer Prairie II, IA (2011-2012)	NA	0	62	102.3		Chodachek et al. 2012
PrairieWinds ND1 (Minot), ND (2010)	NA	0.05	80	115.5		Derby et al. 2011c
PrairieWinds ND1 (Minot), ND (2011)	NA	0.05	80	115.5		Derby et al. 2012c
PrairieWinds SD1, SD (2011-2012)	NA	0	108	162.0		Derby et al. 2012d
PrairieWinds SD1, SD (2012-2013)	NA	0.03	108	162.0		Derby et al. 2013
PrairieWinds SD1, SD (2013-2014)	NA	0.17	108	162.0		Derby et al. 2014
Rail Splitter, IL (2012-2013)	NA	0	67	100.5		Good et al. 2013
Ripley, Ont (2008)	NA	0.10	38	76.0		Jacques Whitford 2009
Rugby, ND (2010-2011)	NA	0.06	71	149.0		Derby et al. 2011b
Top of Iowa, IA (2003)	NA	0	89	80.0		Jain 2005
Top of Iowa, IA (2004)	NA	0.17	89	80.0		Jain 2005
Wessington Springs, SD (2009)	0.23	0.06	34	51.0	Derby et al. 2008	Derby et al. 2010f

Table 10. Raptor use (number of raptors/plot/20-minute survey) and fatality (number of bird fatalities/megawatt/year) estimates for wind-energy facilities in the Midwest with publicly available data.

Project Name	Raptor Use Estimate	Raptor Fatality Estimate	Total #of Turbines	Total MW	Use Reference	Fatality Reference
Wessington Springs, SD (2010)	0.23	0.07	34	51.0	Derby et al. 2008	Derby et al. 2011d
Winnebago, IA (2009-2010)	NA	0.27	10	20.0		Derby et al. 2010e

This fixed-point bird use survey was designed to provide a relative index of use by raptors during all seasons at the Project. While mean diurnal raptor use was higher during the fall (0.52 raptors/800-m plot/20-min survey), probably due to an influx of migrant birds, the Project is not located within a known raptor migration corridor, and there are no features unique to the Project area, compared to adjacent areas, that would appear to attract large numbers of diurnal raptors. Furthermore, raptor fatality rates reported from studies in the Midwest are typically low. Site-specific and regional data suggest there is some potential for raptor mortality, but these potential impacts to individuals are unlikely to cause significant adverse impacts to raptor populations. Likewise, there is some potential for habitat loss and displacement of individuals, but the resources available within the Project area are widely available at the local landscape level; therefore, any diurnal raptor habitat loss and displacement attributable to the Project is unlikely to result in significant adverse population-level impacts to raptors.

While abundance is intuitively connected to raptor fatality risk to some degree, risk is likely influenced by other factors as well, such as species-specific flight behaviors. More than half (58.2%) of all diurnal raptors at the Project were observed below the RSH. A higher proportion of unidentified raptors, buteos, and eagles flew within the RSH compared to other raptor types, potentially indicating that some species may have a higher risk for collision; however, many of these are based on a few individual observations.

Species Specific Summaries

Great blue heron

One great blue heron, a common summer resident and migrant in South Dakota, was recorded during the surveys conducted at the Project. Site-specific data indicate that use of the Project area by this species is low and population-level effects from Project development are unlikely.

Bald Eagle

A total of seven bald eagle observations (four during 60-min surveys and regardless of distance from observer, and three incidentally) were recorded within the Project area during Year One surveys conducted from March 25, 2015 – February 21, 2016 (Table 4). The majority (66.7%) of flying bald eagles recorded during fixed-point bird use surveys were observed within the RSH (Table 5). Bald eagles are generally uncommon during migration, summer, and winter throughout South Dakota; however, they are locally common below the Missouri River dams in winter and nesting within the State is increasingly reported (South Dakota Birds, Birding, and Nature 2017). An April 2015 raptor nest survey conducted by WEST found one occupied/active bald eagle nest recorded within one mi (1.6 km) of the Project boundary. There were also five occupied/active bald eagle nests, one occupied/active eagle nest (species unknown), and one unoccupied eagle nest (species unknown) recorded within or next to the 10-mi (16-km) buffer during the April 2015 raptor nest survey.

