Wildlife Conservation Strategy for the Dakota Range I & II Wind Project

June 2020

PREPARED FOR

Northern States Power Company – Minnesota dba Xcel Energy

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DOCUMENT REGISTER

This Wildlife Conservation Strategy is a living document and may need to be revised from time to time during development, construction, and operations of the project. Revisions to the document are logged below in the document register.

Revision Number	Document Date	Comments	Reviser Initials
Original	06/29/2020	Original Document Draft	

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
APLIC	Avian Power Line Interaction Committee
BCC	Birds of Conservation Concern
BCR	North American Bird Conservation Region
BGEPA	Bald and Golden Eagle Protection Act
CRP	Conservation Reserve Program
ECPG	Eagle Conservation Plan Guidance, *Module 1 – Land-based Wind Energy: Version 2*
ESA	Endangered Species Act
GPS	Global Positioning System
MBTA	Migratory Bird Treaty Act
MW	Megawatts
NLCD	National Land Cover Database
NLEB	Northern long-eared bat
O&M	Operations and Maintenance
RSA	rotor-swept area
SDGFP	South Dakota Game, Fish and Parks
SPUT	Special Purpose- Utility
Tetra Tech	Tetra Tech, Inc.
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WCS	Wildlife Conservation Strategy
WEG	USFWS Land-based Wind Energy Guidelines
WMA	Wildlife Management Area
WNS	White-Nose Syndrome
WPA	Waterfowl Production Area

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1.0 INTRODUCTION

Wind power generation facilities can help reduce dependence on non-renewable energy sources and have many environmental benefits including reduction in the generation of greenhouse gases, preserving open space habitat, and improving air quality. Wind farms do, however, have the potential to result in adverse environmental impacts, including the potential to directly and indirectly impact avian and bat species.

Northern States Power Company dba Xcel Energy (Xcel) is committed to siting, constructing, operating, and decommissioning their facilities in an environmentally responsible and sustainable manner. This environmental responsibility includes conserving and minimizing impacts to natural resources, including wildlife species and the habitats they use. This Wildlife Conservation Strategy (WCS) is intended to address avian and bat risk at the Dakota Range I & II Wind Project per the recommendations of the *U.S. Fish and Wildlife Service* (USFWS) *Land-based Wind Energy Guidelines* (WEG) (USFWS 2012). The USFWS recommends following the voluntary WEG as a way to provide a structured approach for assessing wildlife risks at wind energy facilities, promote communication between project proponents and the USFWS, and provide a practical approach for conserving species of concern, which per the WEG, is defined as any species which:

> *1) is either a) listed as an endangered, candidate, or threatened species under the Endangered Species Act (ESA), subject to the Migratory Bird Treaty Act (MBTA) or Bald and Golden Eagle Protection Act (BGEPA); b) is designated by law, regulation, or other formal process for protection and/or management by the relevant agency or other authority; or c) has been shown to be significantly adversely affected by wind energy development, and 2) is determined to be possibly affected by the project* (USFWS 2012).

Apex Clean Energy Management, LLC, (Apex) began developing the Dakota Range I & II Wind Project (Project) in May 2015. Development efforts initially focused on a 235,034-acre area that included the Project as well as land in Grant, Codington, and Roberts Counties, South Dakota (Tier I Evaluation Area). Based on results of the preliminary site evaluation, Apex elected to focus initial development efforts within 121,429 acres in Grant and Codington Counties. As a result of initial field studies, the boundary was shifted west in 2016 to avoid areas determined to be more sensitive for wildlife (i.e., concentrations of wetlands, federal easements). Further adjustments were made to the 2016 boundary as project and appurtenant facilities were being designed, resulting in a 43,917-acre Project boundary (Appendix A: Figure 1). Xcel purchased the Project from Apex in November 2017, and will be responsible for construction, operation, and decommissioning activities.

The purpose of this WCS is to document Xcel's compliance with relevant wildlife laws and regulations by adhering to the processes outlined in the USFWS WEG and 2013 Eagle Conservation Plan Guidance (ECPG) (USFWS 2013) for developing, constructing, and operating wind energy projects, and to explain the analyses, studies, and reasoning that support progressing from one tier to the next in the tiered approach presented in the WEG. The Tier 4 post-construction monitoring program, and an Adaptive Management Plan to respond to new information and situational changes, if necessary, are also presented.

2.0 REGULATORY FRAMEWORK

Native migratory birds are protected under a variety of state and federal laws and regulations. With regard to the Project, these are the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), and the Bald and Golden Eagle Protection Act (BGEPA). Bats are protected only if they are listed as threatened or endangered under the ESA. These regulations are described in the following subsections.

2.1 MIGRATORY BIRD TREATY ACT

The MBTA is the cornerstone of migratory bird conservation and protection in the United States. The MBTA implements four treaties that provide for international protection of migratory birds. The MBTA prohibits "take" of

migratory birds—more than 1,000 species (Federal Register; 50 Code of Federal Regulations [CFR] 10 and 21), including the bald eagle (*Haliaeetus leucocephalus)* and golden eagle (*Aquila chrysaetos*)—their parts, eggs, or nests "at any time, by any means." "Take" is defined by the MBTA as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or any attempt to carry out these activities." A "take" does not include habitat destruction or alteration, as long as it does not involve a direct taking of birds, nests, or eggs. Currently, federal Circuit Courts are not in agreement on the issue of whether incidental take is a violation of MBTA. The Department of Interior's current interpretation is that the MBTA's take prohibition does not extend to incidental take of migratory birds from otherwise lawful activities. An April 11, 2018 memorandum from the USFWS reinforced this interpretation, stating that the "take of birds, eggs or nests" was prohibited only when the purpose of the activity was to conduct take of birds, but was not prohibited when the take was "incidental" meaning resulting from an otherwise lawful activity whose purpose was not to conduct take.

2.2 BALD AND GOLDEN EAGLE PROTECTION ACT

Under authority of the BGEPA, 16 U.S.C. 668–668d, bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are afforded additional legal protection. The BGEPA prohibits the take, sale, purchase, barter, offer of sale, purchase, or barter, transport, export or import, at any time or in any manner of any bald or golden eagle, alive or dead, or any part, nest, or egg thereof, 16 U.S.C. 668. The BGEPA also defines take to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb," 16 U.S.C. 668c, and includes criminal and civil penalties for violating the statute. See 16 U.S.C. 668. The term "disturb" is defined as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury to an eagle, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior, 50 CFR 22.3. Under 50 CFR §22.26, Eagle Incidental Take Permits are available for incidental take associated with otherwise lawful activities (USFWS 2016a).

2.3 ENDANGERED SPECIES ACT

The ESA directs the USFWS to identify and protect endangered and threatened species and their critical habitat, and to provide a means to conserve their ecosystems. Among its other provisions, the ESA requires the USFWS to assess civil and criminal penalties for violations of the Act or its regulations. Section 9 of the ESA prohibits take of federally listed species. Take is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" 16 U.S.C. 1532. The term "harm" includes significant habitat alteration which kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering, 50 CFR 17.3. Projects involving Federal lands, funding or authorizations will require consultation between the Federal agency and the USFWS, pursuant to Section 7 of the ESA. Projects without a Federal nexus should work directly with USFWS to avoid adversely impacting listed species and their critical habitats.

2.4 STATE PROTECTION

The protection and regulation of species not listed under the federal ESA is typically at the discretion of state wildlife agencies. South Dakota's Endangered and Threatened Species Statute, Chapter 34A-8, requires the South Dakota Game Fish and Parks (SDGFP) to develop a list of species determined to be endangered or threatened within the state, as well as to perform all acts necessary for the conservation, management, protection, restoration, and propagation of these species. SDGFP has identified 22 state threatened or endangered species within South Dakota (SDGFP 2020). The SDGFP made these determinations on the basis of the best scientific, commercial, and other data available to them and after consultation, as appropriate, with federal agencies, other interested state agencies, other states having a common interest in the species and interested persons and organizations.

2.5 NON-REGULATORY FRAMEWORK

In addition to regulatory drivers, this document also discusses bird species included on the USFWS list of Birds of Conservation Concern (BCC). Although these species are not formally protected under any regulatory laws, BCC species are closely monitored by USFWS due to population declines and/or rare occurrences in a specific region. As a result, BCC species that might be encountered at the Project are included in this WCS. Development of the BCC category for birds was the result of a 1988 amendment to the Fish and Wildlife Conservation Act that mandates the USFWS identify 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 overall goal is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions. The BCC categorization is intended to stimulate coordinated and collaborative proactive conservation actions among federal, state, tribal, and private partners (USFWS 2008). The proposed Project Area is located in the Prairie Potholes Region (BCR 11).

2.6 AGENCY CONSULTATION

Consistent with the WEG and ECPG, Apex communicated on a regular basis with the USFWS and SDGFP regarding bird and bat studies and impact avoidance measures, as illustrated in **Table 1**. Study results have been communicated to the USFWS and SDGFP from 2015 until 2017 and agency recommendations and technical input have been incorporated into this WCS.

Table 1. Apex\Agency Correspondence and Meetings

Date	From	To	Type	Description
Jul 24, 2015	Apex	USFWS	Data Request	Apex emailed USFWS requesting information on sensitive species within 10 miles of proposed Project area. USFWS response received Aug 11, 2015.
Aug 6, 2015	Apex	SDGFP	Data Request	Apex submitted a request for natural heritage data within 10 miles of proposed Project area. Data received Aug 10, 2015.
Aug 12, 2015	Apex	USFWS SDGFP	Meeting	USFWS/SDGFP/Apex meet to discuss Tier 1/Tier 2 reviews and agree on Tier 3 studies
Feb 22, 2017	SDGFP	Apex	Email	SDGFP provided Apex with document outlining lek avoidance recommendations.
Mar 28, 2017	Apex	USFWS SDGFP	Meeting	USFWS/SDGFP/Apex meet to review current project boundary, discuss the results of wildlife studies completed to date, and agree on next steps in order for the Project to proceed to construction
Jul 20, 2017	Apex	SDGFP	Email	Apex provided SDGFP with the 2017 lek survey report and planned response to survey results.
Sep 22, 2017	Apex	USFWS SDGFP	Email	Apex provided USFWS and SDGFP with copies of final reports completed to date.

Date	From	To	Type	Description
Sep 25, 2017	Apex	USFWS SDGFP	Meeting	USFWS/SDGFP/Apex meet to discuss the results of wildlife studies completed to date, agree on avoidance and minimization measures, and agree on next steps in advance of submittal of SDPUC Wind Energy Conversion Facility Siting Permit application
Sep 29, 2017	Apex	USFWS SDGFP	Email	Apex provided a copy of the final avian use report to USFWS and SDGFP.

3.0 PROJECT DESCRIPTION

Xcel is proposing to construct and operate the Project which is located approximately 15 miles north of the city of Watertown in Grant and Codington Counties, South Dakota (Appendix A: Figure 1). For the purposes of this WCS the Project Area is considered to be a 1-kilometer buffer around the turbine layout dated May 22, 2020 which covers approximately 25,832 acres. Xcel selected the specific Project Area based on significant landowner support, transmission and interconnection suitability, optimal wind resources, and minimal impact on environmental resources (see Section 4.0).

The Project's capacity will be up to 302.4 megawatts (MW) of wind energy. Project facilities will include: (1) up to 72 wind turbines (with 12 alternates); (2) new gravel access roads and improvements to existing roads; (3) underground electrical collection lines; (4) an operations and maintenance (O&M) building; (5) a collector substation; (6) an interconnection switching station; (7) a SCADA system (installed with the collector lines and interconnection facility); and (8) a temporary batch plant area and staging/laydown area for construction of the Project (Appendix A: Figure 2). The Project will interconnect to the high-voltage transmission grid via the Big Stone South to Ellendale 345-kV transmission line, which crosses the Project site. A new 345-kV interconnection switching station connecting to the Big Stone South to Ellendale line will be constructed, owned, and operated by Otter Tail Power Company and Montana Dakota Utilities. Xcel will construct and own a 345-kV interconnection facility connecting a new collection substation and the interconnection switching station. Because the interconnection facility is less than 2,640-feet long, does not cross any public highways, and does not require the use of eminent domain, it falls outside the South Dakota Public Utilities Commission (SDPUC) jurisdiction and has been permitted locally.

4.0 PRE-CONSTRUCTION SITE ASSESSMENT

4.1 PRELIMINARY SITE EVALUATION (WEG TIER 1)

In accordance with the WEG, development of the Project followed a tiered evaluation process to avoid and minimize impacts on sensitive wildlife species and their habitats. Apex, following Tiers 1 of the WEG, began development of this Project in 2015 by first conducting a preliminary site evaluation of a 235,034-acre area that included the Project as well as additional land in Codington, Grant, and Roberts counties (Burns McDonnell 2018). As part of this effort, a desktop review and site visit were conducted in order to evaluate types of habitat within the area and identify sites with reduced potential for species of concern. According to Apex, the following data sources were used in the desktop review included USFWS IPaC website; South Dakota Natural Heritage Database; U.S. Geological Services (USGS) Breeding Bird Survey; aerial imagery; and non-governmental organization websites (e.g., Audubon Society, American Wind Wildlife Institute Landscape Assessment Tool, e-Bird, and the Hawk Migration Association of North America). In addition, preliminary agency input was requested from USFWS and SDGFP regarding any instances

of federally and state-listed animals and plants, significant natural communities, and other species of concern or significant habitats that occur in the area of interest.

4.2 SITE-SPECIFIC CHARACTERIZATION AND DECISIONS (WEG TIER 2)

Based on results of the preliminary site evaluation, Apex elected to focus initial development efforts within 121,429-acres in Grant and Codington counties and conducted a WEG Tier 2 site characterization. This was expanded upon by Xcel, which hired Tetra Tech to do a Threatened and Endangered Species Assessment of a 61,035-acre study area which included the Project Area. The Threatened and Endangered Species Assessment included a desktop analysis and a reconnaissance-level site visit to evaluate vegetation/habitat coverage and land management/use in June 2018 (Tetra Tech 2018a).

4.2.1 Site Description

The Project Area (1 kilometer buffer of turbine layout dated May 22, 2020) is located within the Level III Northern Glaciated Plains ecoregion, which according to the U.S. Environmental Protection Agency (USEPA 2013) "… *is characterized by a flat to gently rolling landscape composed of glacial drift. The sub-humid conditions foster a grassland transitional between the tall and shortgrass prairie. High concentrations of temporary and seasonal wetlands create favorable conditions for duck nesting and migration. Though the till soil is very fertile, agricultural success is subject to annual climatic fluctuations*."

