Yearlong Biological Surveys and Eagle Risk Assessment Report at the Corriedale Wind Farm Project Year 2 Laramie County, Wyoming

Prepared for:

Cheyenne Light, Fuel and Power Company

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ATTACHMENTS

List of Abbreviations and Acronyms

CF	compact flash
E & E	Ecology and Environment, Inc.
ECPG	Eagle Conservation Plan Guidance
ESA	Endangered Species Act
GPS	Global Positioning System
IPaC	Information for Planning and Consultation
kHz	kilohertz
km^2	kilometer(s) squared
MET	meteorological
Project	Corriedale Wind Farm Project
RSA	Rotor-Swept Area
SSS	Special Status Species
USFWS	United States Fish and Wildlife Service
WGFD	Wyoming Game and Fish Department
WISDOM	Wyoming Interagency Spatial Database and Online Management System

Executive Summary

Ecology and Environment Inc. was retained by Cheyenne Light, Fuel and Power Company to conduct wildlife studies for a proposed wind energy generation facility in Laramie County, Wyoming, known as the Corriedale Wind Farm Project (Project). The proposed Project site encompasses 4,778 acres, and would include the installation of approximately 21 turbines with a generation capacity of 48 megawatts. This report summarizes results from avian point count surveys, eagle point count surveys, raptor nest surveys, eagle nest surveys, and acoustical bat surveys conducted between January 2017 and December 2017. This report also compares 2017 results with 2016 data.

Avian point count surveys were conducted bi-monthly between January 19, 2017 and December 30, 2017. A total of 147 point count surveys (21 surveys x 7 points) were completed. The Project boundary was modified in March 2017, which necessitated modifying some point count stations (points 1, 2, and 3) within the Project area. A new point count station (point 8) was also created in June 2017.

A total of 33 avian species and 1,088 individuals were documented on the Project site during the point count surveys. Mean relative abundance was 7.5 birds per 10-minute point count survey. The most common bird species observed were American crow and McCown's longspur. Of the 33 bird species observed, five species (27 percent) were observed at the height of the rotor-swept area. The species with the highest potential risk index was the American crow, followed by turkey vulture, red-tailed hawk, and common raven.

Golden eagles were observed on nine occasions throughout the year. Golden eagles were observed at survey point 1 on one occasion, survey point 6 on one occasion, and at survey point 4 on seven occasions. A total of 69 eagle minutes were observed for the year. Four fatality estimate models were run. Model 1 and 2 focus on eagle fatality results from 2017 only, while Models 3 and 4 focus on eagle fatality results from 2016 and 2017 combined. Model 1 (all points) estimated 2 eagle fatalities per year, model 2 (all points minus point 4) estimated 0.57 eagle fatalities per year, model 3 (all points both years) estimated 3.4 eagle fatalities per year, and model 4 (all points both years minus point 4) estimated 0.89 eagle fatalities per year.

Four golden eagle nests were detected in the 10-mile buffer around the Project boundary. Golden eagles, which were observed in the Project area, are protected under the Bald and Golden Eagle Protection Act. No active raptor nests were observed within the Project area or within a 0.5 mile buffer.

The acoustical bat detector recorded data for a total of five months, and a total of 95 nights. There were six bat species identified on site. For all recorded bat passes, 97 percent were low-frequency bat species, and 3 percent were high frequency bats. The total activity index (passes per detector night) for the Project was 0.66 bat passes per detector night.

For the purposes of this report, special status species include all species listed by the United States Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) as Endangered, Threatened, or Candidate, including Birds of Conservation Concern, and State of Wyoming Threatened, Endangered, or Species of Greatest Conservation Need. Five USFWS Birds of Conservation Concern were seen in the Project area. However, no ESA listed Endangered, Threatened, or Candidate species were detected during the yearlong surveys.

Introduction and Project Description

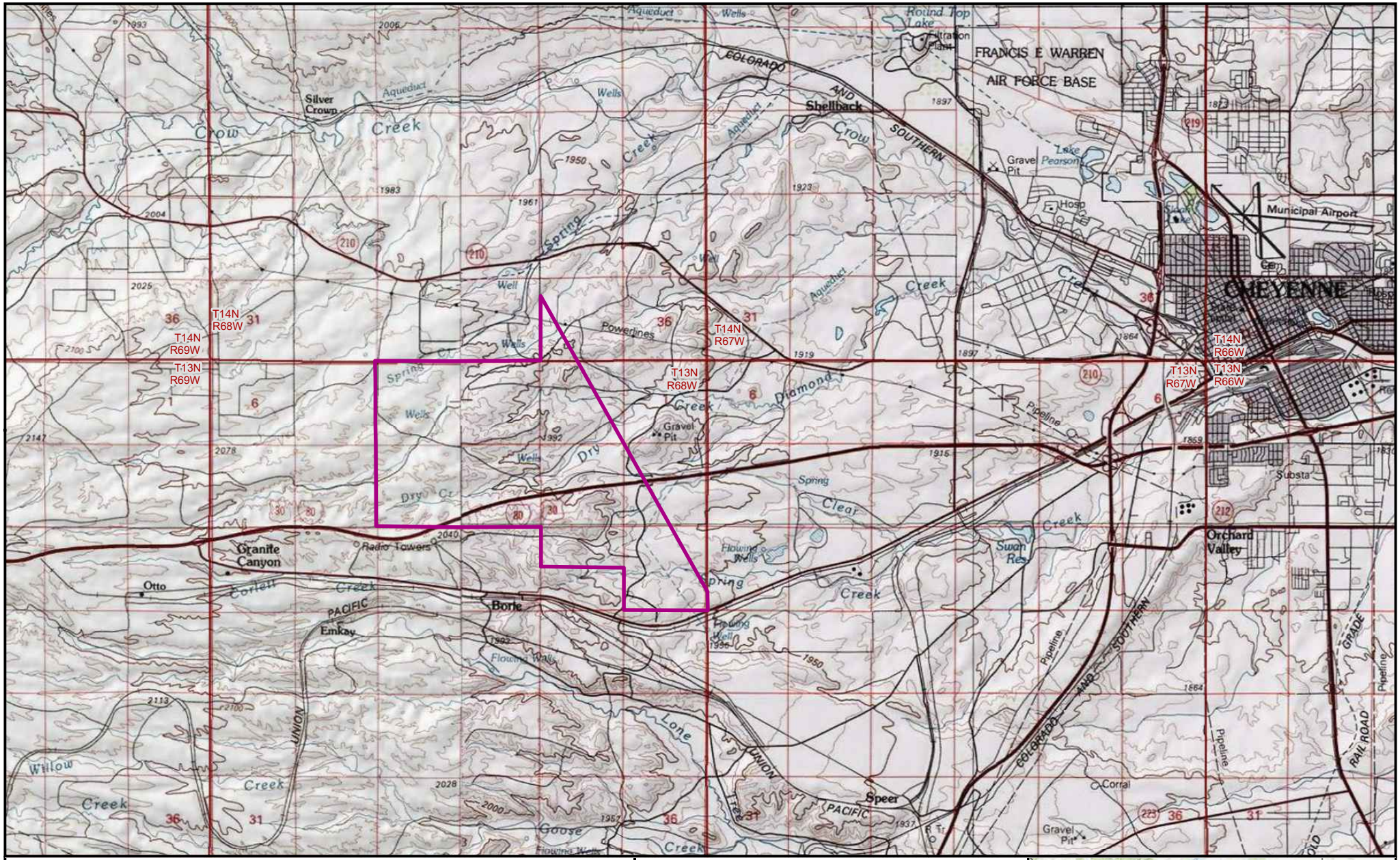
Ecology and Environment Inc. (E & E) conducted yearlong surveys for Cheyenne Light, Fuel and Power Company at the proposed Corriedale Wind Farm Project (Project) from January 2016 to December 2017. This report summarizes the results from the 2017 surveys and the eagle risk analysis, and compares the results with those from the 2016 surveys. These studies included avian point count surveys, eagle surveys, raptor nest surveys, eagle nest surveys, and bat acoustical surveys. All surveys surveyed for Special Status Species (SSS). SSS are defined here as those species listed under the Endangered Species Act (ESA) by the United States Fish and Wildlife Service (USFWS) as Candidate, Proposed, Threatened, or Endangered; and those listed by the State of Wyoming (Wyoming Game and Fish Department [WGFD 2016) as Threatened, Endangered, or Species of Greatest Conservation Need (SGCN).

The proposed Project is located approximately 6 miles west of the city of Cheyenne, off of Interstate 80, in Laramie County, Wyoming (Figure 1). The Project area comprises 4,778 acres, and is situated within the Silver Crown, Emkay, Round Top Lake, and Borie, United States Geological Survey 7.5 Minute Quadrangle Maps in the following Townships, Ranges, and Sections:

- T13N R68W, Sections 2-4, and 9-14
- T14N R68W, Section 35

The proposed Project would be constructed on private land. Current land use includes cattle grazing. The Project is expected to produce approximately 48 megawatts upon projected completion. It is anticipated that the Project would employ up to 21 wind turbine generators. The proposed turbine model (*subject to change*) is the GE 2.5-megawatt 116-meter rotor diameter on an 80-meter hub height tower. The proposed Project also includes buried electrical collector lines, a collector substation, a transmission line, and access roads.

This first section of the report describes the methods of the biological survey, while the subsequent section summarizes survey results.



Project Boundary

Townships

N
W E
S

Data Sources:
USGS Topographic Base

Figure 1
Vicinity Map

Corriedale Wind Farm Project
Laramie County, Wyoming
2017

0 0.75 1.5 3
Miles

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Methods

Agency Coordination

All surveys were conducted in coordination with and as recommended by USFWS. These recommendations were summarized in an agency letter received August 26, 2016. E & E biologists followed the agency letter recommendations, the 2013 Eagle Conservation Plan Guidance (ECPG; USFWS 2013a), and the USFWS Land-Based Wind Energy Guidelines (USFWS 2012).

Agency meetings were held in April and October with Trish Sweanor of the USFWS to update agency personnel as to the progress of the Project and solicit agency feedback. Additional coordination is ongoing with Amanda Withroder of the Wyoming Game and Fish Department (WGFD), following the retirement of Scott Gamo, who originally represented WGFD.

Yearlong survey dates are summarized in Table 1. In this report, seasons are defined as follows:

- Spring: April and May.
- Summer: June, July, and August
- Fall: September, October and November
- Winter: December, January, February, and March.

Table 1. Yearlong Wildlife Survey Dates for the Corriedale Wind Farm Project, Laramie County, Wyoming 2016 and 2017

Year	Season	Type of Survey				
		Avian Point Count	***Raptor Nest***	***Eagle Use***	***Eagle Nest***	***Acoustical Bat***
2016 and 2017	**Spring**	X	X	X	X	X
	Summer	X	X	X		X
	Fall	X		X		X
	Winter	X		X		

Special Status Species

For the purposes of this report, SSS include all species listed by the USFWS under the ESA as Endangered, Threatened, or Candidate, including Birds of Conservation Concern, and or as Threatened, Endangered, or Species of Greatest Conservation Need by the State of Wyoming.

First, a USFWS Information for Planning and Consultation (IPaC) Resource report was generated, which lists ESA protected species that may occur within the Project area based on

potential habitat suitability (USFWS 2017; Table 4). The USFWS IPaC report also generated a list of Birds of Conservation Concern that are protected by the Migratory Bird Treaty Act, and eagles protected by the Bald and Golden Eagle Protection Act. USFWS Birds of Conservation Concern are identified as species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. The Wyoming State Wildlife Acton Plan and the *Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming* were queried for those species listed by the State of Wyoming as Threatened, Endangered, or Species of Greatest Conservation Need that may overlap the Project (WGFD 2017, 2016). Fish, crustaceans, and mollusks were not considered, because there is no water onsite. Any observations of SSS were noted in logbooks during the course of other biological surveys conducted in the Project area.

Avian Point Count Surveys

Field Data Collection

Avian point count surveys were conducted using the standard methodology consistent with USFWS Land-based Wind Energy Guidelines (USFWS 2012). Seven avian point count stations were randomly selected (Figure 2) across the Project area. All potential point count stations were spaced at least a mile apart on roads and usable two-tracks. The random selection of points allows for statistical inference across the entire site. Each station comprised a radius of 800 meters around a central point. Some points were adjusted for improved visibility and coverage of all habitat types. If point count stations were adjusted, location coordinates were collected with a Global Positioning System (GPS) unit.

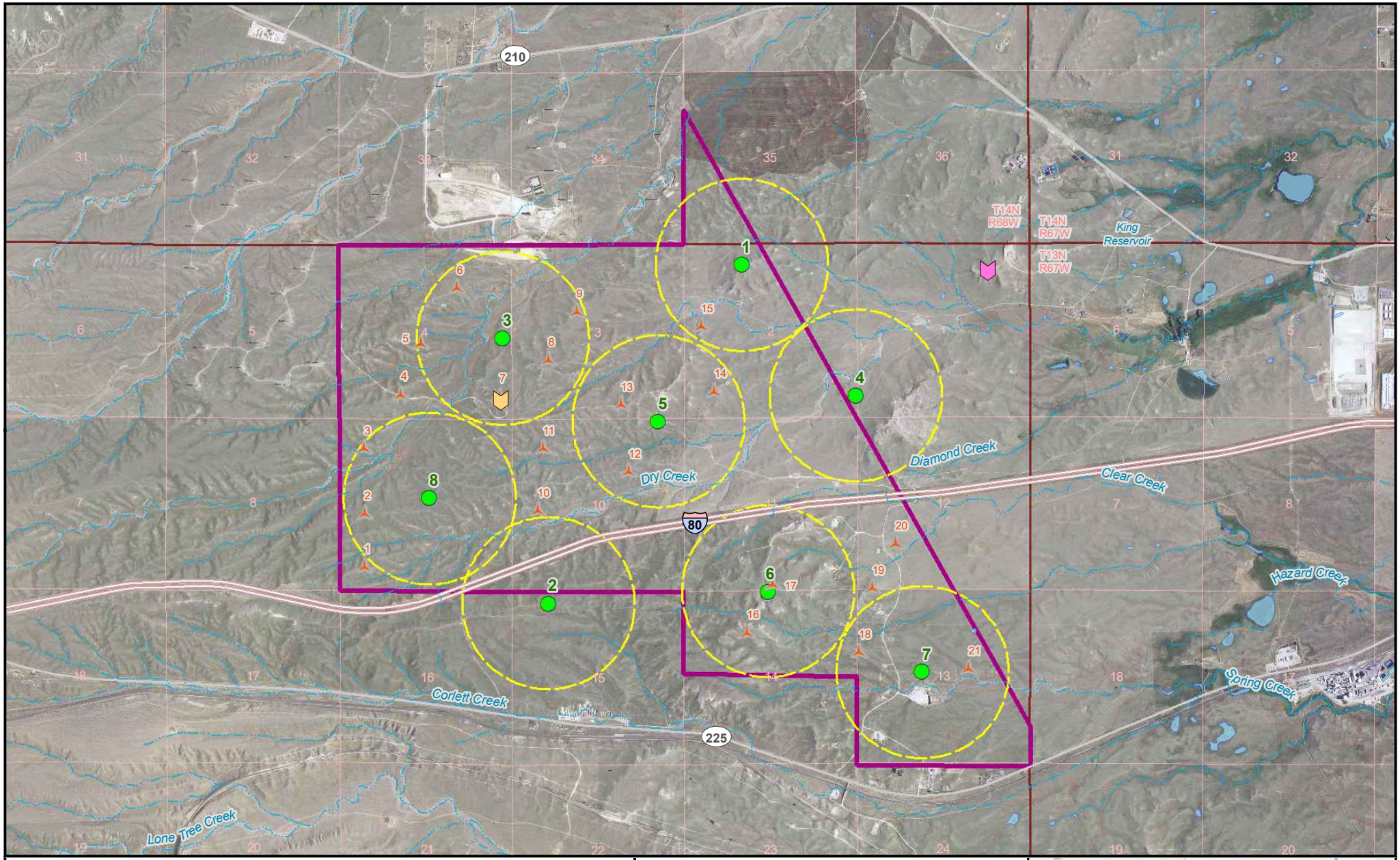
Avian point count surveys were conducted bi-monthly between January 19, 2017 and December 30, 2017. A total of 147 point count surveys (21 surveys x 7 points) were completed, as detailed in Table 2. The Project boundary was modified in March 2017, which necessitated modifying some point count stations (points 1, 2, and 3) within the Project area (Figure 3). A new point count station (point 8) was also created in June.

Table 2. Total Number of Avian and Eagle Surveys by Point for the Corriedale Wind Farm Project in 2017

Point	Number of Surveys for 2017	Comments
1	19	Five surveys were excluded: two in January, two in February, and one in May.
2	N/A	All point 2 surveys were excluded, because they were outside Project boundary.
3	20	Four surveys were excluded: two in January and two in February.
4	23	One survey was not completed in November.
5	24	none
6	24	none
7	24	none
8	13	New point surveyed June 20 to December.
Total	147	

Avian surveys were conducted during all daylight hours, since they were conducted in conjunction with eagle surveys. Data sheets listed species, number of individuals observed, distance from point count station, height, and behavior. Each point count survey was conducted for 10 minutes, during which one biologist would identify and count all birds detected within the plot, defined by an 800-meter radius. Point counts are the most widely accepted method of land-bird survey techniques in bird population studies (USDI 2006).

All data were recorded in field notebooks and subsequently entered into Excel spreadsheets. Quality assurance/quality control consisted of proofing the spreadsheet against original data in the field notebook.