The limited eagle observations during this bird use survey and the raptor nest survey conducted in 2015 suggest that the Project does not fall within a major bald eagle migration route, wintering area, or breeding home range of current nests, but the presence of active bald eagle

nests in the vicinity of the Project indicates bald eagles are present in the general area for an extended period of time (breeding season). Thus, development of the Project may influence individuals moving through or using the Project area, but potential impact to bald eagle populations appears minimal.

Swainson's and Ferruginous Hawk

There were four observations of Swainson's and one ferruginous hawk were recorded during the study period (Table 4). Seventy-five percent of the Swainson's hawk observations were of flying individuals, but none of those hawks were observed flying within the RSH (Table 6). Swainson's hawks are common in South Dakota and utilize a variety of habitats, including open grasslands with occasional trees and shrubs, wetland edges, and agriculture fields, nesting in trees, shrubs, or occasionally on the ground (South Dakota Birds, Birding, and Nature 2017). The one ferruginous hawk was not observed flying. Ferruginous hawk, an uncommon migrant and summer resident, is rarely observed in winter, and inhabits grasslands and open areas (South Dakota Birds, Birding, and Nature 2017).

The potential for individual mortality does exist for both species; however, the low number of fatalities reported throughout projects in the Midwest (one Swainson's hawk and no ferruginous hawk fatalities out of 55 total reported fatalities) suggests that these species are not particularly susceptible to turbine collisions. Collision mortality may affect a few individuals, but are unlikely to cause significant adverse impacts to either populations of the species.

Goshawk and Sharp-shinned and Cooper's Hawk

One goshawk, one sharp-shinned hawk and four Cooper's hawks were recorded during the study period. All are an uncommon migrant in South Dakota, generally preferring wooded areas (South Dakota Birds, Birding, and Nature 2017). Only two Cooper's hawks and no sharp-shinned or goshawks have been found as fatalities through projects in the Midwest. Collision mortality may affect a few individuals of these species, but significant population-level impacts are unlikely.

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**Appendix A. Descriptive Statistics for Bird Species Recorded during Year One of Fixed-Point Bird
Use Surveys Conducted at the Prairie Winds Wind Project in Bon Homme and Charles Mix
counties, South Dakota, from March 25, 2015 – February 21, 2016**

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year One fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
Waterbirds		4	701	0	0	1	35	0	0	5	736
great blue heron ^a	<i>Ardea herodias</i>	1	1	0	0	0	0	0	0	1	1
sandhill crane	<i>Antigone canadensis</i>	3	700	0	0	1	35	0	0	4	735
Waterfowl		21	725	6	53	4	321	13	1,046	44	2,145
Canada goose	<i>Branta canadensis</i>	3	402	2	41	0	0	5	415	10	858
greater white-fronted goose	<i>Anser albifrons</i>	1	50	0	0	0	0	1	6	2	56
lesser scaup	<i>Aythya affinis</i>	1	6	0	0	0	0	0	0	1	6
mallard	<i>Anas platyrhynchos</i>	11	59	3	8	2	4	3	35	19	106
northern shoveler	<i>Anas clypeata</i>	1	2	0	0	1	17	0	0	2	19
snow goose	<i>Chen caerulescens</i>	0	0	0	0	0	0	4	590	4	590
unidentified duck		4	206	0	0	0	0	0	0	4	206
unidentified goose		0	0	0	0	1	300	0	0	1	300
wood duck	<i>Aix sponsa</i>	0	0	1	4	0	0	0	0	1	4
Shorebirds		31	34	32	76	11	52	0	0	74	162
killdeer	<i>Charadrius vociferus</i>	24	27	13	23	6	10	0	0	43	60
unidentified shorebird		0	0	4	36	5	42	0	0	9	78
upland sandpiper	<i>Bartramia longicauda</i>	7	7	15	17	0	0	0	0	22	24
Gulls/Terns		4	693	0	0	2	42	0	0	6	735
Franklin's gull	<i>Leucophaeus pipixcan</i>	4	693	0	0	1	20	0	0	5	713
unidentified gull		0	0	0	0	1	22	0	0	1	22
Diurnal Raptors		9	10	14	14	41	45	19	20	83	89
<u>Accipiters</u>		0	0	0	0	2	2	3	3	5	5
Cooper's hawk ^a	<i>Accipiter cooperii</i>	0	0	0	0	2	2	2	2	4	4
northern goshawk ^{a,b}	<i>Accipiter gentilis</i>	0	0	0	0	0	0	1	1	1	1
<u>Buteos</u>		6	7	8	8	30	34	13	14	57	63
red-tailed hawk	<i>Buteo jamaicensis</i>	6	7	8	8	28	30	9	10	51	55
rough-legged hawk	<i>Buteo lagopus</i>	0	0	0	0	0	0	3	3	3	3
Swainson's hawk ^a	<i>Buteo swainsoni</i>	0	0	0	0	2	4	0	0	2	4
unidentified buteo	<i>Buteo spp</i>	0	0	0	0	0	0	1	1	1	1
<u>Northern Harrier</u>		2	2	4	4	5	5	0	0	11	11
northern harrier	<i>Circus cyaneus</i>	2	2	4	4	5	5	0	0	11	11
<u>Eagles</u>		0	0	0	0	0	0	1	1	1	1
bald eagle ^{a,b,c}	<i>Haliaeetus leucocephalus</i>	0	0	0	0	0	0	1	1	1	1