The National Land Cover Dataset (NLCD) was used to determine available habitats impacts by category (Table 2, Appendix A: Figure 3, Yang et al 2018). The Project Area is dominated by cultivated crops (54 percent) and herbaceous (40 percent) (Table 2, Appendix A: Figure 3). Developed open space, emergent herbaceous wetlands, and open water make up smaller proportions of the Project Area. As a part of the Threatened and Endangered Species assessment, a qualified Tetra Tech biologist conducted a reconnaissance-level site visit of the assessment area and found it consistent with the land cover described by the NLCD and for the ecoregion as a whole and was observed to consist of a mix of grasslands, agricultural lands used for grain crops, developed land (farmsteads), and wetlands. The topography in the vicinity of the Project was observed to be generally flat with uniformly low vegetative cover.

Table 2. Land Cover Types within the Project Area

2016 NLCD Category	Total Acres	Percent of Total
Cultivated Crops	13,978.69	54%
Herbaceous	10,229.23	40%
Developed, Open Space	858.75	3%
Emergent Herbaceous Wetlands	234.64	1%
Hay/Pasture	199.88	1%
Developed, Low Intensity	144.09	1%
Deciduous Forest	115.19	<1%
Open Water	22.50	<1%
Mixed Forest	21.24	<1%
Developed, Medium Intensity	13.56	<1%
Woody Wetlands	5.89	<1%

2016 NLCD Category	Total Acres	Percent of Total
Shrub/Scrub	4.69	<1%
Developed, High Intensity	3.56	<1%
Barren Land	0.22	<1%
Total	**25,832.13**	**100%**

The Project Area is located within the Central Flyway, one of the main migratory bird routes in North America. Most birds that move along the Central Flyway travel from Canada through the central states, eventually reaching the tropics of South America via the Gulf of Mexico (USFWS 2020a). The Project also lies within North American Bird Conservation Region (BCR) 11 (Prairie Potholes). This BCR is the most important waterfowl producing region on the North American continent despite extensive wetland drainage and tillage of native grasslands. The region comprises the core of the breeding range of most dabbling duck and several diving duck species and provides critical breeding and migration habitat for over 200 other birds (American Bird Conservancy 2020a).

4.2.2 Evaluation and Decisions

Publicly available information (including published studies, technical reports, databases), along with information from agencies, local conservation organizations, and/or local experts, and observations made during the 2015 site assessment and the 2018 Threatened and Endangered Species Assessment site visit, was used to address the WEG Tier 2 questions.

Table 3. Federally Threatened and Endangered species known to occur within Grant and Codington counties, South Dakota

Common Name	Federal Status	Available Habitat	Likelihood of Occurrence Within the Project Area
Whooping crane	Endangered	Suitable foraging habitat is present near the Project Area, but suitable roosting habitat is limited.	Low
Rufa red knot	Threatened	Suitable migration and foraging habitat is not likely to be present near the Project Area as mudflats and primary prey items are absent.	Low
Northern long-eared bat	Threatened	Lack of large contiguous woodlots near the Project Area.	Low
Topeka shiner	Endangered	Lack of suitable stream habitat in the Project Area.	Low
Dakota skipper	Threatened	Lack of remnant prairie habitat within the Project Area.	Low
Poweshiek skipperling	Endangered	Lack of remnant prairie habitat within the Project Area.	Low
Bald eagle	Bald and Golden Eagle Act Protection	Breeding habitat available near the Project Area.	High

1. **Are known species of concern present on the proposed site, or is habitat (including designated critical habitat) present for these species?**

Federally listed threatened and endangered species and critical habitat: Published information and site reconnaissance-level habitat assessments, determined that the following federally threatened and endangered species are known to occur within Grant and Codington counties: whooping crane (*Grus Americana*, endangered), rufa red knot (*Calidris canutus rufa*, threatened), northern long-eared bat (*Myotis septentrionalis*, threatened), Topeka shiner (Notropis topeka, endangered), Dakota skipper (*Hesperia dacotae*, threatened), and Poweshiek skipperling (*Oarisma powesheik*, endangered) (Table 3, USFWS 2020b, 2020c). Critical habitat for both the Dakota skipper and Poweshiek skipperling has been identified by USFWS in Grant County (USFWS 2020b). Bald eagles can occur year-round in South Dakota (Aron 2005) and are known to occur in Grant and Codington counties (USFWS 2020b, 2020c)

Whooping crane (Endangered) - A regular spring and fall migrant through South Dakota (Niemuth et al 2018), whooping crane populations have increased from 15 birds in the Aransas-Wood Buffalo population (the only wild, non-experimental population left in the world) to an estimated 504 birds in the 2018-2019 wintering population (USFWS 2019a). Areas characterized by diverse wetland mosaics, and upland foraging within the migration corridor linking breeding and wintering grounds appear to provide the most suitable migration stopover habitat for whooping cranes (CWS and USFWS 2007, Niemuth et al 2018). Areas preferred for roosting are closer to crops and wet natural habitats, whereas areas of high road and human settlement cover tend to be avoided (Belaire et al. 2014, Niemuth et al 2018). Whooping cranes often select roost sites with shallow surface water wetlands such as ponds or rivers with unobstructed visibility (Neimuth et al. 2018, Baasch et al. 2019a). Palustrine wetlands (freshwater wetlands characterized by emergent vegetation) are most often used as roosting sites, but individuals have been found roosting at lacustrine wetlands (wetlands associated with lakes), and riverine wetlands (wetlands associated with rivers and streams) (Howe M. A 1989, Austin and Richert 2001). The size of wetlands used during spring and fall migration ranges from 0.4 hectare (1.0 acre) to over 500 hectares (1,236 acres) with no similar patterns in seasonal use detected (Austin and Richert 2001); 75 percent of roost wetlands were smaller than 4 hectares (10 acres).

Although size of the wetlands used for roosting varies, water depth only ranged from 46 cm (18 inches) to 51 cm (20 inches) and little variability is found among sites (Austin and Richert 2001). The number of and size of the wetlands can influence whooping crane use. Generally, a large wetland basin was considered more attractive than many small wetland basins totaling the same area (Neimuth et al. 2018). However, whooping cranes will also use areas that have multiple smaller wetlands or a mosaic of wetlands to areas with little or no wetlands present (TWI 2013). Wetland use is also influenced by the proximity to anthropogenic features such as roadways (Austin and Richert 2001, TWI 2013, Baasch et al. 2019a).

Whooping cranes forage in wetlands and agricultural fields during migration and may commute between roosting and feeding areas. Palustrine wetlands are used most often when whooping cranes forage in wetlands, but lacustrine and riverine wetlands have also been used as feeding sites (Austin and Richert 2005, Baasch et al. 2019b). Among agricultural crops used as feeding sites, the use of winter wheat was higher than other crop types in the fall, and the use of row-crop stubble (consisting mostly of corn) was higher in the spring than other crop types (Austin and Richert 2001). Whooping cranes have also been observed feeding in sorghum, sunflower, and soybean stubble (Austin and Richert 2001). Feeding sites are often located adjacent to roosting sites. For example, 94.9 and 72.9 percent of roosting sites were within 1 km (0.62 mi) of feeding sites in spring and fall, respectively (Johns et al. 1997, USFWS 2009).

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In South Dakota, whooping cranes have the potential to occur anywhere suitable feeding and roosting habitat is found. However, 95 percent of all documented occurrences have been within at 260-mile corridor adjacent to the Missouri River (Niemuth et al 2018). The Project is located outside of this whooping crane migration corridor and there have been no records of whooping crane sightings within the Project Area through Fall 2018 (USFWS 2018). Based on the desktop habitat evaluation and site visit, suitable whooping crane foraging habitat is available around the Project Area, but roosting habitat is limited. Therefore, the likelihood of occurrence of whooping cranes around the Project Area is low.

Rufa red knot (threatened) – The rufa red knot is a small shorebird that migrates through South Dakota, using wetlands for stopover and feeding. The feed on invertebrates, especially small clams, mussels, and snails. Migrating in large flocks, they move through the contiguous United States from March through early June on their way to arctic breeding grounds, and southward in July through August to wintering areas in South America (American Bird Conservancy 2020b). Based on observations made during the Threatened and Endangered Species Assessment site visit, suitable migration stopover and foraging habitat for rufa red knot, such as mudflats, are not present in the assessment area. Therefore, the likelihood of occurrence of the rufa red knot in the Project Area is low.

The northern long-eared bat (threatened) – The northern long-eared bat (NLEB) is considered uncommon in South Dakota although the Project Area is within the species' range and individuals have been detected in Grant and Codington counties (SDGFP 2004, USFWS 2020b, 2020c). NLEB prefers large, contiguous tracks of upland forested habitat during the summer residency period. Natural roosting habitats in the Project Area are limited to individual trees, wind breaks and woodlots. NLEB do not undertake long-distance seasonal migrations between summer and winter ranges but do make shorter distance movements between summer roosts and winter hibernacula which are generally between 35 – 55 miles can be as great as 168 miles (USFWS 2020d). No wintering hibernacula were identified within the Project Area (Tetra Tech 2018a), nor are there large, contiguous woodlots for summer residency. Therefore, the likelihood of occurrence of NLEB in the Project Area is low.

Topeka shiner (endangered) – The Topeka shiner is a small minnow that lives in small to mid-sized prairie streams with good water quality and cool to moderate temperatures in the central United States (USFWS 2019a). The Topeka shiner was once a common fish throughout its range but has declined by about 70 percent in the last 40 to 50 years (USFWS 2019b). In South Dakota, Topeka shiner are found in tributaries to the James, Vermillion, and Big Sioux river basins (SDFGP 2020) and are expected to occur in Codington County (USFWS 2020c). Based on the lack of suitable stream habitat observed within the Project Area (Tetra Tech 2018a), the likelihood of occurrence of Topeka shiner in the Project Area is low.

Dakota skipper (threatened) – The Dakota skipper is a small butterfly that lives in high-quality mixed and tallgrass prairie. It has been extirpated from much of its range due to loss of native prairie, and now occurs in Minnesota, the Dakotas, and southern Canada (USFWS 2020e). Dakota skipper has been documented in both Grant and Codington counties, and in 2015 the USFWS designated portions of Grant county (South Dakota Unit 4) as critical habitat for the Dakota skipper (USFWS 2020b). This critical habitat is the only known suitable habitat for the Dakota skipper in the Project vicinity and is located one and a half miles from the nearest proposed turbine. An assessment of potential suitable habitat was conducted on the 2017 Project study area and one 4.6 acre area of potential habitat was identified (WEST 2017a). Apex and Xcel determined that this potential habitat would be avoided during Project planning, therefore, the likelihood is low that the Project would affect the Dakota skipper.

Poweshiek skipperling (endangered) – The Poweshiek skipperling is a small butterfly most often found in remnants of native prairie habitat. It is thought the species may have been extirpated from the Dakotas, Minnesota, and Iowa within the past 10-years. In 2014, USFWS announced that the species could only be found at a few sites in a single

county in Michigan, one site in Wisconsin and one site in Manitoba (USFWS 2019c). Grant County is listed by USFWS as containing critical habitat (South Dakota Unit 4) for the Poweshiek skipperling (USFWS 2020b) in the vicinity of the Project. The South Dakota Unit 4 is located one and a half miles from the nearest proposed turbine. Poweshiek skipperling habitat surveys conducted in 2016 and 2017 determined at that time there was no suitable habitat within the Project Area (WEST 2017a). Based on the likely extirpation of the species the likelihood that the Project would affect the Poweshiek skipperling is low.

Bald Eagles - In addition to federally threatened, endangered, and candidate species, the bald eagle, which is protected under the BGEPA, occurs in both Grant and Codington counties year-round (USFWS 2020b, 2020c). Therefore, the likelihood of bald eagle occurrence at the Project is high.

State-listed species: SDGFP has identified five state threatened or endangered species that are known to occur within Grant and Codington counties: piping plover (*Charadrius melodus,* threatened), osprey (*Pandion haliaetus,* threatened), northern river otter (*Lontra canadensis,* threatened), northern redbelly dace (*Chrosomus eos,* threatened), and blacknose shiner (*Notropis heterolepis,* endangered) (SDGFP 2020).

Birds of Conservation Concern: The Project is in BCR 11 (USFWS 2008). There are 27 BCC species listed within BCR 11 that may also occur within the Project Area. Six species are non-breeding migrants; horned grebe (*Podiceps auratus*), solitary sandpiper (*Tringa solitaria*), Hudsonian godwit (*Limosa haemastica*), buff-breasted sandpiper (*Calidris subruficollis*), short-billed dowitcher (*Limnodromus griseus*), and Smith's longspur (*Calcarius pictus*) that may pass through the region, and possibly the Project Area, during spring and fall migration.

Overall, Birds of Conservation Concern are not expected to be abundant within the Project Area due to the prevalence of cultivated land. However, the mosaic of wetlands present within the Project vicinity likely provides foraging habitat for waterfowl and shorebird species. Based on observations made during the site visit and land cover data (Table 2), cultivated land dominates the Project Area and very limited nesting habitat for waterfowl and shorebirds is present in the form of narrow vegetated buffers between open water wetlands and agricultural fields.

2. **Does the landscape contain areas where development is precluded by law or designated as sensitive according to scientifically credible information?**

The Project Area contains no designated critical habitat for federally listed species. One Waterfowl Production Area (WPA) (O'Farrell Unit) and the Mazzeppa State Wildlife Management Area (WMA) are located in the Project Area (Appendix A: Figure 1).

3. **Are there plant communities of concern present or likely to be present at the site?**

Based on information from the Threatened and Endangered Species Assessment site visit and land cover data, the Project is dominated by agricultural land and no known plant communities of concern are present or likely to be present at the site.

4. **Are there known critical areas of congregation of species of concern?**

No known maternity roosts, hibernacula, winter roosts, staging areas, rookeries or other critical congregation areas were identified within the Project Area (Tetra Tech 2018a).

5. **Using best available information has the developer or relevant federal, state, tribal, and/or local agency identified the potential presence of a population of a species of habitat fragmentation concern?**

No official list of species of habitat fragmentation concern has been generated for South Dakota.

6. **Which species of birds and bats, especially those known to be at risk by wind energy facilities, are likely to use the proposed site base on the assessment of site attributes?**

Birds and bats may be subject to both direct (collision and electrocution) and indirect (displacement and habitat fragmentation) impacts from wind energy (Arnett et al 2007). Passerines are the bird group most often found during

post-construction monitoring at wind projects in North America (Erickson et al 2014, AWWI 2019). Bats, particularly migratory, tree-roosting bats have had high rates of collision recorded at wind projects (Arnett and Baerwald 2013, AWWI 2018). Both passerine species and migratory tree-roosting bats have been recorded using the Project. Habitat fragmentation is unlikely to be a major risk at the Project, as the landscape is currently highly fragmented by agricultural development and roadways. Displacement effects on avian species as a result of wind energy development and specifically this Project are explored in more detail in Sections 5.1 and 5.2.