Bat Acoustical Monitoring Site (2016)
Bat Acoustic Monitoring Site (2017)
Eagle Survey Points
800-meter buffer
Project Boundary
WTG (GE-2.5/116 Sec 9)

Perennial Stream
Intermittent Stream
Canal Ditch
Interstate Highway
Major Road

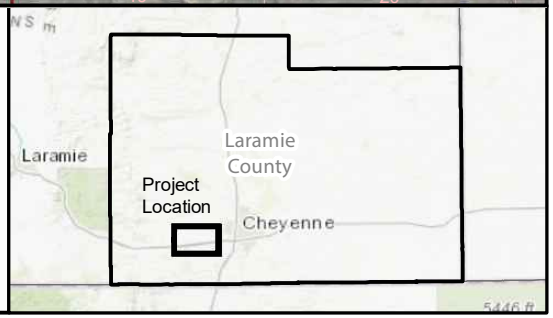
N
W E
S

Data Sources:
NAIP 2017

Figure 2
Eagle and Avian Survey Point Count and Acoustic Bat Survey Locations

Corriedale Wind Farm Project
Laramie County, Wyoming
2017

0 0.375 0.75 1.5
Miles



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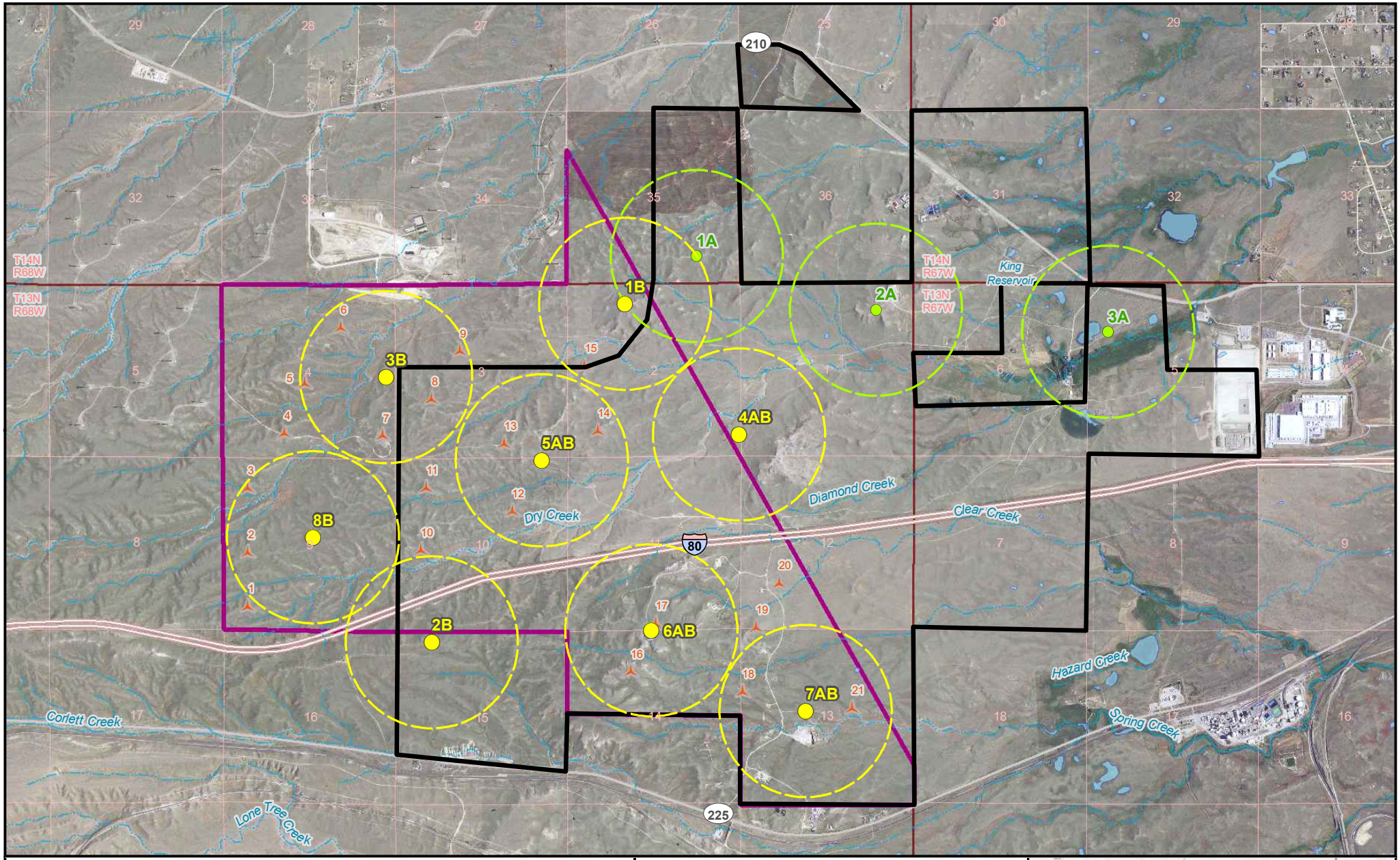


2017 Eagle Survey Points (B)
800-meter buffer (2017)
2016 Eagle Survey Points (A)
800-meter buffer (2016)
Project Boundary
2016 Project Boundary
WTG (GE-2.5/116 Sec 9)

Perennial Stream
Intermittent Stream
Canal Ditch
Interstate Highway
Major Road

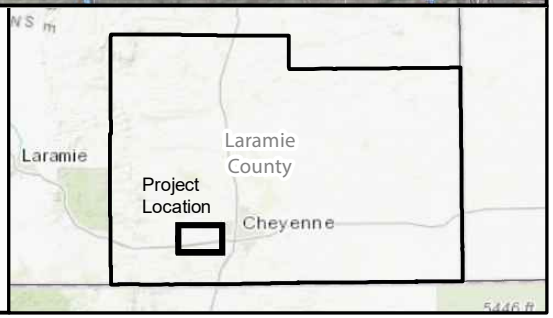
N
W E
S

Data Sources:
NAIP 2017

Figure 3
Project Boundary and Survey Point Changes

Corriedale Wind Farm Project
Laramie County, Wyoming
2016 and 2017

0 0.375 0.75 1.5
Miles



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Special attention was paid to potential observations of SSS, and raptor activity that could potentially occur on the Project site. Species of concern encountered during the course of other these surveys were noted in survey journals.

Raptor Flight Paths

Raptor flight paths can explain how raptors use the project area. Raptor flight paths were recorded during avian and eagle surveys, as requested by Trish Sweanor of the USFWS. The species, direction/s were drawn on eagle survey datasheets. All raptor flight paths were transcribed from datasheets to Google Earth Pro. The flight path of each species is represented by a color. The direction of the path is also shown with an arrow. Both flight path color and path are shown in the results figure.

Data Analysis

Data analysis included species present on the site in relative abundance, and a potential risk index for each species.

Relative Abundance

Relative abundance is a standard ecological measure of a species' relative representation. Relative abundance is calculated based on the point count surveys as the number of observations divided by the number of surveys conducted. For example, the relative abundance for horned lark would be the total number of individual horned larks observed within all 7 point count station areas divided by 147 (the number of surveys conducted):

- 136 observations/147 surveys = 0.9

Potential Risk Index

The potential risk of a species flying in the rotor-swept area (RSA) of the proposed wind turbines was calculated. A potential risk index (R) was calculated for each bird species observed during the point count surveys by multiplying relative abundance of each species with the proportion of observations of each species observed flying (Pf) and the proportion of observations of each species observed flying in the rotor-swept area (Prsa):

$$R = A * Pf * Prsa$$

This calculation incorporates a single species' abundance, the probability that the species is flying, and the probability that the species is flying within the RSA, as determined by data collected during point count surveys. The possible turbines to be deployed within the Project area have a rotor-swept height of 30 to 130 meters.

The ability of this index to predict actual conditions has not been demonstrated. Few studies have compared this index with post-construction fatality estimates, and it is not known if a correlation exists (NWCC 2001, 2011).

Raptor Nest Surveys

Raptor nest location were documented throughout the year within the Project area, in addition to a 0.5-mile buffer around the Project boundary. Biologists remained far enough away as to not disturb nesting birds, and determined whether each nest was active, inactive, or undetermined. Coordinates for each nest location were collected with a GPS unit.

Eagle Surveys and Assessment

The USFWS ECPG presents a tool for assessing the risk of a wind project to bald and golden eagles, and provides details on how siting, design, and operational modifications can mitigate that risk (USFWS 2013a). It outlines requirements for the field surveys and analytical approach for conducting an eagle risk assessment. The results of the risk analysis inform, in consultation with USFWS, the potential need for an Eagle Conservation Plan and an Eagle Take Permit.

The USFWS Region 6 Office (Mountain-Prairie) provided an additional document with recommended protocol for pre-construction eagle nest surveys (USFWS 2016; Attachment 1 and 2). E & E reviewed and followed both the ECPG and Region 6 guidance to the extent feasible.

The eagle risk assessment comprises data collected during eagle nest surveys, including a 10-mile buffer around the Project boundary (Figure 3), and eagle point counts. Eagle point counts were selected in order to meet a USFWS requirement to assess a minimum of 30 percent of Project acreage (USFWS 2013a). The risk analysis, a component of the risk assessment, employs a code acquired from the USFWS.

Eagle Point Count Surveys

Eagle point count surveys were conducted from January 2017 to December 2017, as described for avian point count surveys above. One E & E biologist conducted each survey for an hour. Surveys were conducted during all daylight hours and all weather, unless visibility was impaired. Data recorded for bald and golden eagle observations within the point count plot included number of minutes flying, direction of movement, behavior, and age. The eagle point count plot is defined as a 200-meter high cylinder with an 800-meter radius. Eagles observed outside of this plot were noted and their flight paths recorded.

Eagle Flight Paths

Observing eagle flight paths can help evaluate how eagles use a project area. Eagle flight paths were recorded during eagle surveys, as requested by the USFWS. The species, direction/s were drawn on eagle survey datasheets. All eagle flight paths were transcribed from datasheets to Google Earth Pro. The flight path of each species is represented by a color. The direction of the path is also shown with an arrow. Both flight path color and path are shown in the results figure.

Aerial Eagle Nest Surveys

Bald and golden eagle nest surveys included an aerial helicopter survey within a 10-mile buffer of the Project boundary in order to meet the national and regional recommendations of the ECPG (USFWS 2013a, 2013b). USFWS personnel were queried for the location of any known occupied and unoccupied (historic) eagle nests in the area. E & E reviewed aerial imagery of the survey area for potential eagle nesting habitat (e.g., cliff features and riparian corridors), and focused on these areas. The helicopter eagle nest survey was conducted on June 8, 2017.

Eagle Risk Analysis

The ECPG requires an extensive data set and analysis to conduct the eagle risk analysis for the Project. The USFWS Eagle Risk model code was used to analyze the data in Program R, the data analysis program employed for eagle risk assessment analysis. This model was used to estimate fatalities to both golden and bald eagles.

The ECPG uses a Bayesian statistical inference framework to predict the number of eagle fatalities that would be expected for a wind energy facility, while accounting for uncertainty. The basic USFWS eagle fatality model assumes a predictable relationship between eagle exposure λ and annual fatalities resulting from collisions with turbines, F (Table 3), such that:

$$F = \varepsilon\lambda C$$

Where λ is the exposure rate or eagle use of the site and is determined from pre-construction surveys; C, the collision probability, is the probability of an eagle colliding with a turbine given a minute of eagle flight within the hazardous area, given exposure; and ε, the expansion factor, is a constant that describes the total area and time within a project footprint that is potentially hazardous to eagles. The expansion factor is used to scale the resulting per-unit fatality rate to the entire project for a year. Using the Bayesian modeling framework allows known information to be directly incorporated into the model, by defining appropriate prior probability distributions. These prior distributions for exposure rate and collision probability are provided in the ECPG. The posterior exposure distribution is calculated from the prior distribution and the Project-specific observed data.

Table 3. Definitions of Variables Used in the USFWS Collision Probability Model

Abbreviation	Variable	Description
F	Annual fatalities	Annual eagle fatalities from turbine collisions
λ	Exposure rate	Eagle minutes flying within the Project footprint per hour per kilometer squared (km^2)
C	Collision probability	The probability of an eagle colliding with a turbine given exposure
ε	Expansion factor	Product of daylight hours and total hazardous area (hour * km^2)
k	Eagle-minutes	Number of minutes that eagles were observed flying below 200 meters above ground level during survey counts
δ	Turbine hazardous area	Rotor-swept area around a turbine or proposed turbine from 0 to 200 meters (in km^2)
n	Trials	Number of trials for which events could have been observed (the number of hours * km^2 observed)
τ	Daylight hours	Total daylight hours (e.g., 4,457 hours per year for baseline, in this case)
n_t	Number of turbines	Number of turbines proposed for the Project

Exposure

Exposure refers to the eagle exposure rate λ, the expected number of exposure events (eagle minutes) per daylight hour per square kilometer. Exposure rates were determined by the ECPG from a mixture distribution of Project-specific Gamma distributions (USFWS 2013a). The mixture of distributions is summarized by one Gamma distribution with a mean of 0.352 and a standard deviation of 0.357, which has been derived from conditional distributions (Gelman et al. 2003). The resulting prior distribution for the exposure rate is:

Prior $\lambda \sim Gamma\ (\alpha, \beta)$, with shape and rate parameters of α = 0.97 and β = 2.76

Eagle exposure data collected during field work were used to estimate the annual predicted eagle fatalities. The resulting posterior λ distribution is:

$$Posterior\ \lambda \sim Gamma\ (\alpha + \sum_{i=1}^{n} k^i\ \beta + n).$$

Collision Probability

The collision probability C is the probability of an eagle colliding with a wind turbine given exposure (one minute of flight in the hazardous area). For the purpose of this model, all collisions are considered fatal. The USFWS (2013a) developed the prior distribution for the

collision probability based on a study of golden eagle avoidance rates from four independent sites (Whitfield 2009):

$$Prior\ C \sim Beta(v, v'), with\ parameters\ v\ and\ v'of\ 2.31\ and\ 396.69$$

The Beta distribution describes values between 0 and 1 (Gelman et al. 1995, as cited in USFWS 2013a). The prior C distribution is used to estimate the annual predicted fatalities for a project. After post-construction monitoring is completed, those data will be used to determine the posterior C distribution by updating the prior C distribution. The posterior C distribution cannot be calculated until at least one year of post-construction fatality monitoring has been completed.

The collision probability takes into account the proportion of the project area that actually represents a collision risk to eagles (the RSA around proposed turbines), as well as the total number of turbines and number of daylight hours (time of expected eagle activity) per year. The resulting collision probability is the cumulative probability across all turbines.

Expansion

The expansion factor ε scales the resulting per-unit fatality rate to the daylight hours, τ, in the time frame of interest (season or year) and total hazardous area within the project footprint:

$$\varepsilon = \tau \sum_{i=1}^{n_t} \delta_i$$

Where n_t is the number of turbines, and δ is the circular area centered at the base of the turbine equal to the RSA of the turbine, which is defined as the hazardous area surrounding the turbine. The units for ε are hours per kilometer squared (km^2) per year (or time of interest).

Fatalities

A distribution of predicted annual eagle fatalities for the Project was determined by multiplying the exposure and collision risk distributions, which are then expanded:

$$F = \varepsilon * posterior\ \lambda * prior\ C$$

A total of 1,000 simulations were run using the statistical program R™. The mean, median, standard deviation, and 80 percent quantile (the upper credible limit) were calculated directly from the distribution of predicted fatalities. Table 4 shows the Project-specific inputs for the fatality estimate analysis.

Table 4. Corriedale Wind Farm Project, Inputs Used for USFWS Collision Probability Models to Calculate Eagle Fatalities, Laramie County, Wyoming 2016 and 2017

Model Inputs	Input Values
Number of Turbines	21
Rotor Diameter	0.116 km
Rotor Radius	0.058 km
Rotor Radius Buffer	0 (default setting)
Hazardous Radius	0.058 km
Hazardous Area	0.233 km^2
Survey Duration	60 minutes per point
Days that Survey Strata Represent	365 days (equivalent of 1 year)
Daylight Hours Per Day	varies, 12 hours on average
Eagle Minutes < 200 meters	Varies by model
Number of Survey Counts Conducted	Varies by model
Total Number of Daylight Hours	4,453 hours

Key:
km = kilometer
km^2 = kilometers squared

Acoustical Bat Surveys

Field Data Collection

One bat acoustical monitoring site was established at the meteorological (MET) tower (Figure 2). The MET tower is located 0.4 miles from point 3. The Latitude/Longitude is 41° 7'7.20"N 105° 0'8.10"W, at an elevation of 6,694 feet. This site was surveyed July 18 through October 13. Survey periods corresponded to periods of peak bat activity in Wyoming (Adams 2003).

Sampling apparatus at the weather station tower consisted of an AnaBat SD1 ultrasonic detector (AnaBat) from Titley Electronics (Titley), Ballina, Australia, used to record echolocation calls; weather resistant Bat Hat, microphone, and associated cables; logger box; and solar panel. AnaBat units record bat calls in the range of 7 kilohertz (kHz) to 100 kHz frequency.

Data collection methods followed Kunz et al. (2007). Call recording was conducted during crepuscular and nocturnal hours (about one hour before sunset to one hour after sunrise) to capture peak times of bat activity (Reynolds 2006). All files recorded during the survey period were saved to one-gigabyte compact flash (CF) cards. The CF cards were downloaded at monthly intervals and the data backed up to a computer using Titley's CF card reader software.

Data Analysis

Bat acoustical data were analyzed using Titley's Analook software. A preliminary analysis was run to separate extraneous noise files created by weather, radio or microwaves, insects, birds, etc., from bat echolocation call files. From these call files, those that qualified as bat passes were extracted. A bat pass is an accepted measure of bat activity defined as an echolocation sequence of at least two echolocation pulses, or chirps, with a minimum pulse duration of 10 milliseconds within each sequence, separated by more than one second (Kunz et al. 2007). Two to four chirps are recognizable as a bat but are not evaluated further.

For identification purposes, bat passes with five or more echolocation pulses can be further assigned to high- and low-frequency species groups (identified bat passes). High-frequency bat species have echolocation call frequencies between 35 and 50 kHz. These are restricted to species in the genus *Myotis*. Individual species of myotis bats are difficult to distinguish by call. High-frequency myotis bats known to occur in Laramie County include little brown bat, western long-eared myotis, long-legged myotis, western small-footed myotis, and fringed myotis. Low-frequency bats are defined as species with echolocation calls between 12 and 30 kHz. Low-frequency bats in Laramie County include big brown bat, hoary bat, pallid bat, eastern red bat and silver-haired bat.