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year One fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
<u>Falcons</u>		0	0	0	0	0	0	2	2	2	2
American kestrel	<i>Falco sparverius</i>	0	0	0	0	0	0	2	2	2	2
<u>Other Raptors</u>		1	1	2	2	4	4	0	0	7	7
unidentified hawk		1	1	1	1	2	2	0	0	4	4
unidentified raptor		0	0	1	1	2	2	0	0	3	3
Vultures		2	2	3	9	5	8	0	0	10	19
turkey vulture	<i>Cathartes aura</i>	2	2	3	9	5	8	0	0	10	19
Upland Game Birds		12	14	13	13	4	26	4	16	33	69
gray partridge	<i>Perdix perdix</i>	0	0	0	0	0	0	1	5	1	5
ring-necked pheasant	<i>Phasianus colchicus</i>	11	13	12	12	3	3	2	2	28	30
sharp-tailed grouse	<i>Tympanuchus phasianellus</i>	1	1	0	0	0	0	0	0	1	1
wild turkey	<i>Meleagris gallopavo</i>	0	0	1	1	1	23	1	9	3	33
Doves/Pigeons		12	16	37	55	17	105	8	63	74	239
Eurasian collared-dove	<i>Streptopelia decaocto</i>	0	0	1	1	0	0	0	0	1	1
mourning dove	<i>Zenaida macroura</i>	10	13	35	53	14	80	0	0	59	146
rock pigeon	<i>Columba livia</i>	2	3	1	1	3	25	8	63	14	92
Large Corvids		6	6	1	2	12	33	6	27	25	68
American crow	<i>Corvus brachyrhynchos</i>	6	6	1	2	12	33	6	27	25	68
Passerines		158	370	217	623	129	2,116	28	781	532	3,890
American goldfinch	<i>Spinus tristis</i>	1	1	5	5	1	1	0	0	7	7
American robin	<i>Turdus migratorius</i>	22	47	10	15	10	75	0	0	42	137
Baltimore oriole	<i>Icterus galbula</i>	0	0	1	1	0	0	0	0	1	1
bank swallow	<i>Riparia riparia</i>	0	0	0	0	1	4	0	0	1	4
barn swallow	<i>Hirundo rustica</i>	3	10	39	98	10	61	0	0	52	169
blue jay	<i>Cyanocitta cristata</i>	0	0	0	0	2	3	0	0	2	3
bobolink	<i>Dolichonyx oryzivorus</i>	1	1	4	4	0	0	0	0	5	5
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	0	0	0	0	1	150	0	0	1	150
brown-headed cowbird	<i>Molothrus ater</i>	20	96	19	47	3	23	0	0	42	166
brown thrasher	<i>Toxostoma rufum</i>	1	1	1	1	0	0	0	0	2	2
chipping sparrow	<i>Spizella passerina</i>	1	1	0	0	0	0	0	0	1	1
cliff swallow	<i>Petrochelidon pyrrhonota</i>	0	0	4	16	0	0	0	0	4	16
common grackle	<i>Quiscalus quiscula</i>	11	22	6	7	3	14	0	0	20	43
common yellowthroat	<i>Geothlypis trichas</i>	0	0	2	2	0	0	0	0	2	2
dark-eyed junco	<i>Junco hyemalis</i>	0	0	0	0	0	0	1	30	1	30