7. **Is there a potential for significant adverse impacts to species of concern based on the answers to the questions above, and considering the design of the proposed project?**

No adverse impacts to threatened or endangered species, or Birds of Conservation Concern are anticipated from the Project. No documented species occurrence or suitable habitat was found for rufa red knot, northern long-eared bat or Topeka shiner in the Project Area. Dakota skipper and Poweshiek skipperling critical habitat was identified approximately one and a half miles from the nearest proposed turbine location. While whooping crane stopover habitat may be present within the Project Area, the eastern edge of the whooping crane migration corridor lies 25 miles to the west of the Project Area.

With a low probability of significant adverse impacts to wildlife; Tier 3 surveys were conducted to better understand bird use of the Project (Section 4.3).

4.3 TIER 3 FIELD STUDIES

Following up on Tier 1 and 2 analysis, field studies were conducted, per Tier 3 of the WEG, to evaluate data gaps and gather data necessary to:

- Design a project to avoid or minimize predicted risk;
- Evaluate predictions of impact and risk through post-construction comparisons of estimated impacts; and
- Identify compensatory mitigation measures, if appropriate, to offset significant adverse impacts that cannot be avoided or minimized.

Evaluating risk to birds and bats at a particular wind energy facility involves the result of complex interactions among species distribution, relative abundance, behavior, weather conditions (e.g., wind, temperature) and site characteristics (USFWS 2012). Both USFWS and SDGFP were involved in determining which species needed to be studied in the field and how those studies should be conducted. The following field studies were designed and completed to assess the risk to birds at the Project (Table 4). Risk assessments for birds based on Tier 3 studies are outlined in Section 5.0.

Table 4. Tier 3 Field Studies Conducted at the Dakota Range Wind Farm Project

Study	Taxa	Survey Dates
Eagle Use Surveys (WEST 2017b)	Bald Eagle and Golden Eagle	December 2015 – May 2017
Eagle Use Surveys (Tetra Tech 2018c)	Bald eagle and Golden eagle	March 2018 – November 2018
Avian Use Surveys (WEST 2017b)	All Birds	December 2015 - May 2017
Avian Use Surveys (Tetra Tech 2018b)	All Birds	August 2018 - November 2018

Study	Taxa	Survey Dates
Grouse Lek Surveys (Aerial) (WEST 2016a)	Sharp-tailed grouse and Greater prairie chicken	April 2016 – May 2016
Grouse Lek Surveys (Ground-based) (WEST 2017c)	Sharp-tailed grouse and Greater prairie chicken	April 2017 – May 2017
Aerial Raptor Nest Survey (WEST 2016b)	Raptors	April 2016
Aerial Raptor Nest Survey (WEST 2017d)	Raptors	April 2017
Aerial Raptor Nest Survey (Tetra Tech 2018d)	Raptors	March 2018
Aerial Raptor Nest Survey (Tetra Tech 2019a)	Raptors	March 2019

4.3.1 Agency Discussions

Aug 12, 2015 – USFWS/SDGFP/Apex

- Apex and USFWS agreed that the project site presented a low risk to eagles, but that studies were warranted to assess eagle nests within 10 miles of the project, and to evaluate potential for eagle risk during winter. Summer, spring, and fall eagle point count surveys were not recommended.
- Substantial information on general avian presence is available from nearby wind projects (i.e., Summit Wind), and it was agreed that breeding bird or migration period surveys would not be needed.
- SDGFP indicated that prairie grouse leks were an important resource issue warranting baseline surveys and Apex agreed to conduct lek surveys in Spring 2015.
- USFWS and SDGFP agreed that general acoustic monitoring was limited in utility given Apex's intent to avoid treed and wetland habitats with turbine siting and to feather turbines up to manufacturer's cut in speed. Both agencies agreed that it was important to assess potential summer presence of NLEB using USFWS protocols and inform siting and operational protocols if presence was confirmed.
- The potential exists for the Dakota skipper and Poweshiek skipperling to occur in suitable habitats within the project area. Therefore, surveys to assess habitat potential is warranted in areas planned for disturbance. Apex agreed to conduct surveys following appropriate survey protocols and using qualified surveyors. No other species-specific protocols were recommended for federal or state-listed species due to the low risk nature of the project site.

March 28, 2017

- USFWS requested that additional eagle nest surveys be conducted to determine the number and location of occupied bald eagle nests.
- USFWS recommended that additional eagle use survey points be incorporated to evaluate potential eagle use in the northwest portion of the revised boundary.
- Species of federal/state-listed bats is limited to the federally threatened NLEB, and that the period of risk is most likely during migration only due to the limited amount of summer habitat. Data from the acoustic surveys conducted at the adjacent Summit Wind Farm may provide sufficient information to assess risk at this project due to the similarity in habitats. Given the 4d rule exemption for northern long-eared bats, no further studies or permitting are needed to ensure ESA compliance.

- Apex agreed to complete additional habitat assessments for the Dakota skipper and Poweshiek skipperling within the unsurveyed portions of the current boundary.
- USFWS and SDGFP confirmed that no additional species-specific surveys are warranted for state protected species or other wildlife.

September 25, 2017

- No further studies are recommended for federally listed species and risk is such that no permits are required.
- Avian the surveys conducted to date were sufficient to adequately assess risk within the Project area during the seasons evaluated.

4.3.2 Survey Methods

Sections 4.3.2.1 through 4.3.2.4 below provide a summary of the methodologies employed during Tier 3 field studies at the Project. Survey reports providing full methodology for the field studies are provided in Appendix B.

4.3.2.1 Eagle Use Surveys

2015-2017 - Eagle use surveys were conducted between December 3, 2015 – May 30, 2017 to quantify eagle use and evaluate the risks to eagles at the Project (WEST 2017b). Surveys were conducted at 40-point count locations, approximately once a month during winter and spring using methods described by Reynolds et al. (1980) and recommended in the ECPG. Eagle use surveys were conducted for 60 minutes, and all eagle observations were recorded out to 800 m. The survey plots used in this evaluation were representative of potential development areas and encompassed approximately 30% of the area under consideration for development.

Sampling intensity was designed to document use and behavior of birds during the study period. Surveys were carried out during daylight hours, and survey periods varied to cover approximately all daylight hours during a season. To the extent practical, survey effort was roughly consistent across survey points.

The following information was recorded during each survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). The following data were recorded for each eagle observation: number of individuals observed, distance from survey point when first observed, closest distance of bird to observer, flight height above ground, flight direction, and activity of bird. Approximate flight height, flight direction, and distance from plot center were recorded when the bird or birds were first observed; the approximate lowest and highest flight heights were recorded at any time during the bird or bird's observation.

2018-2019 - Eagle use surveys were conducted between March 19, 2018 and November 27, 2019 (Tetra Tech 2018c) to estimate the seasonal, spatial, and temporal use of a 1-km buffer around the proposed turbines (dated March 6, 2018) by bald eagles, and to provide data for an eagle risk assessment consistent with the ECPG. Eagle use surveys were conducted at 18 locations that were distributed throughout the 1km buffer, providing spatial coverage of approximately 31 percent of the Project Area. The survey effort consisted of one survey hour per month per survey location. Surveys were distributed across daylight hours and the survey schedule was varied between visits so that each survey location was surveyed at all periods of the day. Data collected during each survey included flight paths of individual eagles, minutes of flight categorized by flight height (i.e., minutes at or below 200 meters above ground and within 800 meters of the count location), along with the age class of eagles observed, when possible.

4.3.2.2 Avian Use Surveys

2015-2017 - Fixed-point count avian surveys were conducted between December 3, 2015 – May 30, 2017 (WEST 2017b) to quantify bird use and evaluate the risks to avian species at the Project. Surveys were conducted approximately once a month during winter and spring at 40-point count locations using methods described by

Reynolds et al. (1980). Surveys were conducted for 65 minutes, with small birds recorded within 100 meters for the first five min, large birds (including raptors and eagles) recorded out to 800 m for the next 20 min, and eagles and sensitive species only recorded for the remaining 40 mins, resulting in 60-min eagle surveys (Sect 4.3.2.1; 2015 - 2017). Sensitive species, if observed, were recorded at any time during the 65-min survey.

The following information was recorded during each survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each bird observation: species observed (or best possible identification), number of individuals observed, distance from survey point when first observed, closest distance of bird to observer, flight height above ground, flight direction, and activity of bird. Approximate flight height, flight direction, and distance from plot center were recorded when the bird or birds were first observed; the approximate lowest and highest flight heights were recorded at any time during the bird or bird's observation. Surveys were carried out during daylight hours, and survey periods varied to cover approximately all daylight hours during a season.

2018 - 2019 - Fixed-point count avian surveys were conducted bi-weekly between August 27, - October 30, 2018, and again from August 28 – November 7, 2019 at 18-point count locations based on the Project Area (proposed turbine layout March 7, 2018 plus a 1 kilometer buffer) (Tetra Tech 2018b) to document avian use of the Project during the fall migration period. Each point count location consisted of an 800-meter radius circular plot, and surveys were conducted for 20 minutes at each point-count location. The following data were collected during each survey: species, number of individuals, time, flight height above ground, behavior, and flight direction. Flight behavior was evaluated by calculating the proportion of flying birds that were observed below, within, or above the turbine rotor swept area (RSA). The RSA is considered to be the height interval through which turbine blades are expected to pass. A bird was considered to have flown within the RSA if any of its recorded heights overlapped the RSA.

4.3.2.3 Grouse Lek Survey

2016 - Aerial lek surveys were conducted between April 12, 2016 – May 5, 2016 for sharp-tailed grouse (*Tympanuchus phasianellus*) and greater-prairie chickens (*Tympanuchus* cupido, WEST 2016a). Surveys were completed by two biologists plus one pilot flying in a small fixed-wing aircraft, in accordance with the USFWS and SDGFP recommendations. Surveys were initiated in mid-April and two survey rounds were completed by early May 2016. Surveys were conducted by flying parallel north-south transects spaced 400-m apart through the entire Project and 0.5-mile buffer around the Project. Flight height was approximately 75-150 feet above ground level. Surveys were conducted when winds were below 20 mph and rain was not persistent. A potential lek was defined as a location where 3 or more birds were observed; however, leks were confirmed by repeated observations of strutting males.

2017 - Three ground-based lek surveys were conducted between April 8, 2017 – May 9, 2017 for sharp-tailed grouse and greater prairie chickens (WEST 2017c). The original Project boundary had been modified since the aerial lek surveys in 2016, and this ground-based approach was used to evaluate the new portions of the Project. The 2017 survey area included the unsurveyed portions of the Project and a 0.5-mile buffer. In addition, previously documented leks from 2016 were revisited to evaluate their 2017 status.

Public roads were driven by a biologist from 30 minutes prior to sunrise until approximately two hours after sunrise. The biologist stopped for a minimum of five minutes approximately every half-mile (more often in hilly terrain, less in flat) to listen and look for displaying birds. If a lek was located, the observer would then map the location and record the number of males, females, and birds of unknown sex attending the lek. When possible, surveys were completed on relatively calm mornings with little to no rain. Leks documented in 2016 that were outside the 2017 survey area were also visited to evaluate 2017 status.

Leks were classified as "potential" when three or more birds were observed in one location during the morning surveys. Leks were classified as "confirmed" if the biologists observed males engaged in lek attendance behavior (e.g., dancing, calling) more than one time. Leks were classified as "historic" if they were known leks that could not be found during the surveys.

4.3.2.4 Aerial Raptor Nest Survey

2016 and 2017 - Aerial raptor nest surveys were conducted in the spring of 2016, as well as the spring of 2017 (WEST 2016b, 2017d). Both surveys were conducted before leaf-out, but when raptors would be actively tending to a nest or incubating eggs. Raptor nests were surveyed within the Project boundary and 1-mile buffer and eagle nests out to a 10-mi buffer. Habitat was surveyed by flying meandering transects between 0.25 and 1.0 mi (0.8 and 1.6 km) apart, flying at speeds of approximately 46 miles per hour. The locations of all potential raptor nests were recorded using a hand-held Global Positioning System (GPS). Status of a nest was determined by the presence of adults on or near the nest, eggs, young, whitewash, or fresh building materials. Attempts were made to identify the species of raptor associated with each active nest. Raptor species, nest type, nest status, nest condition, and nest substrate were recorded at each nest

2018-2019 - Aerial raptor nest surveys were conducted in March of 2018 and March of 2019 (Tetra Tech 2018d, 2019a) to inventory bald eagle nests within the Project Area and surrounding 10-mile buffer. Additionally, all raptor nests within the Project Area were recorded during the survey. From a Bell-206 Jet Ranger helicopter, the survey was flown between 60 - 200 feet (18 - 60 meters) above ground level at an approximate speed of 50 miles per hour (80 kilometers per hour) along north-south transects spaced 1 mile apart, covering a total of 718 transect miles. When needed, transects were deviated from in order to conduct more intensive searches of areas with trees likely to support nesting eagles. To aid in navigation and data recording, a GPS receiver was used. A Project overview map, an optically stabilized digital camera, and standardized data collection forms were used to record information. Data collected within the nest survey area included all eagle nests and any observations of eagles. Eagles observed that were not affiliated with a nest were recorded as “incidental”. When a nest was found, the following data were collected: nest identification number, raptor species, presence of adults, eggs or young, nest substrate, and nest height. Additionally, nest conditions were recorded as either excellent, good, fair, poor, or remnant.

4.3.3 Survey Results

4.3.3.1 Eagle Use Survey Results

2015-2017 - One bald eagle was observed during the Winter of 2015 at point count location 7 for a total of three eagle minutes (WEST 2017b). One bald eagle was observed during the Spring of 2017 at point count location 36 for a total of four eagle minutes (WEST 2017b). No golden eagles were observed during the surveys.

2018-2019 - Two bald eagle observations were recorded with a total of three minutes of eagle flight during 324 hours of surveys. No golden eagles were observed during these eagle use surveys. Based on the limited number of eagle observations, no spatial or temporal pattern of activity was evident (Tetra Tech 2020).

4.3.3.2 General Avian Use Survey Results

2015-2017 – Twenty small bird species, including one unidentified woodpecker were recorded at 40 points during 5-min surveys conducted during the spring (20 species) and winter (2 species) seasons. The most common species observed were red-winged blackbird (*Agelaius phoeniceus,* 408 observations*)*, snow bunting *(Plectrophenax nivalis,* 80 observations*),* and horned lark *(Eremophila alpestris;* 50 observations*).* Thirty large bird species, including 9 raptors, were recorded during the large bird surveys. During winter surveys, the most common species observed were greater white-fronted goose (*Anser albifrons*, 260 observations), and Canada goose (*Branta canadensis*, 236 observations). In spring, 26 species were observed, with the most common species being snow goose (*Chen caerulescens*, 555 observations), greater white-fronted goose (130 observations), and Canada goose (95 observations). Red-tailed hawk (*Buteo jamaicensis*; 10 observations) was the most commonly observed raptor, followed by northern harrier (*Circus hudonius*; four observations) (WEST 2017b).