An index of relative bat activity, the activity index, was calculated as the number of bat passes per detector night (the number of nights each detector was recording data). This activity index was determined for each species group. Temporal distribution of bat activity by month was also calculated.

During data analysis, any SSS, which includes species listed under the ESA as Threatened, Endangered, or Candidate Species (USFWS 2010), and species listed by Wyoming as Species of Greatest Conservation Need (WGFD 2017) were noted.

Data Analysis Assumptions

Two assumptions are integrated into all data analyses.

1. Each bat pass accounts for a single bat recorded only once by the AnaBat detector. Recognition of individuals cannot be determined using AnaBat detectors, so the analysis must be conducted assuming one bat pass is equivalent to a single bat (Miller 2001). One bat pass may actually contain more than one individual bat echolocating, or alternatively, multiple bat passes may be the same bat circling around and echolocating.
2. All bat species are equally detected by AnaBat detectors. Different species of bats echolocation calls attenuate at differing distances. Some bat species calls attenuate at shorter distances, and, therefore, are recorded less often than those whose calls carry further. For example, Townsend's big-eared bat has a weak call that attenuates rapidly and is not as readily detected as many other species. Furthermore, behavioral differences may result in certain species being recorded more often than others. Since there is no appropriate way to correct for these differences, detection equality must be assumed (Gannon et al. 2003).

General Wildlife

Desktop Analysis and Site Surveys

The Wyoming Interagency Spatial Database and Online Management System (WISDOM) was queried for the potential occurrence of wildlife species on the Project site including game and non-game species or SGCN tracked by the WGFD. The desktop results were used to inform onsite surveys for indicated species.

Results

Special Status Species

The IPaC resource report produced eight potentially affected Endangered and Threatened species (Table 5).

Table 5. Potentially Affected Endangered and Threatened Species from the USFWS IPaC Report

Common Name	Scientific Name	Status
Birds		
Least tern	*Sterna antillarum*	Endangered
Piping plover	*Charadrius melodus*	Threatened
Whooping crane	*Grus americana*	Endangered
Fish		
Pallid sturgeon	*Scaphirhynchus albus*	Endangered
Flowering Plants		
Colorado butterfly plant	*Gaura neomexicana var. coloradensis*	Threatened
Ute ladies'-tresses	*Spiranthese diluvialis*	Threatened
Western prairie fringed orchid	*Plantanthera praeclara*	Threatened
Mammals		
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	Threatened

Key:
IPaC = Information for Planning and Consultation
USFWS = U.S. Fish and Wildlife Service

No federally Endangered, Threatened, or Candidate species were observed within the Project area in 2016 or 2017.

Of the 14 USFWS Birds of Conservation Concern produced from the IPaC report, three were observed during surveys within the Project area in 2017. These species included golden eagle, lark bunting, and McCown's longspur (Table 6). Of the 29 Wyoming avian Species of Greatest Conservation Need, six were observed during surveys within the Project area in 2017. These species include American kestrel, chestnut-collared longspur, ferruginous hawk, golden eagle,

McCown's longspur, and Swainson's hawk. In Laramie County, 15 Wyoming mammal Species of Greatest Conservation Need, three Wyoming amphibian Species of Greatest Concern, and eight Wyoming reptile Species of Greatest Conservation Need could potentially occur within the habitats within the Project boundary.

Table 6. USFWS Birds of Conservation Concern and WGFD Species of Greatest Conservation Need with Potential to Breed Onsite or Adjacent to the Corriedale Wind Farm Project

Common Name	Latin Name	Observed within the Project	USFWS BCC Species	WGFD SGCN Species
Birds				
American kestrel	*Falco sparverius*	X	-	X
Bald Eagle	*Haliaeetus leucocephalus*	2016 only	X	X
Baird's sparrow	*Ammodramus bairdii*	-	-	X
Blue grosbeak	*Passerina caerulea*	-	-	X
Blue-gray gnatcatcher	*Polioptila caerulea*	-	-	X
Burrowing owl	*Athene cunicularia*	-	X	X
Bushtit	*Psaltriparus minimus*	-	-	x
Cassin's sparrow	*Peucaea cassiniissinii*	-	X	
Chestnut-collared longspur	*Calcarius ornatus*	X	X	X
Common nighthawk	*Chordeiles minor*	-	-	X
Dickcissel	*Spiza Americana*	-	-	X
Ferruginous hawk	*Buteo regalis*	X	-	X
Golden eagle	*Aquila chrysaetos*	X	X	X
Grasshopper sparrow	*Ammodramus savannarum*	-	-	X
Lark bunting	*Calamospiza melanocorys*	X	X	-
Loggerhead shrike	*Lanius ludovicianus*	2016 only	-	X
Long-billed curlew	*Numenius americanus*	-	X	X
McCown's longspur	*Rhynchophanes mccownii*	X	X	X
Mountain plover	*Charadrius montanus*	-	X	X
Peregrine falcon	*Falco peregrinius*	-	-	X
Prairie falcon	*Falco mexicanus*	2016 only	-	X
Red-headed woodpecker	*Melanerpes erythrocephalus*	2016 only	X	X
Sage thrasher	*Oreoscoptes montanus*	-	-	X

Table 6. USFWS Birds of Conservation Concern and WGFD Species of Greatest Conservation Need with Potential to Breed Onsite or Adjacent to the Corriedale Wind Farm Project

Common Name	Latin Name	Observed within the Project	USFWS BCC Species	WGFD SGCN Species
Short-eared owl	*Asio flammeus*	-	-	X
Swainson's hawk	*Buteo swainsoni*	X	-	X
Upland sandpiper	*Bartramia longicauda*	-	-	X
Willow flycatcher	*Empidonax traillii*	-	X	X
Mammals				
Eastern spotted skunk	*Spilogale putorius*	-	-	X
Fringed myotis	*Myotis thysanodes*	-	-	X
Little brown myotis	*Myotis lucifugus*	-	-	X
Pallid bat	*Antrozous pallidus*	X	-	X
Plains harvest mouse	*Reithrodontomys montanus*	-	-	X
Preble's meadow jumping mouse	*Zapus hudsonius preblei*	-	-	X
Sand hills pocket gopher	*Geomys lutescens*	-	-	X
Black-tailed prairie dog	*Cynomys ludovicianus*	-	-	X
Swift fox	*Vulpus velox*	-	-	X
Western small-footed myotis	*Myotis ciliolabrum*	-	-	X
Olive-backed pocket mouse	*Perognathus fasciatus*	-	-	X
Spotted ground squirrel	*Xerosperophillus spilosoma*	-	-	X
Hispid pocket mouse	*Chaetodipus hispidus*	-	-	X
Plains pocket mouse	*Perognathus flavescens*	-	-	X
Silky pocket mouse	*Perognathus flavus*	-	-	X
Amphibians				
Northern leopard frog	*Lithobates pipiens*	-	-	X
Plains spadefoot	*Spea bombifrons*	-	-	X
Western tiger salamander	*Ambystoma mavortium*	-	-	X
Reptiles				
Pale milksnake	*Lampropeltis triangulum multistriata*	-	-	X

Table 6. USFWS Birds of Conservation Concern and WGFD Species of Greatest Conservation Need with Potential to Breed Onsite or Adjacent to the Corriedale Wind Farm Project

Common Name	Latin Name	Observed within the Project	USFWS BCC Species	WGFD SGCN Species
Greater short-horned lizard	*Phrynosoma hernadesi*	-	-	X
Northern many-lined skink	*Plestiodon multivirgatus*	-	-	X
Plains hog-nosed snake	*Heterodon nasicus*	-	-	X
Prairie racerunner	*Aspidoscelis sexlineata*	-	-	X
Prairie rattlesnake	*Crotalus viridis*	-	-	X
Great plains earless lizard	*Holbrookia maculata maculate*	-	-	X
Plains gatersnake	*Thamnophis radix*	-	-	X

Key:
BCC = Birds of Conservation Concern
SGCN = Species of Greatest Conservation Need
USFWS = U.S. Fish and Wildlife Service
WGFD = Wyoming Game and Fish Department

Avian Point Count Surveys

In 2017, a total of 33 species and 1,088 individuals were documented on the Project site during the avian point count surveys (Table 6). Species composition included 18 songbirds (64 percent), 9 raptors (32 percent), and 1 crane (4 percent).

In 2016, a total of 27 species and 534 individuals were observed. Species composition included 16 songbirds (62 percent), 9 raptors (35 percent), and 1 waterfowl (4 percent).

Relative Abundance

In 2017, the number of individuals observed by taxonomic group was 1,015 songbirds (93 percent), 72 raptors (7 percent), and 1 crane (<1 percent). Mean relative abundance was 4.5 birds per 10-minute point count survey (Table 7). The most common bird species observed was American crow, with McCown's longspur, horned lark, common raven, and western meadowlark the next four most abundant species. Other abundant species included the lark bunting, bank swallow, turkey vulture, and red-tailed hawk.

In 2016, the number of individuals observed by taxonomic group was 487 songbirds (91 percent), 46 raptors (9 percent), 1 waterfowl (<1 percent). Mean relative abundance was 4.5 birds per 10-minute point count survey. The most common bird species observed was McCown's longspur with horned lark, bank swallow, western meadowlark and chestnut-collared longspur the next four most abundant species.

Table 7. Avian Species, Number Observed, and Relative Abundance, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Species	Number Observed	Relative Abundance (A)*
American crow	284	1.93
McCown's longspur	177	1.20
Horned lark	136	0.93
McCown's longspur, horned lark	70	0.48
Common raven	63	0.43
Western meadowlark	62	0.42
Lark bunting	60	0.41
Bank swallow	55	0.37
Horned lark, longspurs	31	0.21
Turkey vulture	21	0.14
Red-tailed hawk	19	0.13
Vesper sparrow	16	0.11
Swainson's hawk	12	0.08
Brewer's blackbird	11	0.07
Mountain bluebird	8	0.05
Unknown songbird species	8	0.05
Common nighthawk	7	0.05
Rough-legged hawk	6	0.04
American kestrel	5	0.03
Cliff swallow	5	0.03
Ferruginous hawk	4	0.03
White-crowned sparrow	4	0.03
Chestnut-collared longspur	3	0.02
Golden eagle	3	0.02
Grasshopper sparrow	3	0.02

Table 7. Avian Species, Number Observed, and Relative Abundance, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Species	Number Observed	Relative Abundance (A)*
American pipit	2	0.01
Barn swallow	2	0.01
Chipping sparrow	2	0.01
Western kingbird	2	0.01
Buteo species	1	0.01
Falcon species	1	0.01
House wren	1	0.01
Killdeer	1	0.01
Northern shrike	1	0.01
Sandhill crane	1	0.01
Say's phoebe	1	0.01
Total number observed and mean relative abundance	1,088	N/A

*Relative abundance = the number of observations divided by the number of surveys (147)

Seasonal Avian Use

The seasonal peaks for avian activity were tracked within the Project (Table 8 and Table 9). The raptor observation peaks were September 13 and August 8, 2017. The songbird observation peaks were July 11 and June 20, 2017. Although raptors and songbirds were observed during all seasons at the Project, the highest raptor activity occurred in August with 13 (22 percent) raptors observed, and songbird peak activity was in June (34 percent). The peaks of activity for the Birds of Conservation Concern observed during avian point counts are McCown's longspur, spring and summer; chestnut-collared longspur, fall and winter; and lark bunting, summer. All golden eagle observations are discussed in the eagle point count section below.

Comparatively, in 2016, the raptor observation peak was September 20, 2016. The songbird observation peak was July 19, 2016. Although raptors and songbirds were observed during all seasons at the Project, most raptor activity occurred in August, with 13 (28 percent) raptors observed, and songbird peak activity was in July. The peaks of activity for the migratory Species of Conservation Concern observed during avian point counts are ferruginous hawk, summer; lark bunting, summer; McCown's longspur, summer; prairie falcon, fall and summer; and Swainson's hawk, summer.

Table 8. Avian Species Use by Season, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Common Name	Total Number of Observations	Percent of Observations by Season			
		Spring	Summer	Fall	Winter
American crow	284	20	232	31	1
American kestrel	5	-	4	-	1
American pipit	2	-	-	2	-
Bank swallow	55	-	55	-	-
Barn swallow	2	2	-	-	-
Brewer's blackbird	11	-	-	11	-
Buteo species	1	-	-	1	-
Chestnut-collared longspur	3	-	-	1	2
Chipping sparrow	2	-	2	-	-
Cliff swallow	5	-	5	-	-
Common nighthawk	7	-	7	-	-
Common raven	63	6	2	9	46
Falcon species	1	-	1	-	-
Ferruginous hawk	4	-	4	-	-
Grasshopper sparrow	3	-	3	-	-
Horned lark	136	15	24	77	20
Horned lark, longspurs	31	-	-	31	-
House wren	1	-	1	-	-
Killdeer	1	-	1	-	-
Lark bunting	60	-	60	-	-
McCown's longspur	177	84	88	5	-
McCown's longspur, horned lark	70	60	-	10	-
Mountain bluebird	8	-	-	-	8

Table 8. Avian Species Use by Season, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Common Name	Total Number of Observations	Percent of Observations by Season			
		Spring	Summer	Fall	Winter
Northern shrike	1	-	1	-	-
Red-tailed hawk	19	2	10	7	-
Rough-legged hawk	6	-	-	1	5
Sandhill crane	1	1	-	-	-
Say's phoebe	1	-	1	-	-
Swainson's hawk	12	4	5	3	-
Turkey vulture	21	-	8	13	-
Unknown songbird species	8	-	8	-	-
Vesper sparrow	16	1	13	2	-
Western kingbird	2	-	2	-	-
Western meadowlark	62	20	31	1	10
White-crowned sparrow	4	-	-	4	1

Table 9. Avian Group by Month at Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Avian Group	January	February	March	April	May	June	July	August	September	October	November	December	Total
Cranes	-	-	-	-	1	-	-	-	-	-	-	-	1
Raptors	2	0	1	2	4	9	6	13	10	4	1	3	58
Songbirds	1	1	26	15	43	114	52	25	17	18	7	18	337
Total	3	2	27	17	48	123	59	38	27	22	9	21	396

Potential Risk Index

In 2017, of the 33 bird species observed, 9 species (27 percent) were observed within the RSA (between 44 and 157 meters above the ground) (Table 10). Of the 1,088 individuals seen, 116 individuals (11 percent) were observed in the RSA. The species with the highest risk index (R) is the American crow. The next four potentially vulnerable species include the turkey vulture, red-tailed hawk, and common raven.

In 2016, of the 27 bird species observed, 5 species (19 percent) were observed within the RSA. Of the 534 individuals seen, 27 individuals (5 percent) were observed in the RSA. The species with the highest risk index (R) is the American crow. The next four potentially vulnerable species include the turkey vulture, common raven, red-tailed hawk, and Swainson's hawk.

Table 10. Potential Risk Index of All Avian Species at Corriedale Wind Farm Project, Laramie County, Wyoming 2017

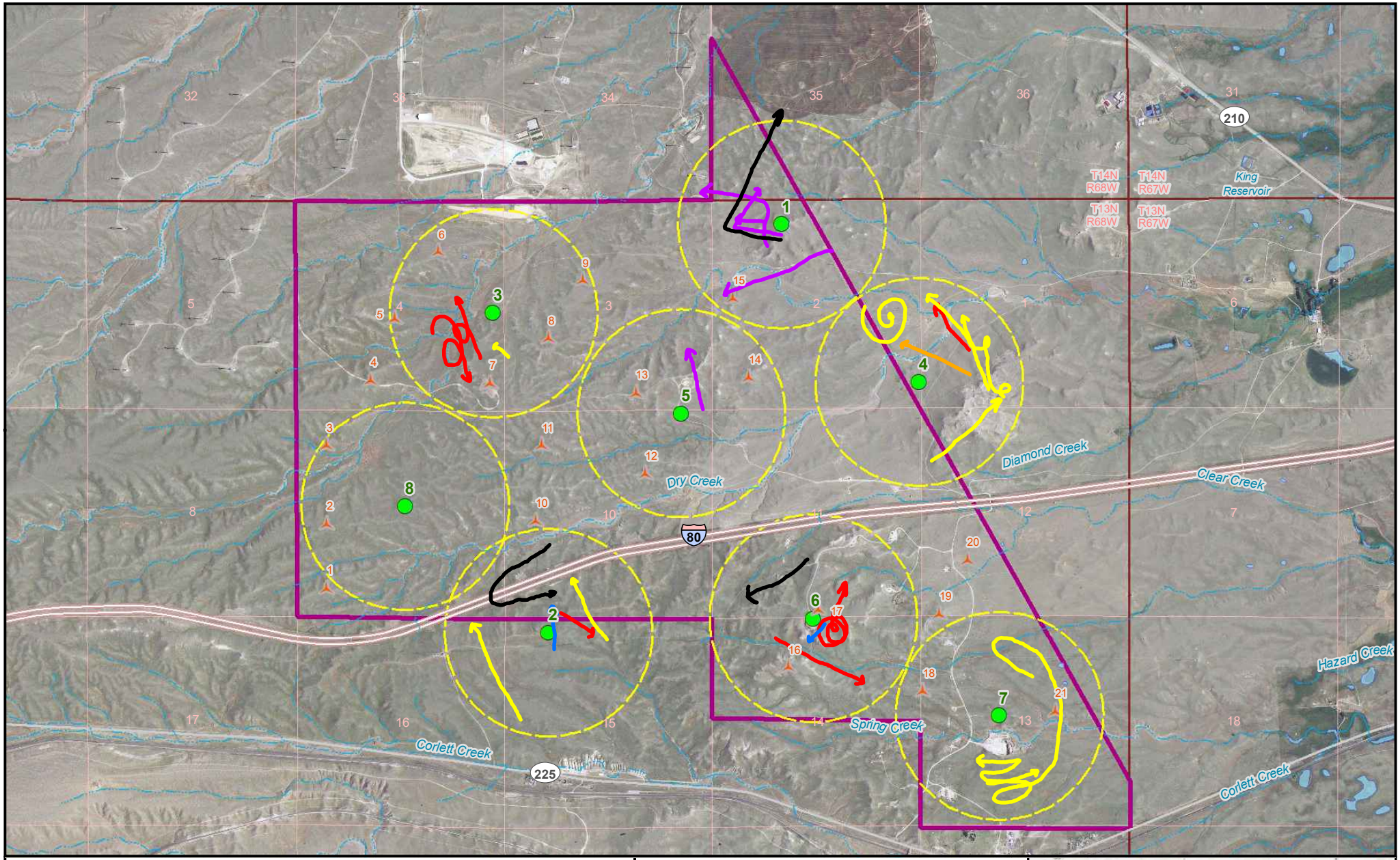
Common Name	Number in RSA	Total Number	Relative Abundance (A)	Proportion Observed Flying (Pf)	Proportion Observed Flying in RSA (Prsa)	Potential Risk Index (R) R = A*Pf*Prsa
American crow	97	284	0.26	0.57	0.60	0.089
Turkey vulture	6	21	0.02	1.00	0.29	0.006
Red-tailed hawk	4	19	0.02	0.95	0.22	0.004
Common raven	2	63	0.06	0.92	0.03	0.002
Ferruginous hawk	2	4	0.00	1.00	0.50	0.002
Rough-legged hawk	2	6	0.01	1.00	0.33	0.002
McCown's longspur	1	177	0.16	0.67	0.01	0.001
Sandhill crane	1	1	0.00	1.00	1.00	0.001
Swainson's hawk	1	12	0.01	0.08	1.00	0.001
Total	116	-	-	-	-	0.107

A detailed analysis for golden eagles is included in the eagle risk assessment section, below.