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year One fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
dickcissel	<i>Spiza americana</i>	0	0	15	18	0	0	0	0	15	18
eastern bluebird	<i>Sialia sialis</i>	1	1	0	0	1	4	0	0	2	5
eastern kingbird	<i>Tyrannus tyrannus</i>	0	0	23	34	0	0	0	0	23	34
European starling	<i>Sturnus vulgaris</i>	2	2	1	19	8	553	2	213	13	787
field sparrow	<i>Spizella pusilla</i>	0	0	0	0	0	0	3	11	3	11
grasshopper sparrow	<i>Ammodramus savannarum</i>	1	2	0	0	0	0	0	0	1	2
Harris' sparrow	<i>Zonotrichia querula</i>	0	0	0	0	1	1	0	0	1	1
horned lark	<i>Eremophila alpestris</i>	9	14	1	2	5	69	15	402	30	487
house wren	<i>Troglodytes aedon</i>	0	0	0	0	1	1	0	0	1	1
Lapland longspur	<i>Calcarius lapponicus</i>	0	0	0	0	0	0	2	40	2	40
loggerhead shrike	<i>Lanius ludovicianus</i>	1	2	0	0	0	0	0	0	1	2
northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	0	0	1	2	0	0	0	0	1	2
orchard oriole	<i>Icterus spurius</i>	0	0	1	2	0	0	0	0	1	2
red-winged blackbird	<i>Agelaius phoeniceus</i>	16	85	15	138	11	351	0	0	42	574
Savannah sparrow	<i>Passerculus sandwichensis</i>	0	0	7	9	3	5	0	0	10	14
snow bunting	<i>Plectrophenax nivalis</i>	0	0	0	0	0	0	2	23	2	23
song sparrow	<i>Melospiza melodia</i>	0	0	1	1	3	13	0	0	4	14
tree swallow	<i>Tachycineta bicolor</i>	0	0	5	6	0	0	0	0	5	6
unidentified blackbird		0	0	1	1	5	659	0	0	6	660
unidentified passerine		2	3	2	24	8	15	1	7	13	49
unidentified sparrow		0	0	0	0	8	20	0	0	8	20
unidentified swallow		1	1	2	45	0	0	0	0	3	46
vesper sparrow	<i>Poocetes gramineus</i>	3	3	1	1	0	0	0	0	4	4
western kingbird	<i>Tyrannus verticalis</i>	0	0	4	6	0	0	0	0	4	6
western meadowlark	<i>Sturnella neglecta</i>	62	78	44	68	43	93	2	55	151	294
	<i>Xanthocephalus</i>										
yellow-headed blackbird	<i>xanthocephalus</i>	0	0	2	51	0	0	0	0	2	51
yellow warbler	<i>Setophaga petechia</i>	0	0	0	0	1	1	0	0	1	1
Goatsuckers		0	0	3	3	0	0	0	0	3	3
common nighthawk	<i>Chordeiles minor</i>	0	0	3	3	0	0	0	0	3	3
Woodpeckers		8	8	6	7	6	9	4	7	24	31
hairy woodpecker	<i>Picoides villosus</i>	1	1	0	0	0	0	0	0	1	1
northern flicker	<i>Colaptes auratus</i>	7	7	4	4	5	8	4	7	20	26

Appendix A1. Summary of individuals and group observations, regardless of distance from observer, by bird type and species recorded during the first 20 minutes of Year One fixed-point bird use surveys conducted in the Prevailing Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Scientific Name	Spring		Summer		Fall		Winter		Total	
		# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs	# Grps	# Obs
red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	0	0	2	3	1	1	0	0	3	4
Unidentified Birds		0	0	0	0	0	0	1	8	1	8
unidentified bird (small)		0	0	0	0	0	0	1	8	1	8
Overall		267	2579	332	855	232	2,792	83	1,968	914	8,194

Grps = Number of groups, # Obs = Number of observations

^a. State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

^b. State Species of Greatest Conservation Need (SDGFP 2014)

^c. Bald and Golden Eagle Protection Act (1940)