No federally threatened or endangered species and one state endangered species, peregrine falcon (*Falco peregrinus*) were observed during the study. Four BCC species were documented in low numbers (American bittern [*Botaurus lentiginosus*], bald eagle, marbled godwit, peregrine falcon). Four species of Greatest Conservation Need

(SGCN) were documented, also in low numbers (American white pelican [*Pelecanus erythrohynchos*], bald eagle, marbled godwit, and peregrine falcon). In general, the bird species observed during the winter and spring fixed-point bird use surveys were common species typical of agricultural and grassland environments in this area of South Dakota.

2018 – 2019 – During the fall 2018 fixed-point count avian surveys, a total of 2,732 birds from 47 species (including 107 unidentified birds) were observed (Tetra Tech 2018b). Songbirds accounted for the most species, individuals and had the highest mean use of any bird group. The species most often observed were barn swallow (*Hirundo rustica;* 315 observations), red-winged blackbird (248 observations), and brown-headed cowbird (*Molothrus ater;* 121 observations). Seven raptor species were observed during the 2018 fall fixed-point count avian surveys: American kestrel, bald eagle, cooper's hawk, ferruginous hawk, northern harrier, red-tailed hawk, and turkey vulture. Northern harrier was the most commonly observed raptor (17 observations), followed by red-tailed hawk (13 observations).

During the fall 2019 fixed-point count avian surveys, a total of 1,470 birds from 47 species (plus an additional 21 unidentified birds) were observed (Tetra Tech 2019b). Songbirds accounted for the most species and individuals while waterfowl had the highest mean use among the bird groups. The species with the most observations were Canada goose (797 observations), European starling (*Sturnus vulgaris*, 414 observations), and brown-headed cowbird (380 observations). Four raptor species were observed during the 2019 fall fixed-point count avian surveys: American kestrel, northern harrier, red-tailed hawk, and turkey vulture. Red-tailed hawk was the most commonly observed raptor (17 observations), followed by northern harrier (14 observations).

The birds found in the Project in 2018 and 2019 are primarily species common in the region that utilize agricultural and wetland habitats. No federal or state threatened, or endangered species were observed during the study.

4.3.3.3 Grouse Lek Survey Results

2016 – A group of approximately 24 sharp-tailed grouse was observed during the first survey; however, no birds were observed in this area during the second survey (WEST 01); therefore, this location was designated as a potential lek (Appendix A: Figure 4). Six male greater prairie-chicken (*Tympanuchus cupido*) were observed displaying at a separate location during both surveys (Appendix A: Figure 4; WEST-02), indicating this is a greater prairie-chicken lek location (WEST 2016a) The two documented leks during this survey are not located in the Project Area.

2017 - One confirmed lek with a maximum of 15 sharp-tailed grouse (Appendix A: Figure 4; WEST-03), and one potential lek with 7 sharp-tailed grouse leks (WEST-04) were observed during the 2017 survey (WEST 2017c). The confirmed sharp-tailed grouse lek is located in the Project Area and is approximately .40-miles from the nearest turbine.

4.3.3.4 Aerial Raptor Nest Survey Results

2016 - Three in-use, and one unoccupied potential bald eagle nests were observed in 2016 (Table 5, Appendix A: Figure 5). None of the nests were located within the Project Area, with the nearest occupied bald eagle nest located 2.4 miles to the north-northeast of the Project Area. Additionally, one in-use red-tailed hawk nest was located within the Project Area (Table 5, WEST 2016b).

2017 - Five in-use bald eagle nests were observed in 2017 (Table 5, Appendix A: Figure 5). Another bald eagle nest, in-use in 2016, was unoccupied in 2017. None of the nests were located within the Project Area, with the nearest occupied bald eagle nest located 3.3 miles to the south-southeast of the Project Area (Appendix A: Figure 5). Additionally, 15 occupied and 17 unoccupied non-eagle raptor nests were observed; 11 red-tailed hawk, 3 great-horned owl, and one unknown non-eagle raptor. Five of these non-eagle raptor nests were located within the Project Area (Table 5; WEST 2017d).

2018 - Four in-use, and three alternate bald eagle nests were observed in 2018 (Table 5, Appendix A: Figure 5). None of the nests were located within the Project Area, with the nearest in-use bald eagle nest located 2.4 miles to the north-northeast of the Project Area. Two other raptor nests were located within the Project Area. Both raptor nests were alternate unknown nests. Additionally, 37 adult and 2 juvenile bald eagles were observed incidentally during the 2018 survey (Tetra Tech 2018d).

2019 - Three in-use, and four alternate bald eagle nests were observed in 2019 (Table 5, Appendix A: Figure 5). None of the nests were located within the Project Area, with the nearest in-use bald eagle nest located 3.3 miles to the south-southeast of the Project Area. One other raptor nest was located within the Project Area and was found to be in-use by a red-tailed hawk. Additionally, 6 adult and 1 juvenile bald eagles were observed incidentally during the 2019 survey (Tetra Tech 2019a).

Between 2016 – 2019, seven raptor nests were located within the Project Area during aerial surveys: one red-tailed hawk nest, one great-horned owl nest, and five unknown non-eagle raptor nests (Tetra Tech 2018d, 2019a, WEST 2016b, 2017b). No bald eagle nests were observed within the Project Area during the surveys. Activity details by year can be found in Table 5.

Table 5. Status of all raptor nests observed during aerial surveys at the Dakota Range Wind Farm Project from April 2016 - April 2019.

Nest Number[2]	Species[3]	Nest Status[1]			
		April 2016	April 2017	March 2018	April 2019
2016-2 (DR-02)	BAEA	Occupied Active	Unoccupied	In-use	Alternate
2016-4 (DR-04)	BAEA	Occupied Active	Occupied Active	In-use	In-use
2017-1 (DR-06)	BAEA	N/A	Occupied Active	In-use	In-use
2017-2 (DR-07)	BAEA	N/A	Occupied Active	Not Surveyed	Not surveyed
2017-3 (DR-08)	BAEA	N/A	Occupied Active	Alternate	Alternate
2018-1	BAEA	N/A	N/A	Alternate	In-use
2018-2	BAEA	N/A	N/A	In-use	Alternate
2016-5 (DR-05)	BAEA	Occupied Active	Occupied Active	Alternate	In-use
2017-8 (DR-13)	GHOW	N/A	Occupied Active	Not Found	Not found
2017-28 (DR-33)	GHOW	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-31 (DR-36)	GHOW	N/A	Occupied Active	Not Surveyed	Not Surveyed
2016-3 (DR-03)	RTHA	Occupied Active	Not Found	N/A	N/A
2017-4 (DR-09)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-5 (DR-10)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-9 (DR-14)	RTHA	N/A	Occupied Active	Not Surveyed	Not surveyed
2017-13 (DR-18)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-15 (DR-20)	RTHA	N/A	Unoccupied	Alternate	In-use
2017-16 (DR-21)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-20 (DR-25)	RTHA	N/A	Occupied Active	Not Found	Not found
2017-22 (DR-27)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed

Nest Number[2]	Species[3]	Nest Status[1]			
		April 2016	April 2017	March 2018	April 2019
2017-24 (DR-29)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-25 (DR-30)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-29 (DR-34)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-35 (DR-40)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2016-1 (DR-01)	UNKN	Unoccupied	Not Found	Not Surveyed	Not Surveyed
2017-6 (DR-11)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-7 (DR-12)	UNKN	N/A	Unoccupied	Not Found	Not found
2017-10 (DR-15)	UNKN	N/A	Unoccupied	Not Found	Not found
2017-11 (DR-16)	UNKN	N/A	Unoccupied	Not Surveyed	Not surveyed
2017-12 (DR-17)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-14 (DR-19)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-17 (DR-22)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-19 (DR-24)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-18 (DR-23)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-21 (DR-26)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-23 (DR-28)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-26 (DR-31)	UNKN	N/A	Unoccupied	Not Found	Not found
2017-27 (DR-32)	UNKN	N/A	Unoccupied	Not Found	Not found
2017-30 (DR-35)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-32 (DR-37)	UNKN	N/A	Occupied Inactive	Not Surveyed	Not Surveyed
2017-33 (DR-38)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-34 (DR-39)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2018-3	UNKN	N/A	N/A	Alternate	Not found

[1]Nest status: “Not surveyed” raptor nests indicate that these nests were not within the area surveyed for nests. “N/A” indicates not applicable.
[2] Name in parenthesis is label used in WEST reports (WEST 2016b and 2017d)
[3]BAEA= Bald Eagle, GHOW = Great-horned Owl, RTHA = Red-tailed Hawk, UNKN = Species Unknown
Note: Final rule (USFWS 2016a) changed nest activity criteria to in-use or alternate. All nest activity for nests surveyed before 2017 were categorized as occupied active, occupied inactive, or unoccupied. Occupied active correlates to in-use and occupied inactive and unoccupied correlate to alternate.

4.3.4 WEG Tier 3 Questions

Tetra Tech evaluated the Project by answering Tier 3 questions from the WEG using information obtained from Tier 3 field studies:

1. **Do field studies indicate that species of concern are present on or likely to use the proposed site?**

No avian species listed as candidate, threatened, or endangered under the ESA were detected within the Project boundary or vicinity during the Tier 3 field surveys. One state endangered species (peregrine falcon) was observed during 2015-2017 Avian Use Surveys.

No golden eagle nests or individuals have been documented during field studies conducted between 2016 – 2019. Seven bald eagle nests were documented within 10-miles of the Project between 2016 – 2019, none of these nests were located within the Project Area. During eagle use surveys conducted between 2015 – 2019, four bald eagles accounting for 10 eagle use minutes were recorded.

Four BCC species were documented in low numbers; American bittern, bald eagle, marbled godwit, peregrine falcon. Four SGCN species were documented in low numbers ferruginous hawk, marbled godwit, American white pelican, and bald eagle and peregrine falcon.

2. **Do field studies indicate the potential for significant adverse impacts on affected population of species of habitat fragmentation concern?**

Tier 3 field studies did not indicate the potential for significant adverse impacts on species of habitat fragmentation concern.

3. **What is the distribution, relative abundance, behavior, and site use of species of concern identified in Tiers 1 or 2, and to what extent do these factors expose these species to risk from the proposed wind energy project?**

All species of concern observed during Tier 3 studies were observed to exhibit relatively low mean use of the Project. Based on low mean use, these species are not expected to be significantly impacted as a result of Project development. Direct and indirect impacts to avian and bat species are discussed in Sections 5.1 and 5.2.

4. **What are the potential risks of adverse impacts of the proposed wind energy project to individuals and local populations of species of concern and their habitats?**

Avian and bat species may be subject to direct impacts such as collision, electrocution, or barotrauma, as well as indirect impacts such as disturbance and displacement or habitat loss and fragmentation. Because species of concern were observed to exhibit relatively low mean use of the Project, their exposure to these risks in expected to be low. Direct and indirect risks to avian and bat species are discussed in more detail in Sections 5.1 and 5.2.

5. **How can developers mitigate identified significant adverse impacts?**

Although significant adverse impacts are not anticipated, Xcel has committed to implementing measures to avoid and minimize risk to avian and bat species during planning and design (see Section 6.1), construction (see Section 6.2), and operation (see Section 6.3) phases of the Project.

6. **Are there studies that should be initiated at this stage that would be continued into post-construction?**

Given the low risk to wildlife expected from the construction and operation of the Project, no further pre-construction studies are warranted. Xcel will conduct post-construction fatality monitoring at the Project (see Section 7).

5.0 RISK ASSESSMENT

One of the primary objectives of this WCS is to provide an assessment of risk to wildlife posed by the Project. The Project involves designing, constructing and operating a wind facility; therefore, risks associated with the Project are assessed relative to current conditions in the area. Risks to birds and bats are both direct including collision and electrocution, and indirect involving habitat lost and fragmentation and disturbance and displacement of individuals.

5.1 IMPACTS TO BIRDS

5.1.1 Direct Impacts

5.1.1.1 Collision

Birds have been identified as a group at risk because of collisions with wind turbines and power lines (Erickson et al. 2005, Drewitt and Langston 2006, Arnett et al. 2007). Specifically, small passerines (e.g., songbirds) are the majority of individuals found in post-construction mortality monitoring studies in the U. S. (AWWI 2019). Post-construction mortality surveys at 53 wind facilities located throughout the Prairie biome (where the Project is located), found that 51.5 percent of documented mortalities were small passerines (AWWI 2019). Locally breeding songbirds may experience lower mortality rates than migrants because many of these species tend not to fly at turbine heights during the breeding season. However, some breeding songbird species have behaviors that increase the risk of collisions with turbines. For example, horned larks have been commonly found as fatalities at wind farms and have the highest percentage of fatalities in the Prairie biome (AWWI 2019), and these fatalities may be partially attributed to the breeding flight displays within the rotor swept area (Johnson and Erickson 2011).

During avian surveys conducted for the Project from 2015 – 2019, the most commonly observed individuals were small passerines. A total of 36 songbird species were recorded at the Project. None of these species were federal or state listed endangered or threatened. The most commonly observed species were horned lark, red-wing blackbird, barn swallow and brown-headed cowbird (WEST 2017b, Tetra Tech 2018b, Tetra Tech 2019b). With the high mean use relative to the other songbirds recorded during project surveys, and documented fatalities occurring at other wind projects, turbine-related fatalities of these species may occur due to operation of the Project. However, any fatalities that do occur are unlikely to have population-level impacts due to the species large, stable populations (Lyon and Montgomerie 1995; Rich et al. 2004; Sauer et al. 2008).

Most songbirds are short-lived and have high reproductive output, and their population growth rates are more sensitive to reproductive failure than to adult survival (Stahl and Oli 2006, Arnold and Zink 2011). Meta-analysis of wind-energy impacts concluded that collisions with wind turbines have negligible cumulative impacts on songbird populations, with mortality rates due to these collisions ranging from 0.008 to 0.0043 percent of the continental population per year (Erickson et al. 2014). Therefore, collision mortality for most songbird species is expected to have negligible effects on population dynamics.

Large birds accounted for 36 of the 72 species, and almost half of the individuals seen during avian surveys conducted from 2015-2019. The highest number of individuals seen during this period were waterfowl with most commonly observed waterfowl species being snow goose, greater white-fronted goose, and Canada goose. Although waterfowl are widespread and occur in areas of wind energy development, fatality monitoring studies have found low fatality rates even when mean use was high for these groups (Erickson et al. 2002, Kerns and Kerlinger 2004, Jain 2005). Turbine collision avoidance rate for Canada goose and snow goose was estimated at 99.93 percent, suggesting very low collision risk for geese (Fernley et al. 2006).

Collision fatalities to waterfowl species that may occur at the Project are unlikely to result in population-level impacts as the most commonly observed waterfowl (snow goose, greater white-fronted goose and Canada goose) have stable to increasing populations, largely due to their adaptability to changing habitats and human disturbance (Drilling et al. 2002; Mowbray et al. 2000; Mowbray et al. 2002; Rich et al. 2004; Sauer et al. 2008).