Key:
RSA = Rotor-Swept Area

Raptor Flight Paths

Nine species of raptors were observed during avian point counts, and their flight paths were recorded. Raptors were observed flying at all seven survey points. Survey points 4 and 6 had the largest number of flying raptors. The species observed were American kestrel, ferruginous hawk, northern harrier, prairie falcon, red-tailed hawk, rough-legged hawk, Swainson's hawk, and turkey vulture (Figure 4). All eagles observed were included in the eagle flight path section. Raptor flight paths were not recorded in 2016.



American Kestrel
Ferruginous Hawk
Northern Harrier
Red-tailed Hawk
Swainson's Hawk
Turkey Vulture

Eagle Survey Points
800-meter buffer
Project Boundary
WTG (GE-2.5/116 Sec 9)

Perennial Stream
Intermittent Stream
Canal Ditch
Interstate Highway
Major Road

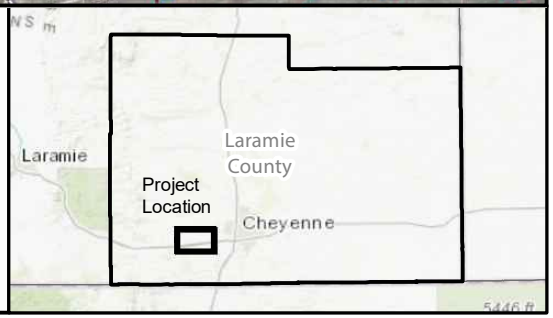
N
W E
S

Data Sources:
NAIP 2017

Figure 4
Raptor Flight Paths

Corriedale Wind Farm Project
Laramie County, Wyoming
2017

0 0.3 0.6 1.2
Miles



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Raptor Nest Surveys

No active nests were found in the Project area or within the 0.5-mile buffer in 2017 or 2016. Very few trees and structures were observed at the Project. The majority of nearby trees surround the landowner's houses, but these trees are 1.5 miles from the Project.

Eagle Surveys and Assessment

Eagle Point Count Surveys

Forty-six percent of the Project was surveyed during eagle point count surveys. The Project is 16 percent over the USFWS suggested 30 percent coverage (USFWS 2013a). Golden eagles were observed on nine occasions throughout the year during surveys. A total of 70 eagle minutes were observed for the year. Golden eagles were observed at survey points 1 and 6 on one occasion, and at survey point 4 on seven occasions (Table 11). A pair of eagles was observed three times during the 2017 yearlong surveys: on October 2 at point 4, and on October 18 at points 4 and 6. All other observations were of individual birds. Golden eagles were observed throughout the year, with the exception of January, April, May, June, August, and September.

In 2016, golden eagles were observed on eight occasions throughout the year during surveys. A total of 46 eagle minutes were observed for the year. Golden eagles were observed at survey points 1 and 7 on one occasion, and at survey point 4 on six occasions.

Table 11. Golden Eagle Observations at Corriedale Wind Farm Project 2016 and 2017

Point	Date	Number of Birds	Age	Eagle Minutes	Observation start time	Observation end time	Initial Distance	Max Distance	Initial Height	Minimum Height	Max Height	Flight Direction	Behavior
2016													
1	4/11/2016	1	A	4	14:34	14:37	350	350	50	25	50	SW	FG/BM
1	4/11/2016	2	A	2	14:46	14:47	0.5	0.5	200	200	200	SE	FG
2	1/29/2016	2	A	4	10:09	10:12	700	700	20	3	20	W	KH/FG
3	4/4/2016	1	A	4	9:57	10:00	50	450	30	30	200	NE	FG/S
4	1/29/2016	2	A	16	12:33	12:40	400	600	30	30	100	W	KH/FG
4	1/29/2016	1	A	5	12:41	12:45	400	600	80	20	80	W	KH/FG
4	2/11/2016	1	J	7	13:19	13:25	800	800	50	40	60	W	FG/KH
4	6/23/2016	1	A	1	13:12	13:13	80	80	25	25	25	S	P/FG
4	6/23/2016	1	A	1	13:20	13:21	80	80	25	25	25	S	P/FG
4	6/23/2016	1	A	1	13:23	13:24	80	80	25	25	25	N	P/FG
4	9/8/2016	1	A	3	13:58	14:00	400	800	40	200	200	W	FG/G
4	10/4/2016	1	A	5	13:41	13:45	500	600	70	70	100	NE	S
4	11/8/2016	1	Unk	1	12:45	12:45	400	80	40	40	40	N	S/G
7	12/12/2016	1	A	1	15:33	15:34	400	400	20	20	20	SW	FG/P
7	12/12/2016	1	A	1	15:37	15:38	400	400	30	30	30	SW	FG/P
7	12/12/2016	1	A	1	15:44	15:45	400	400	20	20	20	SW	FG/P
Total				49									

Table 11. Golden Eagle Observations at Corriedale Wind Farm Project 2016 and 2017

Point	Date	Number of Birds	Age	Eagle Minutes	Observation start time	Observation end time	Initial Distance	Max Distance	Initial Height	Minimum Height	Max Height	Flight Direction	Behavior
2017													
1	11/15/2017	1	A	1	16:30	16:30	400	400	25	25	25	E to W	P/ FG
1	11/15/2017	1	A	1	16:38	16:38	450	450	25	25	25	E	P/FG
4	2/8/2017	1	A	10	12:53	13:02	350	600	50	40	60	SW	G/FG
4	2/22/2017	1	A	1	13:41	13:41	600	600	3	3	3	W	FG
4	2/22/2017	1	A	15	13:57	14:12	300	700	50	50	100	N/A	S/FG
4	3/30/2017	1	A	8	16:48	16:54	400	600	30	30	200	S/SE	FG/S
4	7/11/2017	1	A	1	18:01	18:02	450	480	30	30	30	E	P/FG
4	7/11/2017	1	A	1	18:17	18:17	480	480	25	25	25	W	FG
4	10/2/2017	2	A	2	14:48	14:48	400	400	15	15	15	SW	P/FG
4	10/18/2017	2	A	2	13:01	13:01	300	300	25	25	25	S/SW	P/FG
4	10/18/2017	1	A	10	13:02	13:11	500	700	50	50	80	S/SW	G/S/FG
4	12/13/2017	1	A	1	15:54	15:54	300	300	25	25	25	SW	FG
4	12/13/2017	1	A	1	16:11	16:11	350	350	25	25	25	E	FG
4	12/13/2017	1	A	1	16:13	16:13	300	300	20	20	20	N	FG
6	10/18/2017	2	A	6	10:53	10:55	100	300	20	20	50	NW	FG/G
6	10/18/2017	1	A	8	10:56	16:04	500	800	60	60	80	W	S/G
Total				69									

Key:
FG = Flap-gliding
G = Gliding

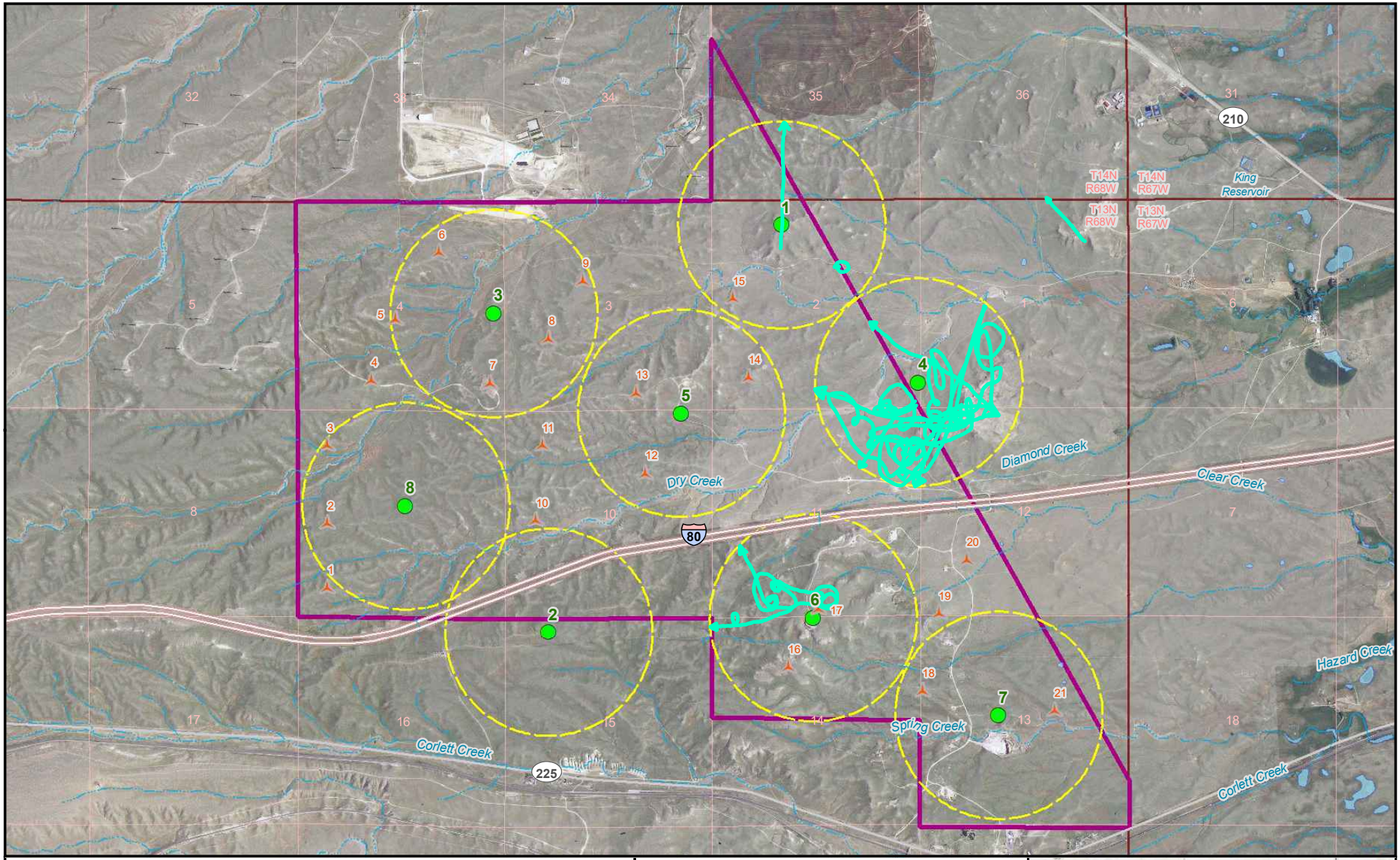
Table 11. Golden Eagle Observations at Corriedale Wind Farm Project 2016 and 2017

Point	Date	Number of Birds	Age	Eagle Minutes	Observation start time	Observation end time	Initial Distance	Max Distance	Initial Height	Minimum Height	Max Height	Flight Direction	Behavior

BM = Being Mobbed
KH = Kiting/Hovering
P = Perched
E = East
N = North
S = South
W = West

Eagle Flight Paths

Golden eagles were observed at three points, 1, 4, and 6. The majority of the eagle observations were recorded at point 4 (Figure 5). Eagle flight paths did not have a discernible pattern. They often perched on power line poles, and flew for a very short time going from pole to pole.
In 2016, the majority of the eagle flight paths were at point 4 and one was at point 7 (Figure 6). Flight paths were focused around the ridge, and several individuals went from the northeast to the southwest.



2017 Golden Eagle Flight Paths
Eagle Survey Points
800-meter buffer
Project Boundary
WTG (GE-2.5/116 Sec 9)
Perennial Stream
Intermittent Stream
Canal Ditch
Interstate Highway
Major Road

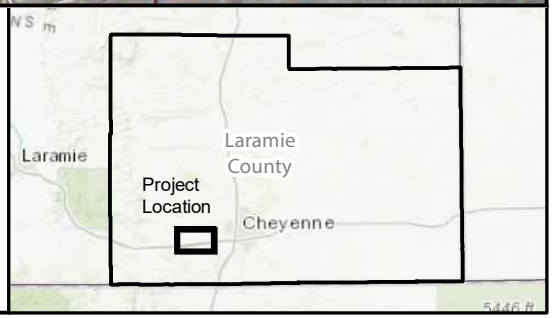
N
W E
S

Data Sources:
NAIP 2017

Figure 5
Golden Eagle Flight Paths

Corriedale Wind Farm Project
Laramie County, Wyoming
2017

0 0.3 0.6 1.2
Miles



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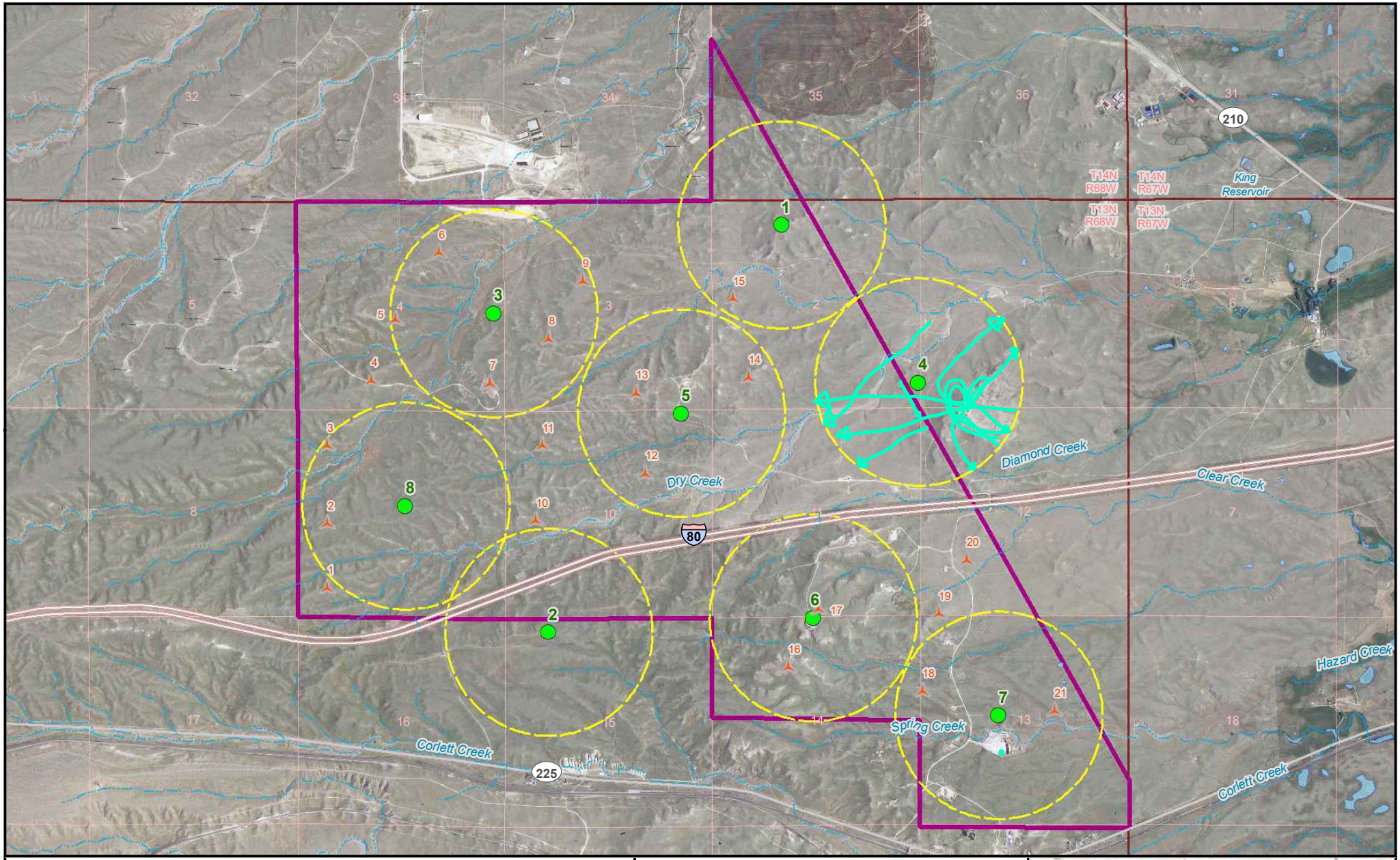