Appendix A2. Mean large bird use (number of large birds/800-meter radius plot/20-minute survey), percent of total use, and frequency of occurrence for each large bird type and species by season during Year One of the fixed-point bird use surveys conducted at the Prairie Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Mean Use				Percent of Use (%)				Frequency of Occurrence (%)			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Waterbirds	10.17	0	0.44	0	33.4	0	5.2	0	3.2	0	1.2	0
great blue heron ^a	0.02	0	0	0	<0.1	0	0	0	1.7	0	0	0
sandhill crane	10.16	0	0.44	0	33.4	0	5.2	0	1.6	0	1.2	0
Waterfowl	8.21	0.18	4.01	11.66	27	7.6	47.6	80.1	22.1	5.5	5.2	7.8
Canada goose	6.28	0.01	0	3.36	20.6	0.5	0	23.1	3.1	1.2	0	6.2
greater white-fronted goose	0.78	0	0	0.09	2.6	0	0	0.6	1.6	0	0	1.6
lesser scaup	0.09	0	0	0	0.3	0	0	0	1.6	0	0	0
mallard	0.92	0.11	0.05	0.55	3	4.8	0.6	3.8	17.2	4.3	2.7	4.7
northern shoveler	0.03	0	0.21	0	0.1	0	2.5	0	1.7	0	1.2	0
snow goose	0	0	0	7.66	0	0	0	52.6	0	0	0	3.1
unidentified duck	0.09	0	0	0	0.3	0	0	0	4.8	0	0	0
unidentified goose	0	0	3.75	0	0	0	44.5	0	0	0	1.2	0
wood duck	0	0.06	0	0	0	2.4	0	0	0	1.4	0	0
Shorebirds	0.54	0.98	0.65	0	1.8	40.7	7.7	0	41	35.5	12.5	0
killdeer	0.43	0.3	0.12	0	1.4	12.6	1.5	0	34.8	16	7.5	0
unidentified shorebird	0	0.45	0.52	0	0	18.7	6.2	0	0	3.8	5	0
upland sandpiper	0.11	0.22	0	0	0.4	9.3	0	0	9.4	18.7	0	0
Gulls/Terns	10.83	0	0.56	0	35.6	0	6.7	0	6.2	0	2.7	0
Franklin's gull	10.83	0	0.25	0	35.6	0	3	0	6.2	0	1.2	0
unidentified gull	0	0	0.31	0	0	0	3.7	0	0	0	1.4	0
Diurnal Raptors	0.10	0.18	0.52	0.45	0.3	7.4	6.1	3.1	7.9	13.9	35.9	37.4
<i>Accipiters</i>	0	0	0.03	0.10	0	0	0.3	0.7	0	0	2.7	10
Cooper's hawk ^a	0	0	0.03	0.06	0	0	0.3	0.4	0	0	2.7	5.8
northern goshawk ^{a,b}	0	0	0	0.04	0	0	0	0.3	0	0	0	4.2
<i>Buteos</i>	0.05	0.10	0.41	0.30	0.2	4.2	4.9	2.1	4.7	8.9	32	24.2
red-tailed hawk	0.05	0.10	0.36	0.21	0.2	4.2	4.2	1.4	4.7	8.9	29.3	15.2
rough-legged hawk	0	0	0	0.07	0	0	0	0.5	0	0	0	7.4
Swainson's hawk ^a	0	0	0.06	0	0	0	0.7	0	0	0	2.7	0
unidentified buteo	0	0	0	0.02	0	0	0	0.1	0	0	0	1.6
<i>Northern Harrier</i>	0.03	0.05	0.06	0	0.1	2.1	0.8	0	3.2	5	6.4	0
northern harrier	0.03	0.05	0.06	0	0.1	2.1	0.8	0	3.2	5	6.4	0
<i>Eagles</i>	0	0	0	0.02	0	0	0	0.1	0	0	0	1.6
bald eagle ^{a,b,c}	0	0	0	0.02	0	0	0	0.1	0	0	0	1.6
<i>Falcons</i>	0	0	0	0.03	0	0	0	0.2	0	0	0	3.3