Despite the observation that most bird fatalities at wind farms are songbirds, raptor mortality historically has received the most attention in studies and reports. Raptor mortality at newer wind projects has been low relative to older-generation wind farms, although there is substantial regional variation in raptor mortality rates (Erickson et al. 2002, 2004, Johnson et al. 2002, Kerns and Kerlinger 2004, Jain et al. 2009).

High raptor use has been associated with high raptor mortality at wind farms (Erickson 2007). Conversely, raptor mortality appears to be low when raptor use is low, as defined by Erickson (2007) as <1.0 birds/20 min, which is

the case for raptor use at the Project which ranged from 0.03 birds/20 min in winter to 0.48 birds/20 min in fall 2018 (WEST 2017b, Tetra Tech 2018b, Tetra Tech 2019a). Based on our avian use and raptor nest surveys the raptor species most likely to be found on the Project are the red-tailed hawk (<0.01 birds/20 min in winter, 0.08 birds/20min in spring, and 0.16 in fall 2019) and northern harrier (<0.01 birds/20 min in winter, 0.03 birds/20min in spring, and 0.16 in fall 2018).

A total of six bald eagles, and no golden eagles have been seen during avian surveys conducted at the Project from 2015 – 2019. One bald eagle was observed during winter 2015 point count surveys, one bald eagle during spring 2017 point count surveys, two bald eagles during fall 2018 avian use surveys, and two bald eagles during Spring 2018 eagle use surveys point count surveys.

The Project and surrounding area are primarily agricultural and have limited nesting habitat for raptors. Seven in-use bald eagle nests were located during nesting surveys between 2015 – 2019 within 10-miles of the Project along with red-tailed hawk and great horned owl nests, although none of the nest were within the Project Area. The combination of low mean use of the Project by raptors, the low number of eagles seen, and the lack of nests near the Project Area suggest a low risk for collisions by eagles and other raptors.

Despite the unlikelihood of significant impacts to avian species at the Project as a result of collision, collision fatalities are a cause of concern, and fatality monitoring (Section 7.0) and adaptive management (Section 8.0) for the Project have been designed to minimize collision fatalities to the extent practicable. The conclusion that collision risk is low is based on the summary above and records of fatalities at other wind energy facilities. Nationally, reported avian fatality rates at wind energy facilities average 2.43 birds/MW/year and range from 0.15 to 11.02 birds/MW/year (Tetra Tech, unpublished data). Avian fatality rates at facilities in the mid-west of North America average 0.77 birds/MW/year (1.16 birds/turbine/year) and range from 0.15 to 1.63 birds/MW/year (AWWI 2019). This suggests that a reasonable expectation for avian collision rate at the Project will be lower than the national average.

5.1.1.2 Electrocution

Utility lines, particularly distribution lines, can potentially result in electrocution of large raptors, such as eagles, because their wingspan is large enough that a bird can simultaneously contact two conductors or a conductor and grounded hardware (APLIC 2006). Any structures that allow for circuit completion (i.e., flesh-to-flesh contact between energized parts or an energized and grounded part) pose an electrocution risk. To protect birds from possible electrocution, the Avian Power Line Interaction Committee (APLIC) recommends that lines have a horizontal separation of 60 inches (150 cm) and a vertical separation of 40 inches (100 cm) between phase conductors or between a phase conductor and grounded hardware (APLIC 2006). Therefore, the risk of electrocution for the Project is low because the transmission line and any collection lines that are not buried will follow APLIC guidelines for the design of overhead lines and will be marked appropriately to minimize the risk of collision with wires.

5.1.2 Indirect Impacts

5.1.2.1 Disturbance/Displacement

In addition to mortality associated with turbines, concerns have been raised that some bird species may avoid areas near turbines after the wind farm is in operation, which is known as displacement (May 2015, Drewitt and Langston 2006). Studies seem to indicate that displacement affects some birds, while others show no effect, or may even be attracted to turbines (Shaffer and Buhl 2015). While uncertainties remain regarding displacement of avian species as a result of wind energy development, research points to a potential for reduced use of the Project for some species rather than complete abandonment.

Shaffer and Buhl (2015) did a before-after-control-impact (BACI) study on grassland birds at three wind projects in North Dakota and South Dakota. They looked for displacement or attraction immediately after (1-year) and delayed

(2-5 years) after construction in nine grassland bird species. They found that displacement occurred in seven of the nine species, with immediate effects in three species (Western meadowlark [*Sturnella neglecta*], upland sandpiper [*Bartramia longicauda*], savannah sparrow [*Passerculus sandwichensis*]), and delayed effects in grasshopper sparrow (*Ammodramus savannarum*), bobolink (*Dolichonyz oryzinvorus*), clay-colored sparrow (*Spizella pallida*) and chestnut-collared longspur (*Calcarius* ornatus). Vesper sparrow (*Pooecetes gramineus*) appeared unaffected by wind turbines and killdeer (*Charadruis vociferous*) were attracted to turbines. Early studies presented conflicting results on the effects of wind turbines on bird numbers. For example, at the Buffalo Ridge wind energy facility in Minnesota, densities of male songbirds were significantly lower in Conservation Reserve Program (CRP) grasslands containing turbines than in CRP grasslands without turbines though the causal mechanism was not studied (Leddy et al. 1999). Reduced abundance of grassland songbirds was found within 50m of turbine pads for a wind farm in Washington and Oregon, although the investigators attributed displacement to the direct loss of habitat or reduced habitat quality and not the presence of the turbines (Erickson et al. 2004). Pearce-Higgins et al. (2012) found little evidence for a post-construction decline for ten species of birds at wind projects in upland habitats in the United Kingdom.

Waterfowl have been shown to avoid turbines. Loesch et al. (2013) found reduced use by breeding pairs of blue-winged teal (*Anas discors*), gadwall (*Mareca strepera*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), and northern shoveler (*Anas clypteata*) within an 804-m radius of operating turbines at a primarily agricultural site in North Dakota. All of these species have been recorded at the Project, and so displacement could be an impact from the Project. However, the agriculture-dominated Project Area likely provides greater opportunity for waterfowl foraging than for breeding, and foraging waterfowl may respond differently to wind energy development. Foraging Canada geese were found to be unaffected by the presence of turbines at a wind farm in northern Iowa (Jain et al. 2009).

Current research suggests that prairie grouse species may avoid anthropogenic structures (Hagen et al. 2011; USFWS 2012). Habitat loss and fragmentation may also have an affect on prairie grouse species (LaBeau 2017). However, long-term data sets are still needed to assess wind energy impacts on sharp-tailed grouse (Johnson et al. 2012). Regardless, state and federal wildlife agencies have regularly expressed concern about the locations of wind turbines and associated infrastructure with respect to grouse leks.

Nesting disturbance and displacement of raptors has been shown to have immediate impact on turkey vultures, red-tailed hawks, sharp-shinned hawks, and Cooper's hawks which recedes over time (Dohm et al 2019). However, Dohm et al (2019) found that American kestrels and northern harriers do not rebound from displacement even after 7-8 years. Additionally, construction disturbance during the nesting season (March to July in South Dakota) could occur, particularly if a nest is in line of site of activity. Both nesting raptors and individuals were recorded at the Project during avian surveys between 2015 – 2019, albeit in small number. So, while the potential for displacement of nesting raptors is possible at the Project, it is reduced by the lack of available nesting habitat and existing background disturbance that includes cultivated agriculture and road traffic.

5.1.2.2 Habitat Loss and Fragmentation

Habitat fragmentation can exacerbate the problem of habitat loss for birds by decreasing undisturbed habitat patch areas and increasing edge habitat. Habitat fragmentation can reduce bird productivity through increased nest predation and parasitism and reduced pairing success of males (Robinson et al. 1995). Both permanent and temporary Project impacts will occur primarily in cultivated crops and grazed pastureland.

5.2 IMPACTS TO BATS

Bats have been identified as a wildlife group at risk due to collisions or other interactions with wind turbines (Arnett et al. 2007, Arnett et al. 2008, Arnettt and Baerwald 2013, Taber et al 2019). Bat collision mortality at wind farms is a widespread phenomenon, commonly exceeding avian collision mortality (Kunz et al. 2007). Of 47 species of bats in North America, 22 have been identified among fatalities at wind farms (AWWI 2018, Taber et al 2019). Migratory

foliage or tree-roosting bat species (hoary bat, eastern red, and silver haired bat) appear to be most susceptible to collision with wind turbines. These species have experienced the highest fatality rates at wind energy facilities in North America, particularly during the spring (March – May) and fall (August – October) season when activity levels increase as these species migrate (Cryan 2003, Kunz et al. 2007, Arnett et al. 2008).

Identification of bat species and suitable habitat present within the Project Area can be used to help limit interactions between wind turbines and bats. Depending on the species, bats typically utilize different structures for roosting and maternity habitat, such as rock formations, farm buildings and dead or dying trees with cavities and loose bark (Schmidly 2004). Many bat species use riparian corridors and wetlands as feeding habitats due to the higher nocturnal insect densities within these areas (Hill and Smith 1984). It is important to note that bats that may potentially be moving through the Project Area and vicinity during migration and not stopping to roost or forage may also be at risk of colliding with turbines.

5.2.1 Direct Impacts

5.2.1.1 Collision and Barotrauma

Bat mortality occurs at wind farms due to collisions with turbine blades and to a lesser extent possibly barotrauma (Kunz et al. 2007). Barotrauma is the tissue damage to air-containing structures (lungs) that results from the rapid air-pressure reduction near moving turbine blades (Baerwald et al. 2008). Migratory foliage or tree-roosting bat species appear to be most susceptible to collision with wind turbines. These species have experienced the highest fatality rates at wind energy facilities in North America, particularly during the spring (March – May) and fall (August – October) season when activity levels increase as these species migrate (Cryan 2003, Kunz et al. 2007, and Arnett et al. 2008, AWWI 2018). Recent research has shown that mean wind speed and mean ambient temperature have the greatest effects on bat activity patterns, and that bat activity is generally lower at low mean nightly temperatures, and wind speeds above 5 meters/second (Weller and Baldwin 2012).

The relationship between pre-construction bat activity, as measured by acoustic surveys, and post construction mortality is apparently weak (Solick and Howlin 2019, Hein et al 2013) and thus we are using regional fatality patterns as an indicator of potential risk at the Project. Bat fatality rates at wind energy facilities in USFWS Region 6 (Mountain Prairie, which includes South Dakota) averages 2.4 bats/turbine/year (AWWI 2018). Of the seven bat species (little brown bat, northern long-eared bat, silver-haired bat, big brown bat, eastern red bat, western red bat, and hoary bat) that may occur within the Project Area, all have been found during mortality searches at operating wind farms.

The northern long-eared bat is the only listed bat species with the potential to occur within the Project Area. Under the final Section 4(d) rule, incidental take of NLEB is prohibited within the USFWS White-Nose Syndrome (WNS) zone, which now includes the entire portion of the U.S. Range (USFWS 2016b, 2019b). Lethal take by operating wind turbines is specifically excluded from this prohibition. The 4(d) rule prohibits incidental take due to hibernacula disturbance or tree removal. Northern long-eared bats are an obligate forest-dwelling species adapted to gleaning and hawking for insects in the sub-canopy in northern deciduous and mixed forests. Foraging occurs entirely within forested areas but is not restricted to mature forests. There are some forest patches within the Project Area, which may provide marginally suitable foraging habitat for northern long-eared bats. There is unlikely to be high quality roosting or foraging habitat in the Project Area due to the lack of interior forest patches or other suitable habitat. Based on the limited quantity of suitable habitat and the lack of documented detections within the Project Area, direct impacts on the northern long-eared bat or their habitat are low.

5.2.2 Indirect Impacts

5.2.2.1 Disturbance/Displacement

The effects of disturbance and displacement have not been well studied, and thus not understood as risks associated with bats and wind farms (Kunz et al. 2007, Taber et al 2019). However, bats are known to habituate to anthropogenic structures (Keeley and Tuttle 1999) and are known to display higher acoustic activity in forest gaps and edges which may be created by wind turbine placement. Given the history of agricultural, and other anthropogenic activity in the Project Area, it can be expected that the local bat community would remain in the area, and probably at similar population levels after construction of the Project. While construction and operation activity may change the noise environment in the Project Area during daylight hours; Project related noise levels are not anticipated to have deleterious effects on resident or migrant bats.

5.2.2.2 Habitat Loss and Fragmentation

The impacts of habitat fragmentation from wind development on bats are not well-understood (Kuvlesky et al. 2007, Taber et al 2019). Both roosting and foraging habitat within the Project Area are limited in availability due to large amounts of open-land agriculture and few large permanent sources of surface water. The Project has a relatively small footprint of temporary and permanent disturbance, and these areas are largely outside of any marginal bat roosting and foraging habitat. Risk to bats of habitat loss and fragmentation should be low and further reduction through best management practices will be taken during the design, construction, and operational phases of the Project (see Sections 6.0 – 8.0).

6.0 AVOIDANCE AND MINIMIZATION MEASURES

6.1 PRE-CONSTRUCTION AVOIDANCE AND MINIMIZATION

This section outlines the measures taken to avoid and minimize risk to avian and bat species during the planning and design phase of Project development, and which will be incorporated into the final Project design. These measures were derived from the WEG, industry standards, and experience Xcel has gained at other wind projects.

- Prior to facility siting, a high-level desktop review was conducted for fatal flaws at several potential sites.
- The Project boundary was modified to minimize effects on wildlife and natural features thus reducing the potential collision and displacement risk to birds and bats.
- No eagle nests are located within the Project Area.
- Turbines were sited with consideration of documented leks.
- Turbines and access roads were sited to avoid critical habitat for the Poweshiek skipperling and Dakota skipper.
- Wetlands and waters surveys of the proposed Project facilities were conducted, and revisions to the Project layout were made to avoid impacts to wetlands and waters. All turbines locations are at least 50 feet from wetlands. Avoiding wetlands and waters reduces the risk to birds and bats potentially using these habitats to forage.
- Access roads will be built only as necessary to reach the turbines and will be located away from wetlands and waterbodies to the extent possible to avoid impacts on aquatic and semi-aquatic species, birds, bats, and their habitats.
- Habitat restoration in potentially suitable Dakota skipper and Poweshiek skipperling habitat will use seed mixtures that incorporate vegetation that supports these prairie butterfly species.

- All turbines will sit on a tubular tower, and not a lattice structure, to minimize perching opportunities for raptors and other birds.
- MET towers will not be located in sensitive habitats or in areas where ecological resources known to be sensitive to human activities are present.
- The electrical collection system for the Project was designed so that the electricity generated at each turbine will be collected by underground power collection lines within the Project boundaries and delivered to the Project substation. Burying collection lines avoids the risk of bird collision or electrocution with this equipment.
- The design of the a 345-kV interconnection line will follow the Avian Powerline Interaction Committee Suggested Practices (APLIC 2006, 2012) to prevent bird collisions and electrocution. Xcel will maintain a horizonal separation of 60 inches and a vertical separation of 40 inches between phases and between phases to ground to protect birds from electrocution (APLIC 2006). The principles of isolation and insulation were considered, and Dakota Range used pad-mounted transformers. Utility poles will be of monopole design where feasible, instead of lattice design, to minimize opportunities for perching and nesting by raptors and other birds.