2016 Golden Eagle Flight Paths
Eagle Survey Points
800-meter buffer
Project Boundary
WTG (GE-2.5/116 Sec 9)
Perennial Stream
Intermittent Stream
Canal Ditch
Interstate Highway
Major Road

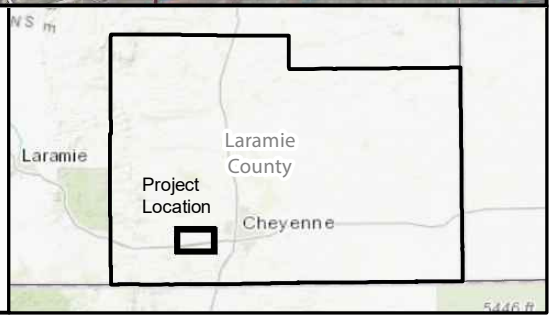
N
W E
S

Data Sources:
NAIP 2017

Figure 6
Golden Eagle Flight Paths

Corriedale Wind Farm Project
Laramie County, Wyoming
2016

0 0.3 0.6 1.2
Miles



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Aerial Eagle Nest Surveys

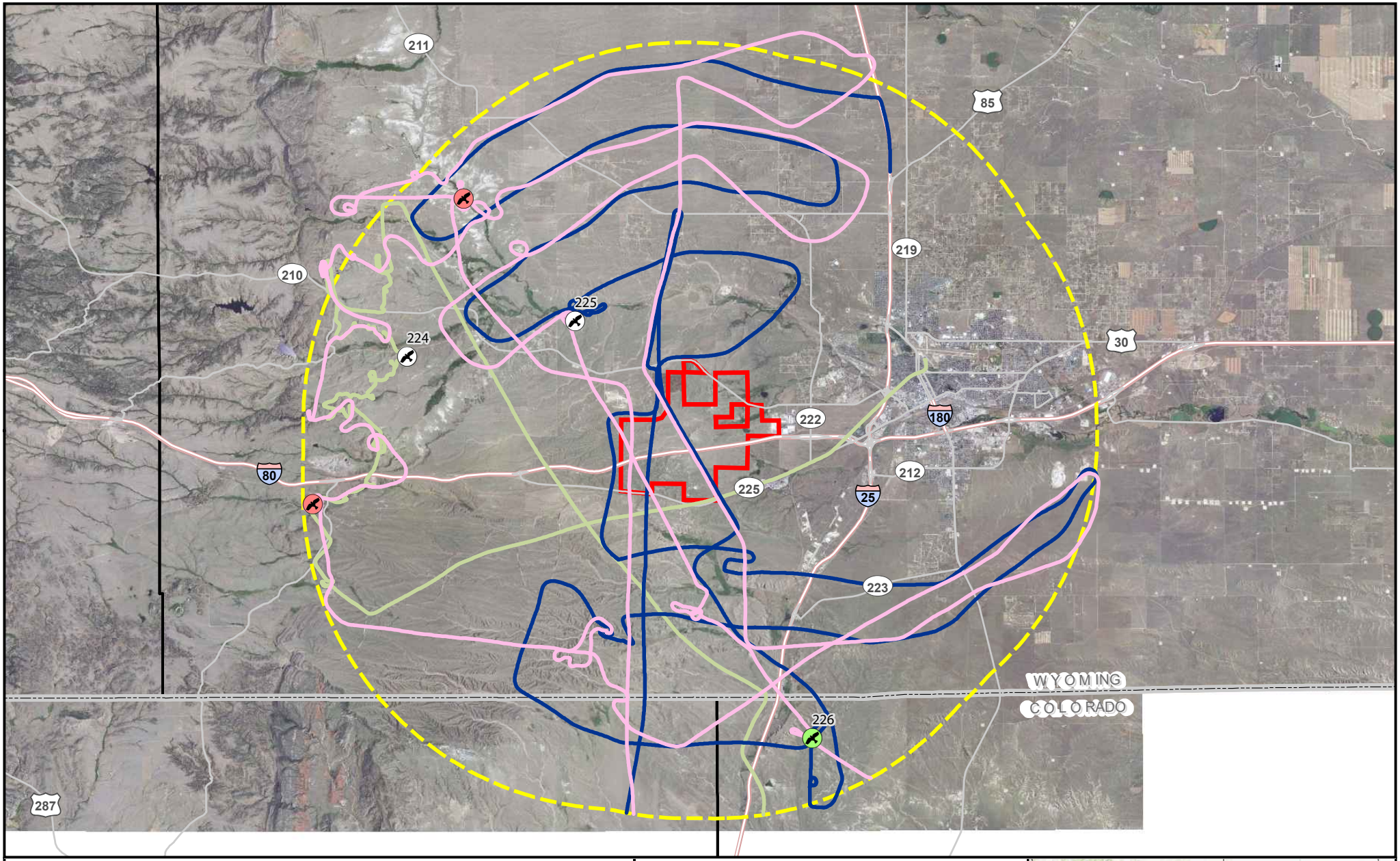
During the 2017 aerial eagle nest survey, four active golden eagle nests were observed (Table 12, Figure 7). Five other nests were unoccupied (i.e., they were no longer present or only remnants remained). Private property and remote locations did not permit further evaluation of these nests from the ground.

In 2016, one golden eagle nest was observed during the helicopter nest survey. This nest was 8.0 miles from the Project boundary, with one fledgling eaglet in the nest and one parent nearby.

Table 12. Aerial Eagle Nest Survey Results, June 8, 2017

USFWS Nest ID	Nest Status	Nest Condition	Number of Young
RN000022	UNOCCUPIED	GONE	-
RN000023	ACTIVE	USABLE	1
RN000024	ACTIVE	USABLE	2
RN000025	UNOCCUPIED	GONE	-
RN000076	UNOCCUPIED	REMNANTS	-
RN000077	UNOCCUPIED	GONE	-
RN000075	UNOCCUPIED	GONE	-
243 (NEW)	ACTIVE	USABLE	1
244 (NEW)	ACTIVE	USABLE	1

Figure 7. Golden Eagle Nest Locations, Corriedale Wind Farm Project, Laramie County, Wyoming 2016 and 2017



Active Golden Eagle Nest Observation 2017
Active Golden Eagle Nest Observation 2016-17
Inactive Nest Observation
2017 Aerial Raptor Nest Survey
2016 Aerial Raptor Nest Survey Track 1
2016 Aerial Raptor Nest Survey Track 2
Project Boundary
Project Area 10-Mile Buffer

Interstate Highway
Major Road
County boundary
states

Data Source:
NAIP 2017

Figure 7
Golden Eagle Nest Locations

Corriedale Wind Farm
Laramie County, Wyoming
Weld and Larimer Counties, Colorado
2016 and 2017

0 2 4 8
Miles

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Eagle Risk Analysis

The inputs used for the eagle analysis by all models are shown in Table 13. The results from the eagle risk analysis are presented below, categorized by the three components of the analysis: exposure, collision probability, and expansion, and the resulting fatalities.

Table 13. Corriedale Wind Farm Project, Inputs Used for USFWS Collision Probability Models to Calculate Eagle Fatalities, Laramie County, Wyoming and 2017

Model Inputs	Inputs Values for 2017		Inputs Values for Both 2016 and 2017 Combined	
	Model 1: All Points	Model 2: All Points Minus Pt 4	Model 3: All Points	Model 4: All Points Minus Point 4
Number of Turbines	21	21	21	21
Rotor Diameter	0.116 km	0.116 km	0.116 km	0.116 km
Rotor Radius	0.058 km	0.058 km	0.058 km	0.058 km
Rotor Radius Buffer	0 (default setting)	0 (default setting)	0 (default setting)	0 (default setting)
Hazardous Radius	0.058 km	0.058 km	0.058 km	0.058 km
Hazardous Area	0.233 km^2	0.233 km^2	0.233 km^2	0.233 km^2
Survey Duration	60 minutes per point	60 minutes per point	60 minutes per point	60 minutes per point
Days that Survey Strata Represent	365 days	365 days	365 days	365 days
Daylight Hours Per Day	Varies by month	Varies by month	Varies by month	Varies by month
Eagle Minutes < 200 meters agl	69	16	118	25
Number of Survey Counts Conducted	147	124	291	244
Total Number of Daylight Hours	4,453 hours	4,453 hours	8,910 hours	8,910 hours

Key:
km = kilometer
km^2 = kilometer squared

Exposure

Across all point counts conducted for the Project, eagles were observed eight separate times in the rotor-swept zone, adding up to 46 eagle exposure minutes for this Project.

The resulting prior distribution for the exposure rate is:

$Prior\ \lambda \sim Gamma\ (\alpha, \beta)$, where α = 0.97 and β = 2.76; where,

$\tilde{\alpha}$ = α + eagle minutes = 0.97 + 70 eagle minutes = 70.97 eagle minutes;

and

$\tilde{\beta} = \beta + n$ = 2.76 + (147 counts * 1.0 hours * π(0.8 km)^2) = 298.32 km^2 * hour.

Eagle exposure data collected during eagle surveys were used to determine the posterior distribution, which is used to estimate the annual predicted eagle fatalities. The resulting posterior λ distribution is:

$Posterior\ \lambda \sim Gamma\ (\alpha + \sum_{i=1}^{n} k_i\ , \beta + n)$, where

$\alpha + \sum_{i=1}^{n} k_i$ = 70.97 and β + n = 298.32, therefore:

$Posterior\ \lambda \sim Gamma$ = (70.97, 298.32); the units for λ are per hour per km^2

The exposure rate as calculated in program R™ had a mean of 0.192 and standard deviation of 0.0282. Note that there may be little influence of the prior on the exposure posterior, because the sampling effort was substantial.

Collision Probability

There is no additional information about collision probability C, because post-construction data have not been collected. The prior distribution is used, which has a mean of 0.0058 and a standard deviation of 0.0038:

$Prior\ C \sim Beta$ (2.31, 396.69)

Expansion

The expansion rate ε, is determined by the number of daylight hours in a year multiplied by the hazardous area around the 21 turbines for the Project. For Models 1 and 2, 4,457 daylight hours were used for the survey period.

ε = 3,518 hr. * π(0.06 km)^2 * 21 = 835.12 hour * km^2

The hazardous area is the RSA around a turbine, which is multiplied by the number of turbines for the Project. The resulting values of 835.12 hour * km^2 is the expansion rates, specific to the Project.

Fatalities

Four fatality estimate models were run. Models 1 and 2 focus on eagle fatality results from 2017 only, while Models 3 and 4 focus on eagle fatality results from 2016 and 2017 combined. Model 1 (all points) estimated 2 eagle fatalities per year, model 2 (all points minus point 4)

estimated 0.57 eagle fatalities per year, model 3 (all points both years) estimated 3.4 eagle fatalities per year, and model 4 (all points both years minus point 4) estimated 0.89 eagle fatalities per year.

Model 1 – Golden Eagle Fatality Estimate All Points in 2017

The predicted distribution of annual fatalities under Model 1, has a mean of 1.3 and a standard deviation of 0.9 (Table 14). The 80 percent quantile is 2.0 eagle fatalities per year. Over the 30-year life span of the wind farm, the estimated fatality is 60 golden eagle fatalities for this model.

Model 2 – Golden Eagle Fatality Estimate All Points Excluding Point 4

The predicted distribution of annual fatalities under model 2 has a mean of 0.39 and a standard deviation of 0.28. The 80 percent quantile is 0.57 eagle fatalities per year. Over the 30-year life span of the wind farm, the estimated fatality is 17.1 golden eagle fatalities for this model.

Model 3 – Golden Eagle Fatality Estimate for Both Years Combined

The predicted distribution of annual fatalities under model 3 has a mean of 2.3 and a standard deviation of 1.5. The 80 percent quantile is 3.4 eagle fatalities per year. Over the 30-year life span of the wind farm, the estimated fatality is 102 golden eagle fatalities for this model.

Model 4 – Golden Eagle Fatality Estimate for Both Years Combined Minus Point 4

The predicted distribution of annual fatalities under model 4 has a mean of 0.6 and a standard deviation of 0.42. The 80 percent quantile is 0.89 eagle fatalities per year. Over the 30-year life span of the wind farm, the estimated fatality is 26.7 golden eagle fatalities for this model.

Table 14. Estimated Eagle Exposure and Fatality by Species, Corriedale Wind Farm Project, Laramie County, Wyoming 2016 and 2017

Variables	Golden Eagle Model 1 All Points	Golden Eagle Model 2 All Points Minus Point 4	Golden Eagle Model 3 All Points	Golden Eagle Model 4 All Points Minus Point 4
Exposure Mean	0.23	0.067	0.2	0.05
Exposure SD	0.028	0.016	0.019	0.01
Fatality Mean	1.3	0.39	2.3	0.60
Fatality SD	0.92	0.28	1.5	0.42
80 Percent Quantile	2.0	0.57	3.4	0.89

Key:

SD = standard deviation

Acoustical Bat Survey

Detector Nights

The AnaBat detector recorded throughout the sample period (Table 15). The detector recorded data for four months, and a total of 95 nights. Several AnaBat malfunctions decreased the number of detector nights.

Table 15. Detector Nights by Month, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Month	Number of Detector Nights
June	17
July	31
August	28
September	17
October	2
Total	95

Species Composition

In 2017, six bat species were identified on site. Five of the six species were low-frequency species: big brown bat, hoary bat, silver-haired bat, Brazilian free-tailed bat, and pallid bat. One high-frequency species was identified in the Myotis group. This high-frequency species may be one of four possible species for Laramie County: little brown bat, long-eared myotis, long-legged myotis, or western small-footed myotis. Due to their similarity, these Myotis group calls are lumped as high-frequency calls. For all recorded bat passes, 97 percent were low-frequency bat species, and 3 percent were high frequency bats**.**

In 2016, a minimum of seven species and maximum of 10 species were identified on site (depending on how many Myotis species were actually present). Within the species, six were low-frequency species: big brown bat, hoary bat, silver-haired bat, eastern red bat, pallid bat, and fringed myotis. Two high-frequency species were identified in the Myotis group, and are counted as at least two, and up to four, species possible for Laramie County: little brown bat, long-eared myotis, long-legged myotis, and western small-footed myotis. For all recorded bat passes, 80 percent were low-frequency bat species, and 20 percent were high frequency bats**.**

Bat Activity

Bat Activity by Species Group

In 2017, a total of 298 call files were recorded. Of all files recorded during this study, 21 percent were bat passes (63 bat passes) (Table 16).

The total activity index (passes per detector night) for the Project was 0.66 bat passes per detector night. Low-frequency bats had an activity index of 0.64 bat passes per detector night, whereas high frequency bats had an activity index of 0.02 bat passes per detector night.

The activity in 2016 was much higher than 2017. The total activity index (passes per detector night) for the Project was 6.8 bat passes per detector night. Low-frequency bats had an activity index of 5.4 bat passes per detector night, whereas high frequency bats had an activity index of 1.4 bat passes per detector night.

Table 16. Bat Passes and Activity Index by Species Group, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

Type of Bat Passes and Activity Index	Low-Frequency Bats	High-Frequency Bats	Total
Total Bat Passes	61	2	63
Activity Index, Bat Pass	0.64	0.02	0.66

Temporal Distribution

In 2017, the bat activity index was highest in June (Table 17). The highest number of bat passes were in June and September.

In 2016, bat call monitoring did not begin until August. The bat activity index was highest in September. The bat passes were highest in August and September.

Table 17. Bat Activity Index and Bat Passes, June through October, Corriedale Wind Farm Project, Laramie County, Wyoming 2017

	Month				
	June	July	August	September	October
Bat Activity Index	2.94	0.74	0.32	1.94	1.00
Total Bat Passes	26	1	2	33	1
Total Detector Nights	17	31	28	17	2

Special Status Species

No identifiable Special Status bat Species were recorded in 2016 or 2017 within the Project site.

General Wildlife

The northern portion of the Project site north of Interstate 80 overlaps crucial range and migration routes for pronghorn. This species was observed throughout the Project area. No other big game species were observed. Limited observations and locations were noted for coyote, American badger, black-tailed jackrabbit, and white-tailed jackrabbit. Wyoming ground squirrel was observed at many point count stations.

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Attachment 1. U.S. Fish and Wildlife Service (USFWS). 2013 Region 6 Recommendations for Avoidance and Minimization of Impacts to Golden Eagles at Wind Energy Facilities, April 11, 2013

Region 6 Recommendations for Avoidance and Minimization of Impacts to Golden Eagles at Wind Energy Facilities, April 11, 2013

The following recommendations were developed through a joint effort between the Migratory Bird Management and Ecological Services Programs in the Region 6 Regional Office and Wyoming Ecological Services Field Office in Cheyenne, Wyoming. The document includes our joint recommendations to avoid and minimize impacts to golden eagles (GOEA) at: (a) recently occupied nests, (b) unoccupied nests, (c) areas of concentrated prey resources, and (d) other project-specific eagle activity areas. Our goal for avoiding and minimizing impacts is to contribute to maintaining stable or increasing breeding populations of eagles by recommending conservation measures that will maintain GOEA breeding territories and by minimizing impacts to other important eagle use areas (e.g., eagle nests, foraging areas, and communal roosts; 50 CFR 22.3). Currently, a sub-team of the Eagle Technical Assistance Team is developing recommendations for addressing activities near eagle nests, but their recommendations may not be available for several months or longer (they intend to use a peer review process). In developing our recommendations, we are aware that our approach could be more or less stringent than the recommendations ultimately developed by the Eagle Technical Assistance Team, but we have strived to use the best available science.

RECOMMENDATIONS

I. Occupied Nests – Use the ½ mean inter-nest distance (MIND) buffer for the project area.

II. Unoccupied (Historic) Nests – No turbines will be constructed within 0.5-mile (800-meters) of any unoccupied (historic) nest. In addition, all turbines between 0.5-mile and 1.0 mile (1,600-meters) of any unoccupied nest will be curtailed during each year starting 15 January until 1 May, unless adequate nest surveys demonstrate that the nests are unoccupied. Also, if the nest becomes occupied, turbines will be curtailed between the 0.5-mile and the ½-MIND during the breeding season until the young fledge or the nest becomes unoccupied.