Appendix A2. Mean large bird use (number of large birds/800-meter radius plot/20-minute survey), percent of total use, and frequency of occurrence for each large bird type and species by season during Year One of the fixed-point bird use surveys conducted at the Prairie Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Mean Use				Percent of Use (%)				Frequency of Occurrence (%)			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
American kestrel	0	0	0	0.03	0	0	0	0.2	0	0	0	3.3
<i>Other Raptors</i>	0.02	0.02	0.01	0	<0.1	1	0.2	0	1.7	2.5	1.4	0
unidentified hawk	0.02	0.01	0.01	0	<0.1	0.5	0.2	0	1.7	1.2	1.4	0
unidentified raptor	0	0.01	0	0	0	0.5	0	0	0	1.2	0	0
Vultures	0.03	0.12	0.10	0	0.1	5.1	1.2	0	3.1	4.1	6.4	0
turkey vulture	0.03	0.12	0.10	0	0.1	5.1	1.2	0	3.1	4.1	6.4	0
Upland Game Birds	0.22	0.17	0.33	0.64	0.7	7.2	3.9	4.4	17.4	17.4	5.2	10.0
gray partridge	0	0	0	0.21	0	0	0	1.4	0	0	0	4.2
ring-necked pheasant	0.21	0.16	0.04	0.06	0.7	6.6	0.5	0.4	17.4	16	3.9	5.8
sharp-tailed grouse	0.02	0	0	0	<0.1	0	0	0	1.6	0	0	0
wild turkey	0	0.01	0.29	0.38	0	0.6	3.4	2.6	0	1.4	1.2	4.2
Doves/Pigeons	0.25	0.70	1.41	1.37	0.8	29.3	16.7	9.4	17.2	41.0	17.3	17.8
Eurasian collared-dove	0	0.01	0	0	0	0.5	0	0	0	1.2	0	0
mourning dove	0.20	0.68	1.09	0	0.7	28.2	13	0	14.1	41	16.1	0
rock pigeon	0.05	0.01	0.31	1.37	0.2	0.5	3.7	9.4	3.1	1.2	3.8	17.8
Large Corvids	0.09	0.02	0.41	0.44	0.3	1	4.9	3	9.4	1.2	12.5	9.7
American crow	0.09	0.02	0.41	0.44	0.3	1	4.9	3	9.4	1.2	12.5	9.7
Goatsuckers	0	0.04	0	0	0	1.7	0	0	0	4	0	0
common nighthawk	0	0.04	0	0	0	1.7	0	0	0	4	0	0
Overall	30.43	2.40	8.43	14.56	100	100	100	100				

Note: Totals by bird type and overall might not correspond to the sum of individual species due to rounding

^a. State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)

^b. State Species of Greatest Conservation Need (SDGFP 2014)

^c. Bald and Golden Eagle Protection Act (1940)