6.2 CONSTRUCTION AVOIDANCE AND MINIMIZATION

Construction activities have the potential to directly and indirectly impact bird and bat species. This section identifies wildlife impact avoidance and minimization measures (BMPs) that Xcel will incorporate during construction of the Project.

- Xcel will avoid activity in potentially suitable habitat for the Dakota skipper and Poweshiek skipperling where possible.
- To reduce habitat disturbance and minimize the potential for wildlife mortality, equipment and vehicle travel will be limited to roads or specific construction pathways during construction.
- Construction traffic, parking, and laydown areas will be located within previously disturbed lands to the extent feasible. The construction footprint will be minimized in areas of native vegetation.
- Restoration of disturbed areas will include the replacement of the original pre-construction topsoil, or equivalent quality topsoil, to its original elevation, contour and compaction. Disturbed soil, if not replanted with crops, will be reclaimed with native vegetation (weed free) seed mixes, if approved by the landowner.
- All trash and food-related waste will be placed in self-closing containers and removed daily from the site. This prevents trash from being exposed or blown around the Project Area and reduces the attraction of wildlife to the Project Area.
- All construction-related traffic within the site will be limited to a maximum speed limit of 15 mph on turbine or transmission line access roads, vehicular speed will be limited to 35 mph on county roads within the Project Area boundary. On county roads outside the Project Area, vehicles will be limited to posted speed limits.
- A site-specific worker environmental training program will be developed and implemented throughout the construction of the Project to inform workers of the biological resources present on-site to minimize wildlife impacts. All employees and contractors working in the field will be required to attend the environmental training session prior to working on-site. This training includes information regarding the sensitive biological resources, restrictions, protection measures, individual responsibilities associated with the Project and the consequences of non-compliance. Written material will be provided to employees at orientation and participants will sign an attendance sheet documenting their participation.

- To avoid habitat destruction, BMPs for fire prevention during construction will be implemented to minimize wildfire potential.
- Xcel will work closely with landowners or land management agencies to devise and implement a plan to control noxious weeks. Any use of pesticides, herbicides, fertilizers, and other chemicals will be in accordance with federal and state laws to minimized drift and other impacts on native habitat.
- Actual construction footprints and surface disturbance areas will be minimized during construction to minimize wildlife habitat disturbance. In addition, all native prairie will be avoided to the extent possible to minimize impacts on native prairie and the bird and wildlife species that rely on it. Native prairie will be reclaimed with native vegetation (weed-free) seed mixed if approved by the landowner.
- Removal of vegetation will be avoided within the peak bird nesting season to the extent feasible to avoid removing or disturbing any nests. If not possible, pre-construction nest surveys will be implemented and any nests of ground-nesting birds (e.g. killdeer) will be flagged and a 50-foot non-disturbance buffer placed around nests while it is occupied.
- To avoid injury or mortality of wildlife due to poisoning, an appropriately sized emergency spill containment kit will be available to contain and remove spilled fuels, hydraulic fluids, and other potential pollutants when working within or near streams, lakes or ponds.
- A Storm Water Pollution Prevention plan will be developed for the construction site to prevent contamination of natural water resources, minimize erosion, storm water runoff, and transport of sediment and other contaminants.

6.3 OPERATIONAL AVOIDANCE AND MINIMIZATION MEASURES

This section identifies wildlife impact avoidance and minimization measures (BMPs) that will be incorporated during operation of the Project.

- The 345-kV transmission line was designed to conform to APLIC (2006, APLIC 2012) suggested practices to the extent possible. These measures are sufficient to protect even the largest bird that may perch or roost on transmission lines or towers.
- The associated overhead tie-line will be marked to reduce the potential for avian collision.
- Avian and bat fatalities will be evaluated during standardized post-construction fatality monitoring for one year.
- Xcel will implement an Adaptive Management Program (Section 8) for avoidance, minimizations, and mitigation of impacts to birds, bats and other sensitive wildlife.
- A site-specific worker environmental training program will be developed and implemented throughout the operational life of the facility to inform workers of the biological resources present on-site to minimize wildlife impacts. All employees and contractors working in the field will be required to attend the environmental training session prior to working on-site. This training includes information regarding the sensitive biological resources, restrictions, protection measures, individual responsibilities associated with the Project and the consequences of non-compliance. Written material will be provided to employees at orientation and participants will sign an attendance sheet documenting their participation.
- “Good housekeeping” procedures will be developed to keep the site clean of debris, garbage, carrion, fugitive trach or waste and graffiti; to prohibit scrap heaps and dumps; and to minimize storage yards. This will prevent trash from being exposed or blown around the Project Area and will avoid attracting predators as such material is a potential food source for eagle and other predators (i.e. rodents and other small mammals).

- To minimize vehicle collisions with wildlife, vehicular traffic will be limited to a maximum speed limit of 15 mph on turbine or transmission line access roads, vehicular speed will be limited to 35 mph on county roads within the Project Area boundary. On county roads outside the Project Area, vehicles will be limited to posted speed limits.
- Xcel will contact local game managers to remove road-killed animals on state and county roadways within the Project Area. Road-killed animals or other carcasses (excluding eagles and other migratory birds) detected by personnel on actual Project service roadways will be removed promptly by Xcel personnel under guidance and/or assistance from local game managers to avoid attracting eagle or other raptors to the Project Area.
- To avoid habitat destruction, BMPs for fire prevention during operation will be implemented to minimize wildfire potential.
- Employees and subcontractors will not be allowed to have firearms or pets at the project and will be instructed no not disturb or harass wildlife.
- Lighting of the turbines will be pursuant to Federal Aviation Administration aviation hazard lighting standards. Xcel is proposing in its lighting plan to use radar activated hazard lights acceptable to the Federal Aviation Administration. Xcel may also install motion activated timed lighting on other entrances and other facilities that require lighting at night to avoid the potential to attract insects that may draw birds and bats towards the facility.
- Xcel has voluntarily agreed to develop and implement this WCS in it continued efforts to demonstrate due diligence in avoiding and minimizing impacts to avian and bat species in association with development and operation of the Project.

6.4 MEASURES TO OFFSET AND/OR COMPENSATE FOR HABITAT RELATED IMPACTS

The Project Area is primarily grassland/herbaceous and cultivated crops. Areas of high-quality native prairie were avoided to the extent possible. Turbine and other infrastructure siting will occur primarily in land currently used as row crops. Any temporary impacts to native prairie will be offset by reseeding using a native vegetation (weed free) seed mix in accordance with landowner preferences. Other temporarily disturbed area will be reseeded or restored to crop, depending on original conditions and landowner preferences. As a result, the Project will not result in significant permanent impacts to agricultural production or the habitat it offers to wildlife.

7.0 TIER 4: POST-CONSTRUCTION MONITORING

7.1 FATALITY MONITORING

The following sections describe the protocol for standardized fatality monitoring Xcel will implement to provide statistical estimates for bat and bird fatalities at the Project. This monitoring framework consists of standardized carcass searches conducted at a sample of the Project turbines. The number of fatalities found during searches represents a minimum number of fatalities at a project because not all fatalities that occur are found by observers. Therefore, carcass persistence trials and searcher efficiency trials will be conducted concurrently with standardized fatality monitoring to account for the bias attributable to carcass removal by scavengers and searcher efficiency. Fatality rates (e.g., birds/turbine/year and birds/operational MW/year) will then be estimated using statistical methods that adjust the number of carcasses found for detection biases. Per-turbine and per-MW estimates provide different ways of scaling fatality information to be comparable to other projects. Annual fatality rates will be calculated for all bird species combined, small (≤ 10 inches) and large (>10 inches) birds, raptors, and sensitive

species (collectively). In some cases, the sample size for a species group of interest, such as eagles or other sensitive species, may be too small to allow for the calculation of accurate fatality estimates. In these cases, numerical counts of total fatalities detected during standardized and operational (see Section 7.1.1 and 7.1.2) searches for each of these species or species groups will be provided in place of rate estimates.

The field and analytical methods proposed below are consistent with post-construction fatality monitoring being conducted, or proposed, for other wind projects elsewhere in the U.S. (Johnson et al. 2003; Young et al. 2003; Jain et al. 2009; Huso 2011, Strickland et al. 2011) and nearby in South Dakota (SWCA 2019 and 2020). Methods and timing outlined here may be modified over the course of the study as Project-specific information is gained to maximize the effectiveness and efficiency of the monitoring program (e.g., search interval, number of turbines searched, plot size).

7.1.1 Standardized Carcass Searches

The objective of the fatality monitoring is to identify the bird and bat species found as fatalities at the Project and to statistically estimate fatality rates. This section outlines the methods for the standardized carcass searches, which constitute the initial step in generating the fatality estimate (i.e., finding the carcasses under the turbines). These values then will be adjusted to account for detection bias (see below). The methods for standardized carcass searches include the sampling duration and intensity, search plot size and configuration, and fatality documentation.

7.1.1.1 Sampling Duration and Intensity

Standardized post-construction fatality monitoring will consist of standardized searches of 30 percent of turbines and will be conducted for the first year of operation. To avoid bias in the fatality estimate, turbines will be selected in a stratified random manner based on geographical position within the Project Area, habitat type and topography. To do this, habitat and topography will be determined for each turbine location and the sample turbines will be randomly selected from the category in proportion to how often they occur in these categories. The same turbines will be searched the entire year to avoid confounding effects from individual turbines with variation among years, but in subsequent survey years individual turbine selection may be adaptively managed.

The survey year will be divided into seasons to allow for the inclusion of season-specific searcher efficiency probabilities and carcass persistence times. Searches at each of the designated turbines will initially be conducted every 2 weeks. However, search frequency may be adjusted based on the results of seasonal carcass persistence trials in order to ensure that on average, the search interval minimizes the bias associated with carcass removal by scavengers (see below).

Seasonal sampling intervals will be as follows:

- Spring: March 15–June 15;
- Summer: June 16–September 14; and
- Fall: September 15–December 15

7.1.1.2 Search Plot Size and Configuration

The search area will consist of a square search plot centered on the turbine. The search plot will extend a minimum of 80 percent of the turbine's maximum blade tip height from the turbine on all sides. Additionally, it is anticipated that the turbine pads (which extend out to approximately 20 feet from the base of turbines) and roads will remain clear of vegetation providing areas of vegetation-free searching within each search plot. Search areas will include maintained turbine pads and access roads, as well as adjacent unmaintained areas. The actual area searched will ultimately be dependent on the configuration of the maintained areas, as well as the portion of the unmaintained area that can be realistically searched as determined during the initial surveys. In cases when there is little or no

bare ground and more than 25% of the ground cover over 12 inches in height, searches will only be done on the roads and pads or in that part of the plot that remains in lower vegetation.

Linear transects will be established within the search plots approximately 6 meters (20 feet) apart (USFWS 2012). The searchers walk along each transect searching both sides out to 3 meters (10 feet) for fatalities. In most cases, the searchers work as a two-person team searching the same turbine in tandem. Personnel trained and tested in proper search techniques will conduct the carcass searches.

7.1.1.3 Fatality Documentation

During the set-up for carcass surveys, a sweep survey will be conducted to remove any fatalities that occur before the study is initiated. These carcasses will be documented in the same manner as those found during the standardized carcasses searches; however, they will not be included in the statistical analysis because the statistical analysis requires a known search interval (i.e., an estimate of when fatalities occurred). Thus, any fatalities detected during the sweep survey will be considered incidental to the study and will inform species composition of fatalities at the Project.

Searchers will assume that carcasses found are a result of turbine collisions unless the cause of death can be clearly attributed to a non-turbine cause. Although an unknown number of fatalities may result from natural predation, disease, or anthropogenic events (e.g., shooting), the condition of the carcasses when found rarely facilitates determining the cause of death. Therefore, any fatalities found within the search plot will be attributed to turbine strike unless other lines of evidence present unequivocally rule out turbine strike.

Carcasses found during standardized carcass searches will be labeled with a unique number, and species, sex, age, date, time found, location (GPS coordinate, and distance/direction from the turbine), condition (e.g., intact, scavenged, feather spot), observer, turbine number, and any comments that may indicate cause of death will be collected. All carcasses will be photographed in situ. Once documented, carcasses will be marked in a standardized fashion (e.g., clipping of primary flight feathers) to indicate they have already been recorded.

Searchers may discover carcasses incidental to standardized carcass searches (e.g., outside of a search plot or of a scheduled survey date). For each incidentally discovered carcass, the searcher will identify, photograph, and record data for the carcass as would be done for carcasses found during standardized scheduled searches but will code these carcasses as incidental discoveries. Incidental discoveries will not be included in the statistical calculation of fatality rate.

Most native birds in North America are protected under the MBTA and cannot be salvaged without a permit from the USFWS. Xcel will obtain a federal salvage permit (Migratory Bird Special Purpose Utility Permit – Wind [SPUT permit]) for the fatality monitoring. Additionally, Xcel will obtain a South Dakota Scientific Collectors permit from SDGFP. Xcel may collect carcasses detected during post-construction monitoring for reuse during bias trials. If the carcass of an eagle or federally listed species is found, searchers will notify the operations manager and Xcel Environmental Services and follow disposition techniques in accordance with the SPUT permit.

7.1.2 Bias Correction Trials

7.1.2.1 Carcass Persistence

Carcass persistence time estimates the amount of time a carcass remains on-site prior to its disappearance from the search area due to scavenging or other means (e.g., due to forces such as wind and rain or decomposition beyond recognition). The objective of the carcass persistence trials is to document the length of time carcasses remain in the search area. Carcass persistence trials will be conducted in multiple seasons to evaluate seasonal differences in carcass persistence (i.e., due to changes in scavenger population density or type) and possible differences in the size of the animal being scavenged.

Carcasses used in the trials will be selected to best represent the size of a range of species. For large birds, carcasses may include domestic waterfowl, pheasant, or similar species legally obtained from game farms. For small birds and bats, carcasses may include European starlings, house sparrows, or other non-native species not legally protected. For bats, we may also use mice.

Assuming adequate carcass availability, one carcass persistence trial will be conducted at during each of the spring, summer, and fall seasons with at least 15 carcasses of each bird size class (large bird, small bird, and bat) placed per season.