III. Areas of Concentrated Prey Resources – Recommend turbines not be constructed in areas of concentrated prey resources unless it can be demonstrated that they do not overlap or are not immediately adjacent to other important eagle use areas, and where sufficient data are available to confirm that the concentrated prey resources are not in project-specific eagle activity areas.

IV. Other Project-Specific Eagle Activity Areas – Focus on areas where there is an intersection of geographic relief (e.g., cliff features used for nesting, ridge features used for migration, rims used for orthographic lift) and documented project-specific eagle activity areas.

DESCRIPTION OF RECOMMENDATIONS

A. Occupied Nests

An occupied nest is a nest used for breeding in the current year by a pair of eagles. Presence of an adult, eggs, or young, freshly molted feathers or plucked down, or current year's mutes (whitewash) suggest site occupancy. In years when food resources are scarce, it is not uncommon for a pair of eagles to occupy a nest yet never lay eggs; such nests are considered occupied (Eagle Conservation Plan Guidance [ECPG[1]] 2012, p. 32). For purposes of these recommendations, we define occupied GOEA nests as nest sites that were occupied at least once during the last five years or last five years of field surveys. Because GOEAs will often use the same nest in multiple years (Kochert and Steenhof 2012), there is a high likelihood that these nests could be occupied again during the life of the project. Nests form the center of activity during the breeding season and are often centers of activity during the non-breeding season as well (Marzluff et al. 1997). Buffering or otherwise protecting eagle nests should substantially decrease the probability of lethal take, as well as disturbance take, of eagles. Other raptors using the same nesting habitats as GOEA (e.g., prairie falcon) will also benefit from protection of GOEA nest sites.

Use the ½ mean inter-nest distance (MIND) buffer for the project area.

The size of the ½-MIND buffer is based on an average distance among all occupied nests within a given year, and approximates the average territory size. Eagle pairs that nest within one-half the mean project-area inter-nest distance are potentially susceptible to disturbance take and blade strike mortality, as these pairs and offspring may use the project footprint (ECPG, p. 12). The ECPG recommends using the ½-MIND to delineate territories and associated breeding eagles at risk of mortality or disturbance (p. 12). Lacking other agency policy recommendations, guidance and regulations, our recommendation is to apply the ½-MIND risk evaluation method described in the ECPG as an avoidance buffer to maintain eagle nesting territories. Hence, using the ½-MIND for a buffer recommendation is a further application of the initial risk assessment approach described in the ECPG. The ½-MIND can be adjusted if site-specific data (e.g., telemetry, prey analysis, other data) are adequate to suggest the buffer should be larger/smaller/non-circular.

B. Unoccupied (Historic) Nests

We define unoccupied GOEA nests as those nests not selected by raptors for use in the current nesting season (ECPG 2012, p. 33). For purposes of these recommendations, we define unoccupied GOEA nests as nest sites that were not occupied during the last five years or last five years of field surveys. It should be noted that occupied nests can be incorrectly assigned as unoccupied if the nests are not repeatedly surveyed during the same nesting season. Even if a nest was unoccupied in one or more years, it is still possible that eagles could reuse that nest in future years (Kochert and Steenhof 2012), especially since the intervals between nest reuse can be lengthy (Kochert and Steenhof 2012, Slater et al. 2013). Given that the anticipated life of a wind project is 30 years (though repowering could extend that indefinitely) it is likely that some

[1] The reference is to internal version 2.0 from March 2012 that has not been released to the public.

unoccupied nests will become occupied during the life of the project. In addition, nests usually occur in areas of historical eagle use (due to topographic features and prey resources) and represent areas where eagles are expected to return in the future.

No turbines will be constructed within 0.5-mile (800-meters) of any unoccupied (historic) nest. In addition, all turbines between 0.5-mile and 1.0 mile (1,600-meters) of any unoccupied nest will be curtailed during each year starting 15 January until 1 May, **unless adequate nest surveys demonstrate that the nests are unoccupied**.

Further, if the nest becomes occupied, turbines will be curtailed between the 0.5-mile and the ½-MIND during the breeding season until the young fledge or the nest becomes unoccupied.

C. Areas of Concentrated Prey Resources

Protection buffers for prey base areas likely used by GOEA. These areas typically receive use by GOEA during the nesting season, migration, and during wintering (so potentially year-round).

Recommend turbines not be constructed in areas of concentrated prey resources unless it can be demonstrated that they do not overlap or are not immediately adjacent to other important eagle use areas, and where sufficient data are available to confirm that the concentrated prey resources are not in areas of project-specific eagle activity areas.

D. Other Project-Specific Eagle Activity Areas

Apply protections (e.g., buffers) for other project-specific eagle activity areas identified by survey data (e.g., 800-meter point counts) (these are different than "important eagle use areas" defined in regulations and the ECPG). Although project-specific, certain areas (e.g., topographic relief creating uplifts, migration corridors, perch sites) are typically used by eagles; therefore, it is appropriate to identify these and provide buffer recommendations for them.

Focus on areas where there is an intersection of geographic relief (e.g., cliff features used for nesting, ridge features used for migration, rims used for orthographic lift) and documented project-specific eagle activity areas.

Identify specific locations where the project-specific eagle activity areas intersect topographic and/or geographic features used by eagles and provide recommendations for a buffer where there is overlap. Recommended buffers for geographic features would vary based on the value/use of the geologic feature to eagles, with those having greater value/use by eagles receiving larger buffers. For this option, avoidance and minimization is site-specific, with custom-designed buffers for eagle activity areas based on project-specific geography and documented eagle use of those features.

Attachment 2. U.S Fish and Wildlife Service (USFWS). 2016. Region 6 Recommended Protocol for the Proposed Corriedale Wind Farm Project in Wyoming for Pre-Construction Eagle Nest Surveys

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, WY 82009

In Reply Refer To:
06E13000- 2016-CPA-0232

AUG 2 6 2016

Nathan Groh, Environmental Engineer
Black Hills Corporation
1301 West 24th Street
Cheyenne, Wyoming 82001

Dear Mr. Groh:

Thank you for meeting with our office on May 24, 2016, to discuss the proposed Black Hills Corporation's Corriedale Wind Energy Project (Corriedale Project) to be located west of the city of Cheyenne in Laramie County, Wyoming. The proposed Corriedale Project is anticipated to consist of 25 wind energy turbines and will be located on private land. Based on this number of turbines, you informed us that the Corriedale Project will not require a Wyoming Department of Environment Quality Industrial Siting Permit and will not go through the State of Wyoming review process. However, you have informed our office that you plan to review potential Corriedale Project impacts to wildlife in coordination with the Wyoming Game and Fish Department as well as our office. Specifically, you plan to coordinate with our office to evaluate impacts to threatened and endangered species and migratory birds, including eagles to comply with regulatory requirements.

In this letter we are documenting our coordination to date and our recommendation for continued engagement with our office. During the May 24 meeting our office informed you of guidance for addressing U.S. Fish and Wildlife Service (Service) trust resources during Corriedale Project development and operation. This guidance includes the Service's National Land-Based Wind Energy Guidelines (WEG) (USFWS 2012) and the Eagle Conservation Plan (ECP) Guidance (USFWS 2013). On July 13, 2016, we received updated information via telephone and email correspondence informing our office that the Corriedale Project development timeline had been extended to allow sufficient time for collection and interpretation of avian use, habitat, and nest data. On July 18, 2016, our office provided you with a map of known eagle nests within 10 miles of the Corriedale Project boundary to assist with your data collection effort.

We are providing you with information on protective measures for threatened and endangered species pursuant to the Endangered Species Act, as amended (ESA), 16 U.S.C. 1531 *et seq*; migratory birds, including eagles, in accordance with the Migratory Bird Treaty Act (MBTA), 16

U.S.C. 703; and eagles, in accordance with the Bald and Golden Eagle Protection Act (Eagle Act), 16 U.S.C. 668. Our office is available to assist Black Hills Corporation with compliance with these federal wildlife laws during preliminary site review and continuing through the development and operation of the Corriedale Project.

THREATENED AND ENDANGERED SPECIES AND SPECIES OF CONCERN

The Service provides an "Information, Planning, and Conservation" (IPaC) web-based tool to assist project developers determine whether any threatened and endangered species, designated critical habitat, proposed species and proposed critical habitat, migratory birds of conservation concern, or wetlands and National Wildlife Refuges may be affected by a proposed project. IPAC (https://ecos.fws.gov/ipac/) provides project developers the ability to explore and evaluate the landscape to site projects in a way that minimizes conflicts with Service trust resources. If it a threatened and endangered species, designated critical habitat, proposed species, or proposed critical habitat may be affected by your Project, please contact and work with our office.

NATIONAL LAND-BASED WIND ENERGY GUIDELINES

The WEG describes a "tiered approach" for assessing and then avoiding and minimizing potential adverse effects of wind energy development to wildlife and their habitats. The tiered approach is a decision-making process for collecting information in increasing detail; quantifying the possible risks of proposed wind energy projects to wildlife and their habitats; and evaluating those risks in order to make siting, construction, and operation decisions. There are five tiers where a developer evaluates risks and makes decisions regarding those risks. We recommend you provide our office with the results of your Project's landscape scale screening (Tier 1) and site characterization (Tier 2) to facilitate discussions of proposed Tier 3 field surveys (Tier 3). Tier 1 and Tier 2 analyses should include an evaluation of Corriedale Project risk to species of concern, including eagles, threatened and endangered species, and bird species listed as Birds of Conservation Concern (USFWS 2008).

The WEG provides a recommendation that a Bird and Bat Conservation Strategy (BBCS) be developed for wind energy projects. We have enclosed USFWS Region 6 guidance for developing and organizing a BBCS. A BBCS documents the analyses, studies, and reasoning that support the progression from one tier to the next, and it is a life-of-the-project framework for identifying and implementing actions to conserve birds and bats during project operation, maintenance, and decommissioning. A BBCS should describe: (1) avoidance, minimization, and mitigation for adverse impacts to birds and bats; (2) ongoing post-construction monitoring efforts; and (3) adaptive management. It is the responsibility of the wind energy project developer and operator to assess project-related impacts to birds, bats and their habitats, and to work to avoid and minimize those impacts.

EAGLE RULE AND EAGLE CONSERVATION PLAN GUIDANCE

In 2009, the Service published a final rule (74 FR 46836) authorizing limited issuance of permits to take bald and golden eagles where the take is compatible with the preservation of the bald and

golden eagle and is associated with, but is not the purpose of, an otherwise lawful activity and cannot practicably be avoided. In 2013, the Service issued ECP Guidance to explain the requirements of the 2009 eagle permit rule as it applies to wind energy facilities and provides a process for wind power developers and operators to obtain authorization to take eagles under the Eagle Act (USFWS 2013).

The ECP Guidance provides instruction for developing an ECP for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities in areas where take of eagles may occur. An ECP provides the data needed to support an application for a programmatic eagle take permit including information on siting, configuration, construction, and operational alternatives that avoid or minimizes eagle take to the point where any remaining take is unavoidable. An ECP will also include a description of the mitigation needed to meet the statutory preservation standard, currently defined as maintaining stable or increasing breeding populations of bald and golden eagles. We have enclosed USFWS Region 6 guidance for developing and organizing an ECP to support a programmatic eagle take permit application. The ECP should describe and document how a project developer and/or operator intends to comply with the regulatory requirements for programmatic eagle take permits and the associated National Environmental Policy Act (NEPA) process associated with the Service's decision regarding potential issuance of an eagle take permit .

The Service provides a process for wind energy companies to develop an ECP to support a programmatic eagle take permit with the understanding that some proposed wind energy projects in Wyoming may not meet the regulatory requirements for a take permit or that projects may need to be substantially re-designed to meet that requirement. It is important to closely follow Service guidance to avoid and minimize the take of eagles and to ensure that all remaining unavoidable take can be permitted.

Following the ECP Guidance, wind energy projects may be ranked into three categories ranging from a Category 1 project, with high risk to eagles, to a Category 3 project, with minimal risk to eagles. Construction of a Category 1 project is not recommended because the project would likely not meet the regulatory requirements for permit issuance and may place the project developer or operator at risk of violating the Eagle Act and MBTA. The ECP Guidance describes the studies needed to determine if your Corriedale Project is a Category 1, 2, or 3. Studies supporting an ECP include surveys of the Corriedale Project area nesting population, eagle use including mapping of eagle flight paths, prey base with an emphasis on concentrated sources of prey, and if appropriate, surveys of communal roosts and migration counts.

Siting wind turbines within a project area so that the likelihood of eagle collision is minimized is a major focus of an ECP. To identify where turbines can be sited to minimize the likelihood of collision mortality, you will need to understand eagle use across the Corriedale Project footprint. Eagle use data to inform project siting to avoid eagle collisions can be obtained by surveying as close to 100 percent of the Corriedale Project footprint as possible, and this will also provide the minimum 30 percent survey coverage needed for eagle fatality estimates (USFWS 2013).

COORDINATION WITH U. S. FISH AND WILDLIFE SERVICE OFFICES

Both Stage 1 of the ECP Guidance and Tier 1 of the WEG are landscape level site-assessments. Project developers should carry out Stage 1/Tier 1 by gathering existing information from available sources to evaluate broad geographic areas to assess the suitability for development and the risk to Service trust resources. Information gathered during this step will provide a basis for your discussions with our office on your Project-specific survey needs.

The Service's Wyoming Field Office and the Region 6 Migratory Bird Management Office have developed additional recommendations for wind energy projects that complement the WEG and ECP Guidance. We have enclosed four guidance documents, including recommendations for avoidance and minimization of impacts to golden eagles, a protocol for eagle nest surveys, and outlines for development of an ECP and BBCS. Wyoming specific guidance can also be found at http://www.fws.gov/wyominges/wind.php.

Coordination with the Service should begin early in project planning to allow for a minimum of 2 years of field data collection, data analyses, development of a BBCS and, if appropriate, an ECP with the required NEPA for possible issuance of a programmatic eagle take permit. We recommend meeting with our office to review survey methodologies prior to field data collection, and meeting with us at least annually to report pre-construction survey data. The Wyoming Field Office serves as you primary Service contact and we will ensure your coordination with the Region 6 Migratory Bird Management Office as needed.

SURVEY RECOMMENDATIONS FOR MIGRATORY BIRDS

An effective baseline of bird activity, distribution, and habitat will follow WEG Tiers 1 and 2 and ECP Guidance Stage II analyses and be based on existing bird and habitat data, field surveys of habitat and bird use, and identification of current and proposed impacts. These data will allow an evaluation of risk to migratory bird resources from the Corriedale Project construction and operation and identification of options to mitigate for impacts to their habitat.

Birds of Conservation Concern (USFWS 2008) occurring in the Corriedale Project area should be a focus of survey and conservation efforts. Point counts (800-meter radius) for raptors, including eagles, should cover as close to 100 percent of the Corriedale Project area as possible. We recommend mapping the flight paths of raptors. Smaller point counts (e.g., 100-200 meter radius) for other migratory birds should be located in all habitat types found within the Corriedale Project area. Surveys should be distributed across all seasons and time of day. Because wildlife use of a site can vary between years, the Service recommends collecting a minimum of 2 years of data prior to the start of Corriedale Project construction. Habitat data collected should include important bird habitats, such as topographic features, nesting substrates, roost sites, prey base, other foraging habitats, water sources, and perch sites etc. We recommend that survey methods follow established and repeatable protocols (National Research Council 2007) and be reviewed by our office prior to implementation.

We recommend that survey data be reported to our office on an annual basis in spreadsheet and Geographic Information System formats for review to facilitate ECP and BBCS development. Survey protocols in subsequent years may be adapted based on prior year survey results.

LEGAL REQUIREMENTS AND RESPONSIBILITIES

The federal laws listed above contain prohibitions on taking, including killing, injuring and in some cases disturbing, federally protected species without exemption or authorization from the Service. The guidance referenced in this letter describes ways to comply with those laws. The Service's Office of Law Enforcement (OLE) carries out its mission through investigations and prosecution but also by fostering working relationships with individuals, companies, and industries that have taken prudent and effective steps to avoid take of federally protected species. The OLE focuses investigative efforts on those that take federally protected species without identifying and implementing all reasonable, prudent and effective measures to avoid that take. Companies will need to secure prior authorization from the Service as described above for any take of eagles or threatened or endangered species that is reasonably expected to occur.

Any take of eagles absent a permit will be investigated by OLE and referred to the United States Department of Justice for appropriate action. Although a permit to authorize the incidental take of other migratory birds is currently not available, the responsible party's due diligence in avoiding take, or lack of, is closely evaluated by both the Service and Department of Justice when determining an appropriate legal resolution.

PROJECT PLANNING TIMELINE

Project planning will need to allow sufficient time to conduct the recommended minimum of 2 full years of eagle-use surveys prior to construction in order to develop an ECP in support of a programmatic eagle take permit. Additional time should be incorporated into the Corriedale Project schedule for analyses and development of the ECP and approximately one additional year for the Service to conduct the required NEPA process for permit issuance. Development of an effective ECP and a BBCS through coordination with our office and obtaining a programmatic eagle take permit for remaining unavoidable take will demonstrate Black Hills Corporation's efforts to comply with the MBTA and Eagle Act.

We look forward to coordinating with Black Hills Corporation as you consider the conservation of threatened and endangered species, eagles, and other migratory birds during planning for the proposed Corriedale Wind Energy Project in Laramie County, Wyoming. If you have questions regarding this letter, please contact Patricia (Trish) Sweanor at (307) 772-2374, extension 239.