Appendix A3. Mean small bird use (number of large birds/100-meter plot/20-minute survey), percent of total use, and frequency of occurrence for each small bird type and species by season during Year One of the fixed-point bird use surveys conducted at the Prairie Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Mean Use				Percent of Use (%)				Frequency of Occurrence (%)			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
Passerines	5.88	6.83	15.59	11.48	97.9	99.1	99.2	99.6	90.6	90.0	65.0	39.6
American goldfinch	0.02	0.07	0.01	0	0.3	1	<0.1	0	1.6	6.6	1.2	0
American robin	0.76	0.2	0.91	0	12.6	2.9	5.8	0	31.9	12	7.7	0
Baltimore oriole	0	0.01	0	0	0	0.2	0	0	0	1.4	0	0
bank swallow	0	0	0.05	0	0	0	0.3	0	0	0	1.2	0
barn swallow	0.16	1.06	0.79	0	2.6	15.4	5	0	4.7	34	10.7	0
blue jay	0	0	0.04	0	0	0	0.2	0	0	0	2.5	0
bobolink	0.02	0.06	0	0	0.3	0.8	0	0	1.6	5.5	0	0
Brewer's blackbird	0	0	1.88	0	0	0	11.9	0	0	0	1.2	0
brown-headed												
cowbird	1.52	0.61	0.16	0	25.4	8.9	1	0	28.8	23.3	2.7	0
brown thrasher	0.02	0.01	0	0	0.3	0.2	0	0	1.6	1.4	0	0
chipping sparrow	0.02	0	0	0	0.3	0	0	0	1.6	0	0	0
cliff swallow	0	0.20	0	0	0	2.9	0	0	0	5	0	0
common grackle	0.35	0.10	0.18	0	5.8	1.4	1.1	0	12.6	8.3	3.8	0
common yellowthroat	0	0.03	0	0	0	0.4	0	0	0	2.7	0	0
dark-eyed junco	0	0	0	1.25	0	0	0	10.8	0	0	0	4.2
dickcissel	0	0.23	0	0	0	3.4	0	0	0	19.6	0	0
eastern bluebird	0.02	0	0.05	0	0.3	0	0.3	0	1.6	0	1.2	0
eastern kingbird	0	0.38	0	0	0	5.5	0	0	0	23.5	0	0
European starling	0.03	0.24	1.07	0	0.5	3.4	6.8	0	1.6	1.2	3.9	0
field sparrow	0	0	0	0.17	0	0	0	1.5	0	0	0	4.7
grasshopper sparrow	0.03	0	0	0	0.5	0	0	0	1.6	0	0	0
Harris' sparrow	0	0	0.01	0	0	0	<0.1	0	0	0	1.2	0
horned lark	0.22	0.03	0.87	7.15	3.7	0.4	5.5	62	14.2	1.3	5.4	27.5
house wren	0	0	0.01	0	0	0	<0.1	0	0	0	1.4	0
Lapland longspur	0	0	0	1.17	0	0	0	10.1	0	0	0	5.8
loggerhead shrike	0.03	0	0	0	0.6	0	0	0	1.7	0	0	0
northern rough-												
winged swallow	0	0.03	0	0	0	0.4	0	0	0	1.3	0	0
orchard oriole	0	0.03	0	0	0	0.4	0	0	0	1.4	0	0
red-winged blackbird	1.37	1.54	2.31	0	22.9	22.3	14.7	0	22.1	17.7	9.3	0
Savannah sparrow	0	0.12	0.06	0	0	1.7	0.4	0	0	9.5	2.7	0

Appendix A3. Mean small bird use (number of large birds/100-meter plot/20-minute survey), percent of total use, and frequency of occurrence for each small bird type and species by season during Year One of the fixed-point bird use surveys conducted at the Prairie Winds Wind Project in Bon Homme and Charles Mix counties, South Dakota, from March 25, 2015 – February 21, 2016.

Type/Species	Mean Use				Percent of Use (%)				Frequency of Occurrence (%)			
	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter
snow bunting	0	0	0	0.88	0	0	0	7.7	0	0	0	5.8
song sparrow	0	0.01	0.16	0	0	0.2	1	0	0	1.2	3.9	0
tree swallow	0	0.06	0	0	0	0.9	0	0	0	3.8	0	0
unidentified blackbird	0	0.01	5.5	0	0	0.2	35	0	0	1.2	2.5	0
unidentified passerine	0.05	0.3	0.2	0	0.8	4.4	1.3	0	3.2	2.6	9.3	0
unidentified sparrow	0	0	0.17	0	0	0	1.1	0	0	0	6.6	0
unidentified swallow	0.02	0	0	0	0.3	0	0	0	1.7	0	0	0
vesper sparrow	0.05	0.01	0	0	0.8	0.2	0	0	3.1	1.4	0	0
western kingbird	0	0.04	0	0	0	0.6	0	0	0	2.6	0	0
western meadowlark	1.22	0.68	1	0.86	20.3	9.8	6.4	7.5	74.6	44.7	35	3.1
yellow-headed blackbird	0	0.68	0	0	0	9.9	0	0	0	2.8	0	0
yellow warbler	0	0	0.01	0	0	0	<0.1	0	0	0	1.4	0
Woodpeckers	0.12	0.07	0.12	0.05	2.1	0.9	0.8	0.4	10.9	5.3	6.6	3.3
hairy woodpecker	0.02	0	0	0	0.3	0	0	0	1.6	0	0	0
northern flicker	0.11	0.05	0.11	0.05	1.8	0.8	0.7	0.4	10.9	5.3	5.4	3.3
red-headed woodpecker	0	0.01	0.01	0	0	0.2	<0.1	0	0	1.2	1.2	0
Overall	6.01	6.90	15.71	11.53	100	100	100	100				

^a. State Species of Concern tracked by the South Dakota Natural Heritage Program (SDGFP 2017)