Each carcass used for the carcass persistence trial will be placed randomly within the area used for the trials. Random locations will be generated to allow the accurate placement of the carcasses by field personnel. Carcasses will be dropped from waist height and allowed to land in a random posture. Each trial carcass will be discreetly marked (e.g., small tag or wire wrapped around one leg) prior to dropping so that it can be identified as a study carcass if it is found by other searchers or wind facility personnel. Personnel will monitor the trial carcasses on days 1, 2, 3, 4, 7, 10, 14, 20, and 30. When checking the carcass, searchers will record the condition as intact (normal stages of decomposition), scavenged (feathers pulled out, chewed on, or parts missing), feather spot (only feathers left), or gone (cannot be found). Changes in carcass condition will be cataloged with pictures and detailed notes; photographs will be taken at placement and any time major changes have occurred. At the end of the 30-day period, any evidence of carcasses that remain will be removed and properly disposed of.

Estimates of the probability that a carcass persisted between search intervals and therefore was available to be found by searchers, will be used to adjust carcass counts for bias using methods available in GenEst (Dalthrop et al 2018).

7.1.2.2 Searcher Efficiency Trials

The ability of searchers to detect carcasses is influenced by a number of factors including the skill of an individual searcher in finding the carcasses, the vegetation composition within the search area, and the characteristics of individual carcasses (e.g., body size, color). The objective of searcher efficiency trials is to estimate the percentage of bird fatalities that searchers can find. Estimates of searcher efficiency are then used to adjust carcass counts for detection bias. Searcher efficiency trials will be conducted in all seasons to account for seasonal differences in searcher efficiency. Carcass species used in the trials and marking and placement techniques will be the same as those in the carcass persistence trials. Additionally, carcasses collected under the auspices of the SPUT permit may be used for searcher efficiency trials.

Personnel conducting the searches will not know when trials will be conducted or the location of the efficiency-trial carcasses. Trials will be conducted multiple times throughout each season and will incorporate testing of each member of the field crew. Assuming adequate carcass availability, at least 15 carcasses of each bird size class (large bird, small bird, and bat) will be placed per season for searcher efficiency trials. A minimum of 10 carcasses per size and season are needed to estimate searcher efficiency. Searcher efficiency trials will be conducted at the monitored turbines. The number of carcasses placed prior to the search (i.e., the number available for detection during each trial) will be verified immediately after the trial by the person responsible for distributing the trial carcasses. Any carcasses not found by searchers will be collected after the trial.

The probability of a carcass being observed is expressed as p, the proportion of trial carcasses that are detected by searchers in the searcher efficiency trials. The probability will be estimated by carcass size class (large bird, small bird) and season. A bootstrapped estimate and 90 percent confidence interval will be calculated based on 5,000 iterations for searcher efficiency.

7.1.3 Fatality Rate Estimation

To calculate the Project-wide fatality rate (fatalities/turbine/year and fatalities/MW/year) and the total Project fatalities, the GenEst (Dalthrop et al 2018) or other appropriate statistical methods will be utilized. The fatality rate

can be calculated for subgroups, including large birds, small birds, raptors (including eagles), bats, or sensitive species if at least 5 fatalities within the subgroup are found.

The estimation of fatality rates will incorporate fatalities documented during standardized carcass searches adjusted for bias. Specifically, fatality estimates will take into account:

- Search interval;
- Observed number of carcasses found during standardized searches during the monitoring year for which operation of the facility cannot be ruled out as the cause of death;
- Carcass persistence, expressed as the probability that a carcass is expected to remain in the study area (persist) and be available for detection by the searchers during carcass persistence trials; and
- Searcher efficiency expressed as the probability of trial carcasses found by searchers during searcher efficiency trials.

A bootstrapped estimate and 90 percent confidence interval will be calculated for the fatality estimate. The 90 percent confidence interval represents the upper and lower bounds of the range of fatality rates that has a 90 percent probability of containing the true fatality rate. The 90 percent confidence interval is useful in a management context as a means of assessing the range of fatality rates that are probable given the number of carcasses that were detected. It should be noted that the upper 90 percent confidence limit corresponds to 95 percent probability that the true fatality rate is lower than the upper 90 percent confidence limit.

7.1.4 Reporting

A post-construction fatality monitoring report will be prepared for the standardized carcass searches to summarize avian and bat fatalities associated with operation of the Project. This report will include a detailed summary of the methods; results from carcass searches, carcass persistence trials, and searcher efficiency trials; an estimate of fatalities on a per-turbine and per-MW basis; and discussions of the results in the context of adaptive management.

7.2 OPERATIONAL MONITORING

Operations and maintenance staff will conduct inspections for bird and bat fatalities each time a turbine is visited as an auxiliary effort to regular operations and maintenance activities. Any carcasses discovered will be recorded as incidental fatalities. Incidentally found wildlife will be documented for the life of the wind farm to identify wildlife concerns should they arise.

7.2.1 Training

All operations personnel will be trained to identify potential wildlife conflicts (including identification of sensitive species) and the proper response, and training records will be maintained on-site. This training will include sensitivity to birds and other wildlife. An incidental reporting process will be developed for operations personnel ensuring they can document bird or bat casualties during routine maintenance work and at other time that they are within the Project Area. Incidentally found wildlife will be documented and reported according to federal and state collection permits, as applicable.

Any injured wildlife observed during operations of the Project will be left in place until Xcel's primary environmental representative will decide the most appropriate course of action depending on the condition and species of injured animal discovered. All injured eagles or federally listed species will be handled in accordance with applicable federal and state collection permits, as applicable, or as directed by appropriate law enforcement personnel.

7.3 ADDITIONAL SURVEYS

Based on avoidance and minimization measures implemented during siting of Project facilities and results of Tier 3 studies, no habitat loss, degradation, or fragmentation effects are anticipated that warrant specific post-construction monitoring studies.

8.0 ADAPTIVE MANAGEMENT

Post-construction monitoring will be adaptively managed to adjust search protocols and frequency as needed to optimize data inputs for the statistical estimator. Xcel will coordinate any adjustments with USFWS, SDGFP, and SDPUC.

9.0 CONTACTS AND KEY RESOURCES

Table 6. List of Key Resources

Role, Organization	Name	Contact Information
Environmental Specialist, Xcel	Kate Schindler	Kathleen.schindler@tetratech.com 612-330-6743
Operations Manager, Xcel	TBD	TBD
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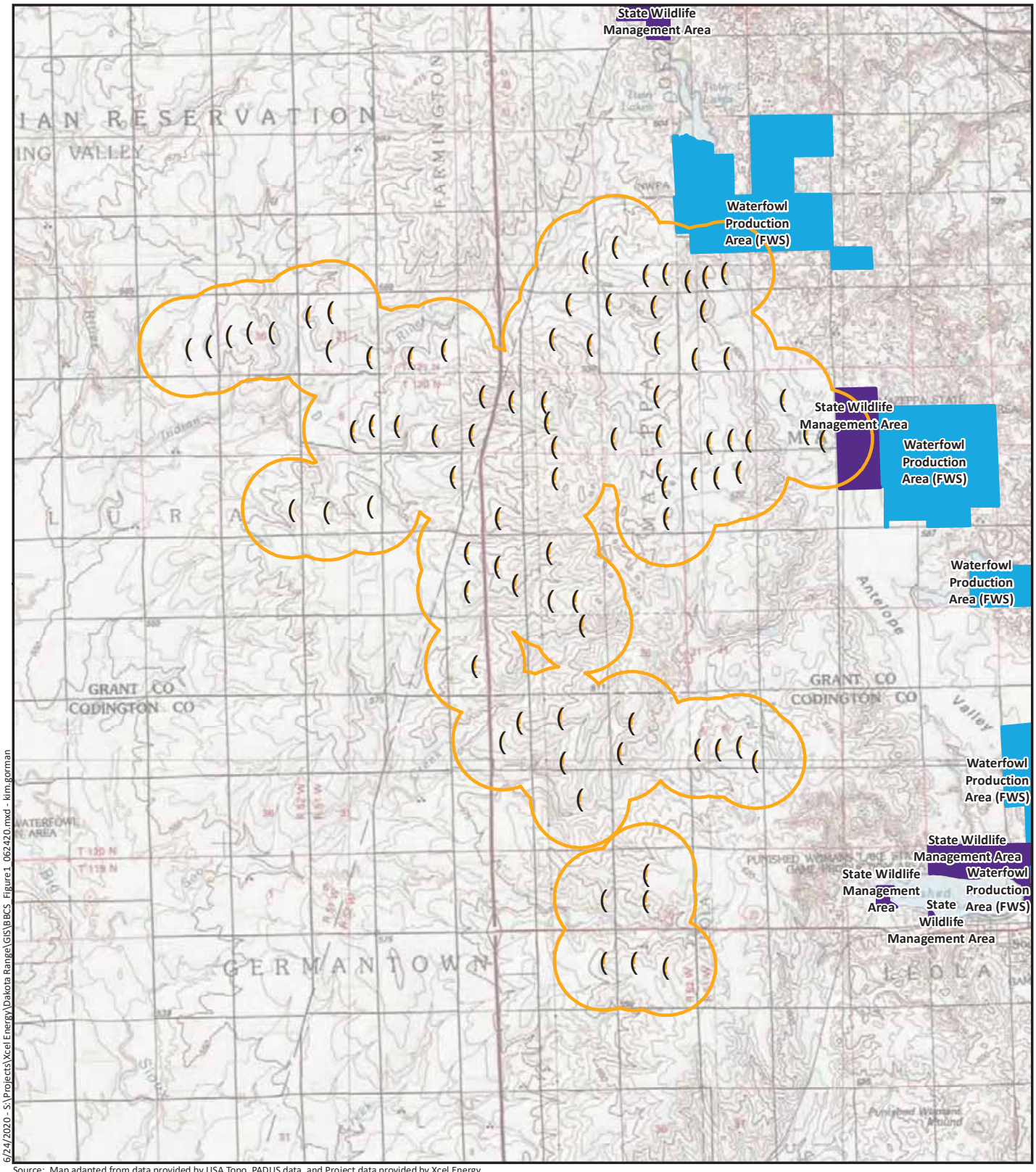
APPENDIX A: FIGURES



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Source: Map adapted from data provided by USA Topo, PADUS data, and Project data provided by Xcel Energy.

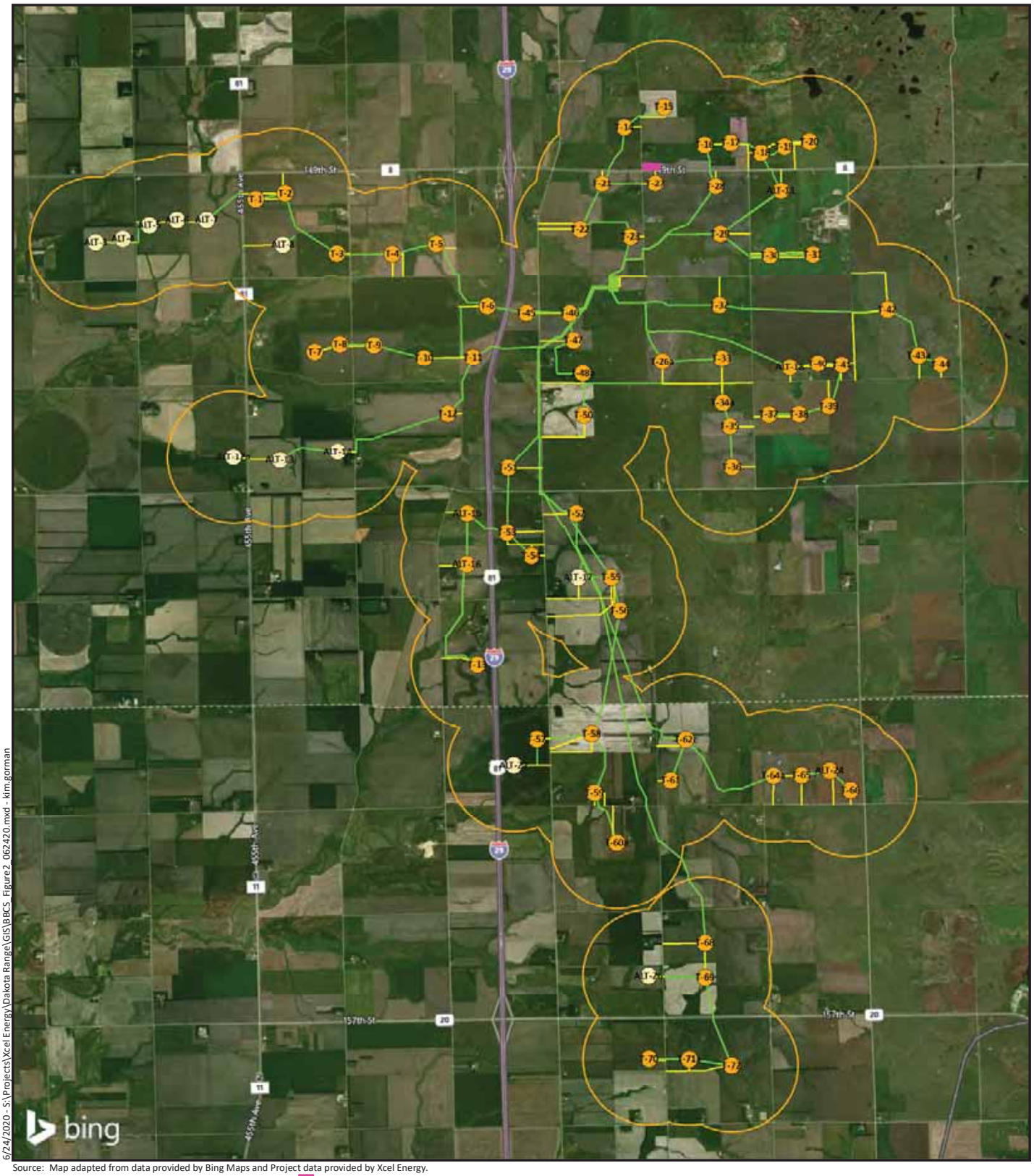
Proposed Facility Layout 5/22/2020

- Primary Turbine Location
- Alternate Turbine Location
- Fish and Wildlife Service (FWS)
- State Fish and Game
- Project Area

0 1 2 3 Miles

Figure 1: Project Vicinity
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

Xcel Energy® TETRA TECH



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Source: Map adapted from data provided by Bing Maps and Project data provided by Xcel Energy.