Sincerely,

Tyler A. Abbott
Acting Field Supervisor
Wyoming Field Office

Enclosures (4)

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July 19, 2016

U.S. Fish and Wildlife Service (USFWS) Region 6, Recommended Protocol for the Proposed Corriedale Wind Project in Wyoming for Pre-Construction Eagle Nest Surveys

NOTE: This protocol was developed for conducting pre-construction eagle nesting surveys at the proposed Corriedale wind energy development project and is only intended for this purpose. This protocol consists of a general nest survey protocol for eagle nests to determine eagle productivity parameters and it should be applied for both bald and golden eagles. For the nest survey protocol the key productivity parameters that should be determined are occupancy, productivity, and nest success. Of these three parameters determination of nest occupancy is especially important. The protocol recommendations are designed to be consistent with, and to complement and supplement, the USFWS recommendations for surveying project-area nesting populations of eagles as detailed in Appendix C of the USFWS Eagle Conservation Plan Guidance (ECPG) (USFWS 2013).

A. Recommended Protocol for General Bald and Golden Eagle Nest Surveys

First Visit/First Survey: Complete this during the time period from 1 January to end of the 3rd week of February. These should be ground-based nest checks with emphasis on, but not limited to, known/historic eagle nests within the survey area. Use historic nest records and at a minimum visit all known historic eagle nests within the survey area. Check to determine whether or not nests are occupied (see definition below).

Second Visit/Second Survey: Complete this during the time period from the beginning of last week of February through 3rd week of March. This visit/survey should be an aerial survey of the search area for eagle nests. We recommend the use of a helicopter instead of fixed-wing aircraft to complete this work. Aerial surveys conducted with a helicopter provide greater flexibility and utility in nest searching and possibly greater overall survey accuracy. Collect key location data for nests including UTM's or Latitude/Longitude for all nest locations. A major emphasis with this survey is determining the locations of all historical eagle nests structures and checking these for nest occupancy in the current nesting season. An additional point of emphasis for this survey effort should be to search for new eagle nests within the survey area. An aerial survey is recommended during this time period since this is when occupancy of nests by eagle pairs in this area should be at a peak, and it should encompass the mean egg –laying dates for these pairs.

Third Visit/Third Survey: Complete this during the time period from the beginning of last full week of March through the end of April. These should be ground-based nest checks with emphasis on updating the status of all occupied nests being tracked for the current nesting season based on the results from the first and second Visits.

Fourth Visit/Fourth Survey: Complete this during the time period from the beginning of the 3rd week of April to the end of May. This visit/survey also should be an aerial survey of the search area for eagle nests during the peak of eagle nesting activity for the nesting season. This visit should confirm which nests are occupied and yield information about productivity (see definition below) for these nests. An aerial survey is recommended for this visit since this time period should encompass the mean hatch dates for eagle pairs within this area and it should be optimal for determining brood size.

Fifth Visit/Fifth Survey: Complete this during the time period from the beginning of June to the end of end of the first week of July. These should be ground-based nest checks with an emphasis on determining if nests are successful or whether they have failed. Another emphasis should be on determining productivity of occupied nests. Surveys conducted during this time period should overlap with mean dates when nestlings in this area are 55 days and 70 days old respectively. Hence this period is especially important in determination of fledge rates for the young eagles.

Sixth Visit/Sixth Survey: Complete this during the time period from the beginning of the second week of July through the end of August. Timing of this visit should be carefully tied to outcomes from the fifth visit. If young are at late nestling stage during the fifth visit the sixth visit should follow more closely (within at least 2 weeks of the fifth visit). These should be ground–based nest checks. Further assess productivity and make final estimate of nest success for all occupied eagle nests during the current nesting season. These visits also have increased importance for determining productivity parameters for eagle pairs that either nested late or that failed in their first nesting attempt and then re-nested during this same nesting season.

Other Visits: For eagles there may be some nest sites that are more challenging to make determinations on for occupancy, productivity, and nest success. Therefore other visits may be necessary in addition to the 6 visits outlined above to collect this data.

Definitions (taken from USFWS 2013 Eagle Conservation Plan Guidance):

Occupied Nest* is a nest used for breeding in the current year by a pair of eagles. Presence of an adult, eggs, or young, freshly molted feathers or plucked down, or a current year's mutes (whitewash) suggest site occupancy. In years when food resources are scarce, it is not uncommon for a pair of eagles to occupy a nest yet never lay eggs; such nests are considered occupied.

Productivity- the number of juveniles fledged from an occupied nest, often reported as a mean over the sample of nests.

*Note- Additional evidence that can be used to help confirm occupancy include the presence of a new stick nest at a location where there was not one previously, evidence of substantial repair to an existing

nest/ addition of many sticks to an existing nests, the presence of one or more freshly killed prey items, and the presence of some fresh greenery or other decoration in a nest structure.

General Guidelines for Eagle Visits/Surveys:

- Conduct all monitoring in a safe manner. All field work involves some risk; however, human safety is always a priority.

- Per the USFWS ECPG the minimum bound for the eagle nesting survey area should be either the project footprint and all area within 10 miles of this, or if recent information is available (within the last 5 years) on spacing of occupied eagle nests for the project-area nesting population then this can be used to delineate an appropriate survey boundary for the project area (USFWS; Appendices C and H, 2013).

- Per the USFWS ECPG locations of occupied nests of eagles should be determined within the project area for no less than 2 breeding seasons prior to construction (USFWS; Appendix C).

- For eagles, generally no less than 6 visits / surveys per nesting season with visits/surveys scheduled and completed in appropriate time windows relative to the full eagle nesting season. For bald and golden eagles in Wyoming this is generally 1 January through 31 August each year, although these dates can be refined and modified as field data is collected over time on species and site-specific information. There are exceptions to this 6 visit/survey recommendation for those cases where either nesting efforts fail or the nest is not occupied during the current nesting season. These exceptions are covered in greater detail in bullet items below.

- Visits/surveys should also be spread out appropriately throughout the full eagle nesting season. Generally there should be no less than approximately 3 weeks between visits/surveys nor should there be more than approximately 6 weeks between visits/surveys.

- All nests should be visited multiple time including nests that are determined to have failed. For bald and golden eagle nests that fail continue monitoring visits at least through April 1. If as of April 1 there is no change in status for a failed nest then no further monitoring beyond this date is necessary for the current nesting season.

- Visit all known or suspected eagle nests within the survey area and check repeatedly. Continue to look for evidence of "new" nests, both existing nests that were missed during pre-construction surveys as well as newly built nests within the current nesting season.

- In addition to visiting any known or suspected eagle nests the project-area nesting population survey should include all potential eagle nesting habitat within the project area (USFWS ECPG; Appendix C).

- Map the full survey area at the beginning of each nesting season and survey the same geographic area for repeated visits within each nesting season.

- At least 2 of the visits/surveys should be aerial surveys. Use of helicopter for aerial surveys is recommended over use of fixed-wing aircraft but the choice of aircraft is at the discretion of the company. The 2 aerial surveys should occur at least 60 days apart in time. It may be desirable to conduct the second aerial survey during early May. During this time, eggs or young in occupied nests should be clearly visible, or it is now possible to confirm that an eagle nest is unoccupied. Also, conducting aerial surveys during early May could increase efficiencies by allowing observers to quickly check on nests of most other raptor species. Most raptor species, except some Swainson's hawks, and some early nesting great-horned owls, will be incubating eggs or tending nestlings by this time.

- Report take, or problems (e.g., rotor wash knocks nestling out of nest) or observations of illegal activities to the USFWS as soon as possible, so that appropriate actions can be taken (e.g., contact rehabilitator, additional monitoring, adjustments in methods, investigation, etc.).

- At least three surveys are needed to determine that an eagle nest is not occupied during the current nesting season and these should occur between early February and early May. In making a determination that the nest is not occupied using ground-based surveys the last 2 surveys to confirm that the nest is unoccupied should be at least 4 hours long. The reason for conducting multiple visits, and for some of the visits to cover longer time periods, and for these visits to be spaced out over a longer portion of the nesting season, before a nest can be classified as unoccupied is to demonstrate that a sufficient effort was invested in making this determination. A single nest visit of short duration could easily result in a determination that a nest is unoccupied, yet the adults may simply have been away from the nest during the visit yielding a false conclusion about the occupancy status of the nest. Nests that are missing (not observed, could not be located) or are gone (tree blew down, nest fell off cliff) should be rechecked according to the schedule to look for rebuilding at the same or a nearby location, rather than assuming the nest is not occupied.

- For nest visits where a determination that the nest is occupied by eagles (per the above definition of occupied nest), ground-based surveys need only last until the confirming evidence is observed and documented.

- Within a nesting season once a nest has been determined to be used continue to monitor that nest following the above protocol until the young have fledged from the nest or the nest fails whichever happens first.

- Use qualified biologists – this is especially important for aerial surveys.

- The goal for eagle nest surveys in general is to determine territory occupancy, productivity and nest success for all eagle nesting territories within the survey area.

- Create standard data forms for recording data from ground-based surveys and aerial surveys and complete these each time a survey is conducted. The data forms should at least contain: date, survey number, time the survey was conducted, names of surveyors, method(s) used, unique nest identifier (number or name), location information (UTM, Lat/Long), description of the location to help locate the nest (e.g., approximately 30 feet from the top of the cliff), type of nest structure/substrate (e.g., cliff, tree), species (including non-eagle), condition of the nest (e.g., good, dilapidated, gone), whether eagles were seen at or near the nest, the number of eagles and eggs and young observed, and other indications that the nest is used by eagles or another species (e.g., greenery, whitewash, prey remains, presence of other species). Nests should also be documented with digital photography.

- Whether doing aerial surveys or ground-based nest monitoring use appropriate methods and cautions so that the monitoring work itself does not result in disturbance take of eagles.

U.S. Fish and Wildlife Service, Region 6, Mountain-Prairie Region

Outline for a Bird and Bat Conservation Strategy: Wind Energy Projects

A Bird and Bat Conservation Strategy (BBCS) is a life-of-a-project framework for identifying and implementing actions to conserve birds and bats during wind energy project planning, construction, operation, maintenance, and decommissioning. It is the responsibility of wind energy project developers and operators to effectively assess project-related impacts to birds, bats and their habitats, and to work to avoid and minimize those impacts.

A wind project BBCS should be updated regularly as new information, including monitoring of project impacts and technical advancements, becomes available. A BBCS is a strategy for assessing impacts, avoiding/minimizing impacts, guiding current actions, and planning future impact assessments and actions to conserve birds and bats. It provides reference to project history and previous impact assessments and actions. A BBCS contains the studies, analyses, and reasoning leading to project-specific decisions and implementation of actions. The 2012 U.S. Fish and Wildlife Service (USFWS) Land-Based Wind Energy Guidelines (WEG) provides comprehensive guidance on the process for addressing bird and bat conservation at all stages of wind energy development.

Decisions made through the BBCS framework include determining if there is a need to develop other bird and bat conservation plans such as an Eagle Conservation Plan (2013 USFWS Eagle Conservation Plan Guidance) or Habitat Conservation Plan (Endangered Species Act, section 10(a)(1)(B). Specific surveys needed to support those plans may be most effectively conducted in tandem with surveys to develop the BBCS.

Wind energy projects currently in operation which have not been planned, developed, or operated following a BBCS framework, will, at a minimum, need to supplement assessments of impacts to birds and bats with Post-Construction Assessments and Adaptive Management Studies, working closely with the USFWS.

The following outline is provided by USFWS Region 6 as a guide for developing and organizing a BBCS.

from WEG Tier 3, Chapter 4: (8) What are the distributions, abundance, behaviors and site-use of birds and bats, and what project elements expose these species to risk? (9) What are the potential risks to individuals and local populations of birds and bats and their habitats? (10) How can impacts to birds and bats be avoided and minimized? (11) What studies should be initiated and continued post-construction to evaluate predictions of impacts to birds and bats? Describe the level of scientific rigor of studies, and coordination and sharing of data with USFWS field offices.

1. Bird and Bat Status Assessments
   Describe how assessment studies were of sufficient duration and intensity to ensure adequate data were collected to accurately characterize bird and bat use of the area.

   (a) Bird and Bat Species Presence
      (i) Species Presence by Season
      (ii) Species of Concern (WEG, p. 63)
      (iii) Species of Habitat Fragmentation Concern (WEG, p. 63)

   (b) Bird and Bat Habitats
      Describe, quantify, and map.

   (c) Bird and Bat Use Patterns
      Describe, quantify and map survey data (e.g., from point counts, acoustic surveys, and migration surveys).

   (d) Baseline (Pre-construction) Habitat Management
      Describe the management of habitat at the proposed site prior to construction.

2. Bird and Bat Risk Assessment and Decisions Based on Assessments
   Describe assessment methods and assumptions.

   (a) Project Risk Assessment

      (i) Direct Impacts:
         Describe direct project impacts on birds and bats (e.g., wind turbine collisions, powerline electrocutions and collisions, vehicle collisions, barotrauma, disturbance, displacement, behavioral changes, and habitat loss, degradation and fragmentation).

      (ii) Indirect Impacts
         Describe indirect project impacts on birds and bats (e.g., loss of population vigor, attraction to modified habitats, and increased exposure to predation).

      (iii) Cumulative Impacts

   (b) Risk Assessment Decisions

      (i) Decision Criteria to either Abandon Site or Advance Project

      (ii) Decision of Need for Other Bird and Bat Conservation Plans
         Describe decision to develop other plans such an Eagle Conservation Plan, Habitat Conservation Plan, Candidate Conservation Plan with Assurances, or a plan to address state-managed species.

V. Conservation Measures to Avoid and Minimize Adverse Impacts (during project construction, operation, maintenance, and decommissioning)
Describe conservation measures and when and how each measure will be applied. Some measures will apply to all project phases, but other measures will only apply to specific phases of the project (e.g., construction versus operation). See WEG Chapter 7 for examples. While the following topics in the outline should all be included, the organization of this section may be modified (e.g., conservation measures may be organized by project phase, project elements, or category of conservation action).

A. Measures to Avoid/Minimize Direct Impacts

1. Fatalities

2. Disturbance/Displacement/Behavioral Changes

(a) Nest/Roost/Hibernacula Management
Describe how impacts to nests and nesting attempts will be avoided or minimized during all phases of the project. For example, constructing outside the breeding season or using nest buffers may be appropriate during construction, but measures to discourage or prevent birds from nesting in a sub-station may be needed during operation.

(b) Management of Other Habitat-use Areas (e.g., Foraging Areas)

3. Habitat Loss/Degradation/Fragmentation

B. Measures to Avoid/Minimize Indirect Impacts
For example, address measures to avoid loss of population vigor and increased exposure to predation.

C. Measures to Offset and/or Compensate for Habitat-Related Impacts

D. Measures to Avoid and Minimize Other Identified Project-Specific Risks

VI. Post-construction Studies to Estimate Impacts (WEG Tier 4)
Provide assessments of ongoing project risks to birds and bats and the effectiveness of conservation measures. Describe study methods and the level of survey effort (i.e., how many of each survey type was conducted, over what time period and seasons, and location and geographic coverage).

A. Carcass Surveys

B. Nest/Roost/Hibernacula Surveys

C. Habitat Surveys

D. Other Surveys
A need for surveys, such as point counts, acoustic surveys, mist net surveys, may be identified through measuring project impacts.

VII. Other Post-construction Studies and Adaptive Management (WEG Tier 5)
Describe adaptive management studies which may (1) be planned during development of the BBCS via measuring impacts during post-construction and the discovery that conservation measures are not adequate to avoid and minimize impacts, or may (2) address unplanned or unforeseen impacts. Describe the actions taken during the following steps.

A. Evaluate need for action (1) based on assessing effectiveness of conservation measures through post-construction monitoring of impacts, or (2) as determined by unforeseen impacts or circumstances.

B. Identify potential technical/operational option(s) to avoid and minimize impacts (e.g., via scientific literature or industry innovation).

C. Present technical/operational option(s) to agency/authority for review to determine if it merits field testing or application. If, after review, field testing or application is not merited, go to step B. If field testing or application is merited, go to step D.

D. Field test or apply technical/operational option(s), with agency/authority concurrence of methods, in settings which will not increase adverse impacts to birds and bats nor will result in impacts exceeding those allowable in permits or other project-related plans.

E. Evaluate and report effectiveness of technical/operational option(s) with review by agency/authority. If ineffective, go to step B. If effective go to step F.

F. Apply effective avoidance and minimization measures.

G. Monitor effectiveness (update post-construction monitoring in BBCS, if necessary, with agency/authority review).

H. Update BBCS Section on Conservation Measures, return to step A to evaluate need for further action.

VIII. Project Permits Addressing Birds and Bats

Identify need for permits. For example, migratory bird permits would be required for active nest relocation, temporary possession, depredation, salvage/disposal, and scientific collection.

A. Bird and Bat Permits

Identify permits needed for project construction, operation, and/or maintenance.

B. Agency and Process for Permit Issuance

Identify the responsive agency and processes to apply for and comply with permits.

IX. Reporting Formats and Schedule

Describe formats and schedule for reporting data and study results to responsive agencies.

A. Preconstruction Survey Data

B. Operation/Post-construction Monitoring

C. Adaptive Management

D. Permits

X. Personnel Training

Describe process and curriculum for providing personnel and contractors with education about wildlife laws; processes to follow upon finding injured birds, bats or carcasses; and actions they can take to avoid impacts to birds and bats.

XI. Contacts/Key Resources

A. List of Contacts and Key Resources

B. Coordination Processes
Who/when/where a company should initiate contact and under what circumstances.

XII. References and Literature Cited

XIII. Appendices

A. Baseline Survey Reports

B. Post Construction Reports

1. Carcass Monitoring
2. Nest/Roost/Hibernacula Surveys
3. Habitat Surveys
4. Other Surveys: For example, point counts, acoustic surveys, mist net surveys

C. Adaptive Management Studies

D. Other Plans Guiding Bird and Bat Conservation (e.g., ECP)

E. Permits Related to Birds and Bats

U.S. Fish and Wildlife Service, Region 6, Mountain-Prairie Region

Final Outline and Components of an Eagle Conservation Plan (ECP) for Wind Development: Recommendations from USFWS Region 6

Purpose and Expectations:

The U.S. Fish and Wildlife Service (USFWS) Eagle Conservation Plan Guidance, Module 1, Land-based Wind Energy , Version 2 (ECPG)[1] provides specific in-depth guidance for developing an Eagle Conservation Plan (ECP) for conserving bald and golden eagles in the course of siting, constructing, and operating wind energy facilities. The ECP describes and documents how the project developer and/or operator intends to comply with the regulatory requirements for programmatic eagle take permits and the associated NEPA process by avoiding and minimizing the risk of taking eagles by evaluating possible alternatives in siting, configuration, construction, and operation of wind projects. The ECP should provide detailed information on siting, configuration, construction, and operational alternatives that avoid and minimize eagle take to the point where any remaining take is unavoidable and, if required, mitigates that remaining take to meet the statutory preservation standard. An ECP provides support for an application for a programmatic eagle take permit.

This Region 6 document provides recommendations, in an outline format, for developing and organizing the content of an ECP, and includes additional details on topics that should be addressed in an ECP. This guidance applies equally to both bald and golden eagles. While developing an ECP and applying for a programmatic eagle take permit is voluntary, take of eagles under the Bald and Golden Eagle Protection Act is prohibited without a permit; therefore, we encourage developers/operators of wind projects that may take eagles to develop an ECP and apply for a programmatic eagle take permit. Throughout the process of developing an ECP there should be regular communication between the project developer and/or operator and USFWS personnel (Ecological Services and Migratory Bird Management Offices). This can include emails, conference calls, and meetings involving review of survey data, review and editing of draft documents, joint development of avoidance and minimization measures, review and discussion on model runs, joint work on calculations for compensatory mitigation when required, etc.

[1] Available at http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf

ECP Outline Recommendations:

I. Introduction and Purpose: Include an explanation of the relationship between the ECP and other related documents, such as NEPA reviews for the project (EA or EIS), Bird and Bat Conservation Strategy (BBCS), etc.

II. Regulatory Framework

A. Laws and Regulations- Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA) – Use applicable default language taken from the USFWS Wind Energy Guidelines (WEG; USFWS 2012, pp. 2-3)

B. State or Tribal Wildlife laws and other Federal laws that apply

III. Project Description

A. Describe all project components, including structures and infrastructure (wind turbines, roads, buildings, met towers, distribution and transmission lines, substations, etc.).

B. Provide a map of project area with project area boundary delineated.

C. Provide a map of topographic relief for the project area.

D. Provide a map of proposed final wind turbine layout, roads, distribution and transmission lines, substations, buildings, met towers (permanent), etc.

E. Provide a map of vegetation classes and aquatic features for the project, including a summary table with information on the acreage or linear miles of each class or feature present and how many acres/miles will be lost or degraded by project development.

IV. Initial Site Assessment (ECPG Stage 1)

A. Brief summary of available sources reviewed for the project site relative to eagles, including reports, publications, GIS maps, agency files, species experts, on-line databases, and initial site visit(s).

B. Were alternate sites considered/evaluated, and if so what criteria were used to compare sites?

C. Address all questions in ECPG Appendix B on page 51. Clearly identify the process used to address these questions. Based on the responses to these questions develop a map that categorizes eagle risk for all sites initially considered for development.

D. Categorize Eagle Risk for Stage 1 (ECPG Appendix B) using ECPG criteria on pp. 25-26.

V. Site-specific Surveys and Assessment (ECPG Stage 2): This section should address the questions in ECPG Appendix C, page 53.

A. Eagle Use

1. Thoroughly describe what types of eagle-use surveys were conducted, the survey protocols used, the number of surveys completed, and when surveys were conducted (years, seasonal coverage, time of day, etc.). Survey types may include, but are not limited to, eagle point count surveys, flight paths, migration monitoring, behavioral studies, and telemetry. If any survey protocols changed during these surveys, explain the changes and provide a rationale for them. If survey types and protocols differed from Appendix C in the ECPG, describe what the differences were and provide a rationale.

2. Include a map of points used for eagle use surveys and an estimate of the percentage of the project area and project footprint they cover.

3. Provide results and thorough details on all pre-construction site-specific surveys that were conducted by year and/or season. Summarize survey results in the ECP. If annual monitoring reports are available for the project, they may be included in an Appendix.

4. Provide results from any other field work to identify migration corridors, roost sites, foraging areas, wintering areas, etc., not mentioned above.

B. Eagle Nests

1. Describe what is known about eagle nesting in the project area prior to any project-related surveys; include a map showing the locations of all historic eagle nests.

2. Thoroughly describe all raptor/eagle nest surveys conducted (i.e. aerial, ground searches, etc.), including methodology, timing and frequency of the surveys; provide a map of the area searched for nests (i.e., how far out from the project area and project footprint did you survey for nests); describe condition of all eagle nests, provide photographs of eagle nest sites, provide outcomes for each eagle nest by species (i.e., tending, occupancy, productivity, and nest success); and provide project-area mean inter-nest distance for eagles by species (if calculated, provide methods used for that calculation).

C. Eagle Prey Base Assessment

1. Thoroughly describe methodologies/protocols used to assess the eagle prey base (especially areas with concentrated prey resources).

2. Provide map(s) indicating areas with concentrated prey resources (e.g., prairie dog towns, leks, ungulate wintering/parturition areas, etc.) in relation to proposed final turbine layout. Map rivers, lakes and reservoirs where bald eagles forage on fish and waterfowl, and map areas of open water available during winter, if any.

3. Describe potential anthropogenic sources of eagle prey for the project area including cattle or sheep grazing operations, road kill carcasses on roads, gut piles from hunting seasons, etc.

D. Eagle Risk Categorization for Stage 2

1. Describe how the eagle use, eagle nest, and eagle prey base assessment data were used to assess the eagle risk category. Use ECPG criteria on pgs. 25-26.

VI. Avoidance and Minimization of Risks in Project Siting (ECPG Stage 4)

A. Project Planning/Design Phase: site selection

1. Were alternative sites considered for development and was there consideration for reducing eagle/raptor/migratory bird risk in this process?

2. Were wind turbines removed and/or relocated from the initial project design, and if so, why?

3. Were any project roads, power lines, or buildings removed or relocated from the initial project design, and if so, why?

4. Document all key adjustments made to the initial project design, why they were made, what information was used to make changes, and any subsequent draft designs. Thorough descriptions should accompany any maps.

5. Were the USFWS Region 6 Recommendations for Avoidance and Minimization of Impacts to Golden Eagles at Wind Energy Facilities (April, 2013) followed in the project design phase? If not, provide a rationale.

VII. Predicting Eagle Fatalities (ECPG Stage 3)

A. Describe the methods and assumptions used. If these differ from Appendix D in the ECPG, describe the differences and provide a rationale.

1. Provide all input data used.

2. Present results from Eagle Modeling by Eagle Species

a. USFWS eagle fatality model

b. Outcomes from other models (if any)

B. Other Eagle Risk Assessment

1. Disturbance/Displacement Assessment

2. Assessment of Project-level Take: Complete this analysis consistent with ECPG Appendix F.

3. Local Area Population (LAP) Analysis

4. Cumulative Impacts Analysis – Comprehensive assessment of known factors impacting eagles, eagle habitat, prey base, etc., within the sphere of the LAP. This includes known eagle mortality from all other factors within the LAP, including existing wind facilities, power lines, poisoning, etc. Proponent will need to work jointly with USFWS on this section. Refer to ECPG Appendix F.

C. Eagle Risk Categorization for Stage 3. Use ECPG criteria on pp. 25-26.

VIII. Additional Avoidance and Minimization of Risks, ACP's, and Compensatory Mitigation (ECPG Stage 4)

A. Construction Phase Best Management Practices (all that apply from USFWS 2012, WEG Chapter 7)

B. Operational Phase

1. Best Management Practices (Including, at a minimum, those from USFWS 2012, WEG Chapter 7 which apply to eagles)

2. Experimental Advanced Conservation Practices, per ECPG Appendix E.

C. Compensatory Mitigation

1. Calculations of needed mitigation for your project using Appendix G of ECPG; thoroughly describe calculations that were used to generate results.

2. Present a plan for the implementation of compensatory mitigation, including the type of compensatory mitigation that will be implemented. How was the type of compensatory mitigation being proposed actually selected? The plan should demonstrate the project developer's/operator's ability to complete it. Where will the compensatory mitigation be completed relative to relevant Local Area Population, Bird Conservation Regions (ECPG pg. 38), Eagle Management Units (ECPG pg. 39), etc.? What is the expected life of the compensatory mitigation action(s)?

3. Effectiveness monitoring: describe monitoring approach, duration, etc.

4. Adaptive Management, including commitments to change operations in response to monitoring outcomes as applicable. (See ECPG pg. 28 and ECPG Appendix A)

IX. Calibration and Updating of the Fatality Prediction and Continued Risk Assessment (ECPG Stage 5)

A. Post-construction monitoring (eagle/avian surveys)

1. Describe the methodology/protocols to be used for carcass surveys for eagles/migratory birds (including searcher efficiency trials and carcass persistence trials). These will be developed jointly by the developer/operator and the USFWS per ECPG Appendix H.

Note: General considerations for design of the fatality monitoring program include:

- Kunz et al. (2007). Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71: 2449-2486.
- Strickland et al. (2011). Studying Wind Energy/Wildlife Interactions: a Guidance Document. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA, and relevant points from USFWS WEG pp. 35-37.

2. Surveys of eagle/raptor nests (occupancy, productivity, and success)

- Describe methods to be used, number of years surveys will be conducted, area to be surveyed, etc.

3. Disturbance Monitoring: Document any post-construction monitoring of eagle nesting territories and communal roost sites to evaluate disturbance effects. (See ECPG Appendix H, pg. 98). Provide details of the protocols and methods to be used for such monitoring.

4. Describe eagle use/migratory bird surveys that will be conducted post-construction. Provide methodology, timing and frequency of survey effort, location of survey points,

percent of area that will be surveyed, number of surveys, etc. If such surveys will not be conducted, provide a rationale.

5. If there will be an incidental (i.e., informal) wildlife monitoring system established, describe the system, including personnel that will implement it, data forms to be used, how the reporting process will work, and how conflicts with informal monitoring and formal carcass surveys will be avoided.

X. Permits

A. For USFWS programmatic eagle take permits, conditions will be provided by USFWS.

B. Other USFWS Permit Types: Other Migratory Bird Treaty Act (MBTA) permits may be required for project management. These include, but are not limited to, nest relocation, temporary possession, depredation, salvage/disposal, and scientific collection.

1. Identify MBTA permit types the project is likely to apply for. Also describe the process which will be used to obtain and comply with all necessary MBTA take permits for the project.

2. Other State or Tribal wildlife permits

XI. References/Literature Cited

What not to include in your ECP:

-Literature review or summary of effects of wind turbines on eagles/migratory birds/wildlife

-Comparisons of predicted eagle take at your project with other on-line wind energy facilities

Region 6 Recommendations for Avoidance and Minimization of Impacts to Golden Eagles at Wind Energy Facilities, April 11, 2013

The following recommendations were developed through a joint effort between the Migratory Bird Management and Ecological Services Programs in the Region 6 Regional Office and Wyoming Ecological Services Field Office in Cheyenne, Wyoming. The document includes our joint recommendations to avoid and minimize impacts to golden eagles (GOEA) at: (a) recently occupied nests, (b) unoccupied nests, (c) areas of concentrated prey resources, and (d) other project-specific eagle activity areas. Our goal for avoiding and minimizing impacts is to contribute to maintaining stable or increasing breeding populations of eagles by recommending conservation measures that will maintain GOEA breeding territories and by minimizing impacts to other important eagle use areas (e.g., eagle nests, foraging areas, and communal roosts; 50 CFR 22.3). Currently, a sub-team of the Eagle Technical Assistance Team is developing recommendations for addressing activities near eagle nests, but their recommendations may not be available for several months or longer (they intend to use a peer review process). In developing our recommendations, we are aware that our approach could be more or less stringent than the recommendations ultimately developed by the Eagle Technical Assistance Team, but we have strived to use the best available science.

RECOMMENDATIONS

I. Occupied Nests – Use the ½ mean inter-nest distance (MIND) buffer for the project area.

II. Unoccupied (Historic) Nests – No turbines will be constructed within 0.5-mile (800-meters) of any unoccupied (historic) nest. In addition, all turbines between 0.5-mile and 1.0 mile (1,600-meters) of any unoccupied nest will be curtailed during each year starting 15 January until 1 May, unless adequate nest surveys demonstrate that the nests are unoccupied. Also, if the nest becomes occupied, turbines will be curtailed between the 0.5-mile and the ½-MIND during the breeding season until the young fledge or the nest becomes unoccupied.

III. Areas of Concentrated Prey Resources – Recommend turbines not be constructed in areas of concentrated prey resources unless it can be demonstrated that they do not overlap or are not immediately adjacent to other important eagle use areas, and where sufficient data are available to confirm that the concentrated prey resources are not in project-specific eagle activity areas.

IV. Other Project-Specific Eagle Activity Areas – Focus on areas where there is an intersection of geographic relief (e.g., cliff features used for nesting, ridge features used for migration, rims used for orthographic lift) and documented project-specific eagle activity areas.

DESCRIPTION OF RECOMMENDATIONS

A. Occupied Nests

An occupied nest is a nest used for breeding in the current year by a pair of eagles. Presence of an adult, eggs, or young, freshly molted feathers or plucked down, or current year's mutes (whitewash) suggest site occupancy. In years when food resources are scarce, it is not uncommon for a pair of eagles to occupy a nest yet never lay eggs; such nests are considered occupied (Eagle Conservation Plan Guidance [ECPG[1]] 2012, p. 32). For purposes of these recommendations, we define occupied GOEA nests as nest sites that were occupied at least once during the last five years or last five years of field surveys. Because GOEAs will often use the same nest in multiple years (Kochert and Steenhof 2012), there is a high likelihood that these nests could be occupied again during the life of the project. Nests form the center of activity during the breeding season and are often centers of activity during the non-breeding season as well (Marzluff et al. 1997). Buffering or otherwise protecting eagle nests should substantially decrease the probability of lethal take, as well as disturbance take, of eagles. Other raptors using the same nesting habitats as GOEA (e.g., prairie falcon) will also benefit from protection of GOEA nest sites.

Use the ½ mean inter-nest distance (MIND) buffer for the project area.

The size of the ½-MIND buffer is based on an average distance among all occupied nests within a given year, and approximates the average territory size. Eagle pairs that nest within one-half the mean project-area inter-nest distance are potentially susceptible to disturbance take and blade strike mortality, as these pairs and offspring may use the project footprint (ECPG, p. 12). The ECPG recommends using the ½-MIND to delineate territories and associated breeding eagles at risk of mortality or disturbance (p. 12). Lacking other agency policy recommendations, guidance and regulations, our recommendation is to apply the ½-MIND risk evaluation method described in the ECPG as an avoidance buffer to maintain eagle nesting territories. Hence, using the ½-MIND for a buffer recommendation is a further application of the initial risk assessment approach described in the ECPG. The ½-MIND can be adjusted if site-specific data (e.g., telemetry, prey analysis, other data) are adequate to suggest the buffer should be larger/smaller/non-circular.

B. Unoccupied (Historic) Nests

We define unoccupied GOEA nests as those nests not selected by raptors for use in the current nesting season (ECPG 2012, p. 33). For purposes of these recommendations, we define unoccupied GOEA nests as nest sites that were not occupied during the last five years or last five years of field surveys. It should be noted that occupied nests can be incorrectly assigned as unoccupied if the nests are not repeatedly surveyed during the same nesting season. Even if a nest was unoccupied in one or more years, it is still possible that eagles could reuse that nest in future years (Kochert and Steenhof 2012), especially since the intervals between nest reuse can be lengthy (Kochert and Steenhof 2012, Slater et al. 2013). Given that the anticipated life of a wind project is 30 years (though repowering could extend that indefinitely) it is likely that some

[1] The reference is to internal version 2.0 from March 2012 that has not been released to the public.

unoccupied nests will become occupied during the life of the project. In addition, nests usually occur in areas of historical eagle use (due to topographic features and prey resources) and represent areas where eagles are expected to return in the future.

No turbines will be constructed within 0.5-mile (800-meters) of any unoccupied (historic) nest. In addition, all turbines between 0.5-mile and 1.0 mile (1,600-meters) of any unoccupied nest will be curtailed during each year starting 15 January until 1 May, unless adequate nest surveys demonstrate that the nests are unoccupied.

Further, if the nest becomes occupied, turbines will be curtailed between the 0.5-mile and the ½-MIND during the breeding season until the young fledge or the nest becomes unoccupied.

C. Areas of Concentrated Prey Resources

Protection buffers for prey base areas likely used by GOEA. These areas typically receive use by GOEA during the nesting season, migration, and during wintering (so potentially year-round).

Recommend turbines not be constructed in areas of concentrated prey resources unless it can be demonstrated that they do not overlap or are not immediately adjacent to other important eagle use areas, and where sufficient data are available to confirm that the concentrated prey resources are not in areas of project-specific eagle activity areas.

D. Other Project-Specific Eagle Activity Areas

Apply protections (e.g., buffers) for other project-specific eagle activity areas identified by survey data (e.g., 800-meter point counts) (these are different than "important eagle use areas" defined in regulations and the ECPG). Although project-specific, certain areas (e.g., topographic relief creating uplifts, migration corridors, perch sites) are typically used by eagles; therefore, it is appropriate to identify these and provide buffer recommendations for them.

Focus on areas where there is an intersection of geographic relief (e.g., cliff features used for nesting, ridge features used for migration, rims used for orthographic lift) and documented project-specific eagle activity areas.

Identify specific locations where the project-specific eagle activity areas intersect topographic and/or geographic features used by eagles and provide recommendations for a buffer where there is overlap. Recommended buffers for geographic features would vary based on the value/use of the geologic feature to eagles, with those having greater value/use by eagles receiving larger buffers. For this option, avoidance and minimization is site-specific, with custom-designed buffers for eagle activity areas based on project-specific geography and documented eagle use of those features.