Proposed Facility Layout 5/22/2020

- Primary Turbine Location
- Alternate Turbine Location
- Access Road
- Collection
- Operations and Maintenance
- Substation
- Project Area

0 1 2 3

Figure 2: Project Facilities
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

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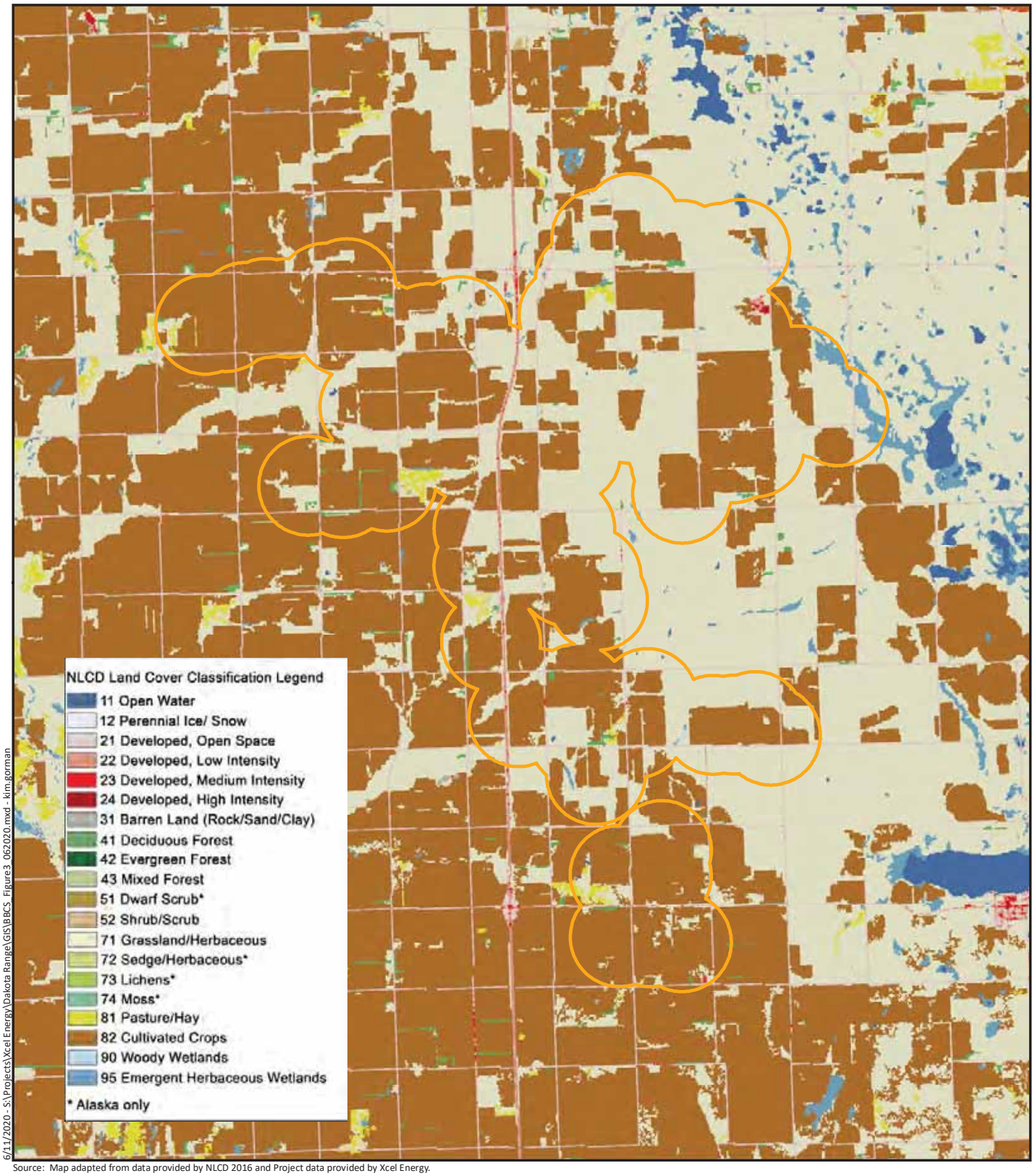

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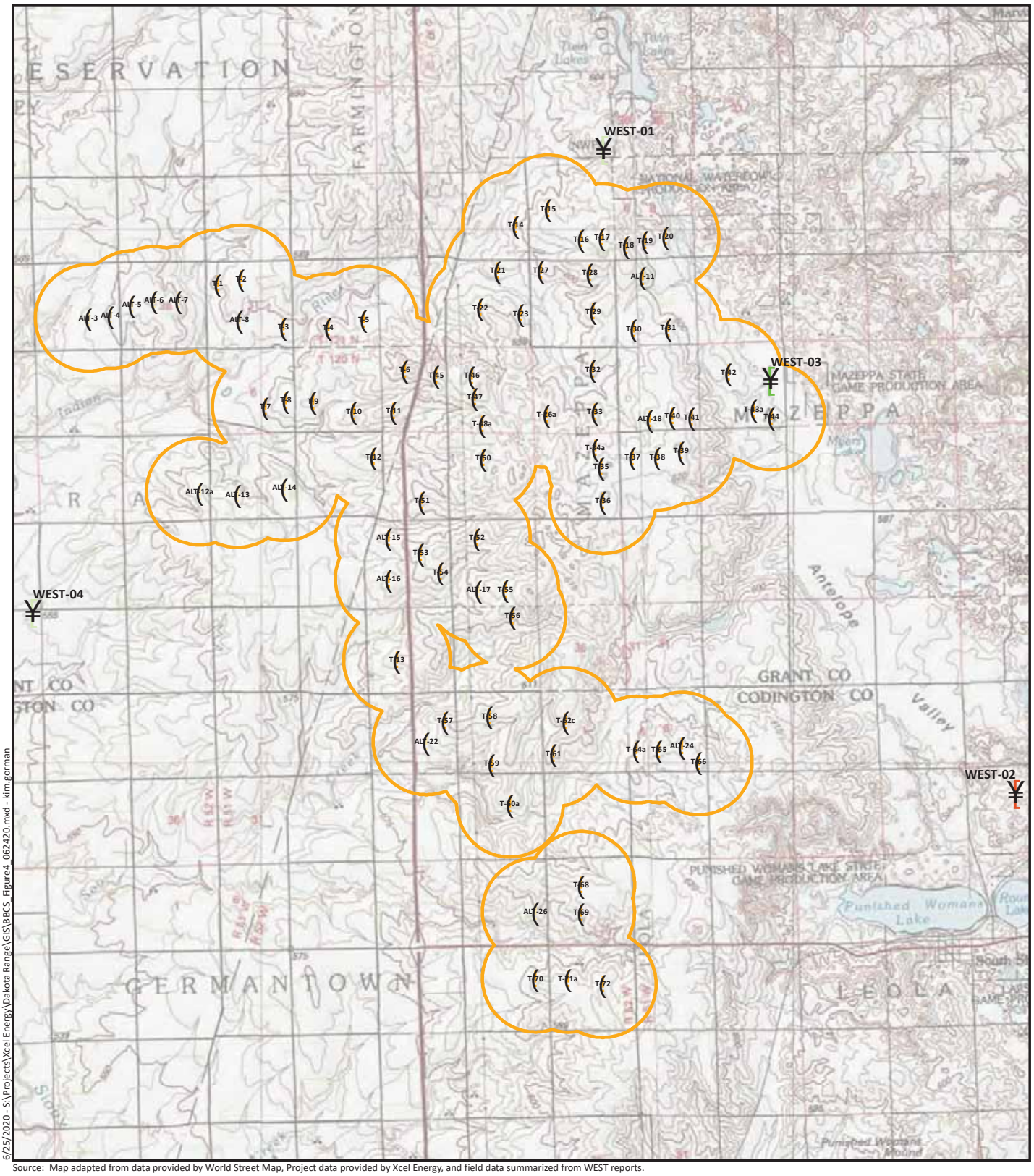
Source: Map adapted from data provided by NLCD 2016 and Project data provided by Xcel Energy.

Project Area

Figure 3: Land Cover
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

0 1 2 3 Miles

Xcel Energy® TETRA TECH



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Source: Map adapted from data provided by World Street Map, Project data provided by Xcel Energy, and field data summarized from WEST reports.

Lek Location

- Confirmed Sharp-tailed Grouse
- Confirmed Greater Prairie Chicken
- Potential Sharp-tailed Grouse

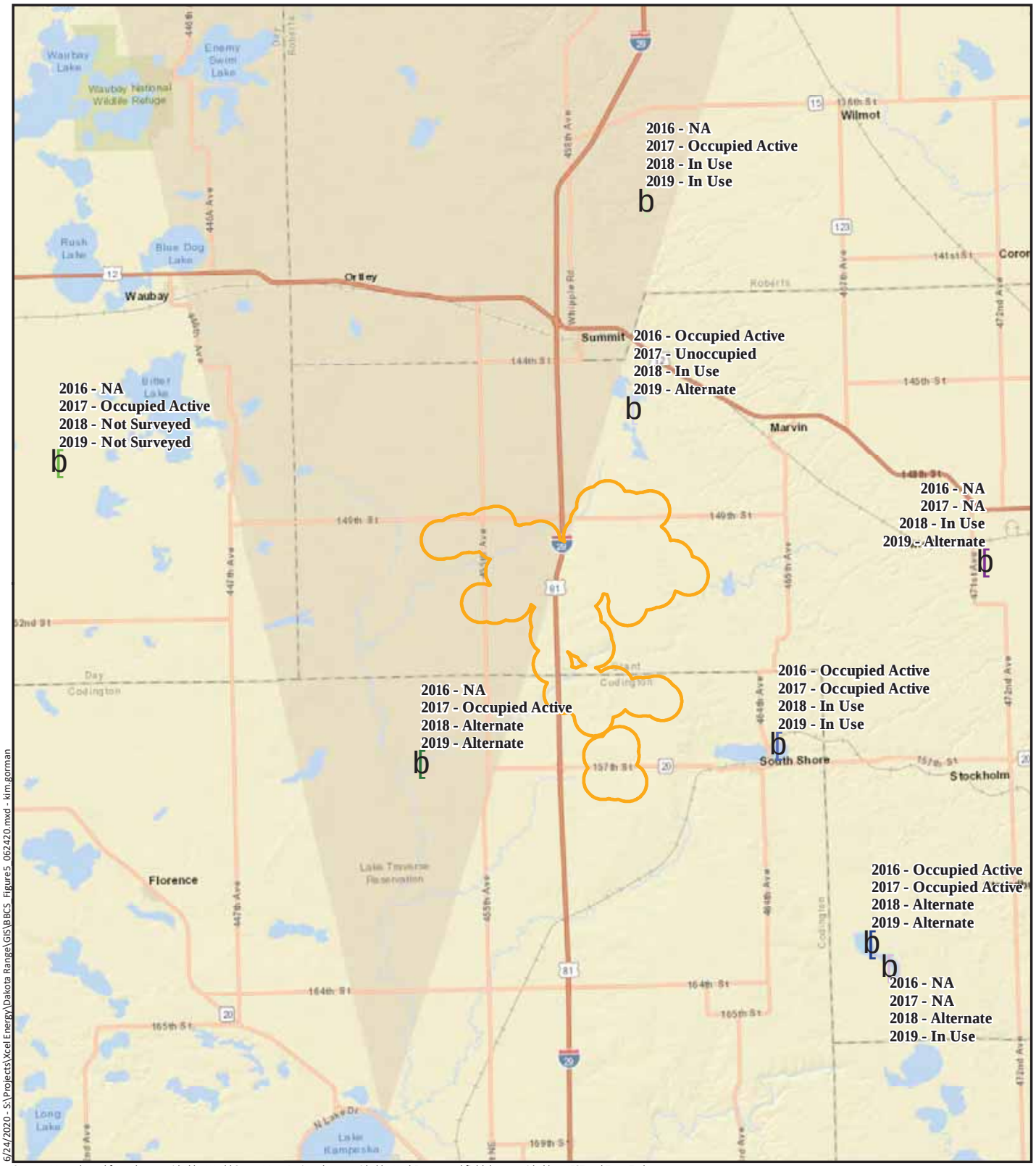
Proposed Facility Layout 5/22/2020

- Primary Turbine Location
- Alternate Turbine Location
- Project Area

0 1 2 3 Miles

Figure 4: Lek Survey Results
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

Xcel Energy® TETRA TECH



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Source: Map adapted from data provided by World Street Map, Project data provided by Xcel Energy, and field data provided by WEST and Tetra Tech.

Surveyed Eagle Nest (Status by Year)

- 2016-02
- 2016-04
- 2016-05
- 2017-01
- 2017-02
- 2017-03
- 2018-01
- 2018-02
- Project Area

0 1 2 3 Miles

Figure 5: Surveyed Eagle Nest Status by Year
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

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APPENDIX B: BASELINE SURVEY REPORTS

ENVIRONMENTAL & STATISTICAL CONSULTANTS
4007 State Street, Suite 109, Bismarck, ND 58503
Phone: 701-250-1756 ◆ www.west-inc.com ◆ Fax: 701-250-1761

TECHNICAL MEMORANDUM

Date: September 28, 2017

To: Jennie Geiger, Apex Clean Energy Management, LLC

From: Western EcoSystems Technology, Inc.

Subject: Dakota Range I Wind Project – Avian/Eagle Use Summary

INTRODUCTION

Dakota Range I Wind, LLC, an affiliate of Apex Clean Energy Management, LLC (Apex), is developing the Dakota Range I Wind Project (Project), in Codington and Grant counties, South Dakota (Figure 1). General avian use point-count surveys were initiated in December 2015 to evaluate species composition (including small bird species), relative abundance, and seasonal variation for large bird species. Eagle use was evaluated at the same locations using methodology recommended in the US Fish and Wildlife Service (USFWS) *Eagle Conservation Plan Guidance* (ECPG; USFWS 2013). Study periods and methods were developed in coordination with USFWS and South Dakota Game Fish and Parks. In this technical memorandum, Western EcoSystems Technology, Inc. (WEST) summarizes data recorded for small and large bird species, eagles, and species of concern (i.e., federally or state-threatened and endangered species [Endangered Species Act 1973], USFWS Birds of Conservation Concern [BCC; USFWS 2008], and South Dakota Species of Greatest Conservation Need [SGCN; South Dakota Wildlife Action Plan 2017]) recorded during surveys.

Project Area

The Project, about 50,125 acres (20,285 hectares), is located in the Northern Glaciated Plains Level III Ecoregion (US Environmental Protection Agency 2016) with most of the Project in the Big Sioux Basin Level IV Ecoregion and the remainder in the Prairie Coteau. The predominant land cover/use types within the Project are cultivated crops and herbaceous (grassland; US Geological Survey [USGS] National Land Cover Database 2011, Homer et al. 2015; Figure 2). The most common cultivated cropland in 2016 was corn (*Zea mays*) and soybeans (*Glycine max*; US Department of Agriculture National Agricultural Statistics Service 2016).

According to the National Wetlands Inventory (NWI; USFWS NWI 2007), most of the wetlands within the Project are classified as freshwater emergent wetlands. The next most common

wetland type is freshwater pond. Several rivers and streams are within the Project: the Big Sioux River flows southwest through the northwestern portion of the Project, Soo Creek flows southwest through the central area of the Project, Mahoney Creek flows southwest through the south-central portion of the Project, and Mud Creek flows southwest through the southern portion of the Project (Figure 3).

METHODS

Fixed-point avian use surveys were conducted approximately once monthly during winter and spring from between December 3, 2015 – May 30, 2017 at 40 survey points using methods described by Reynolds et al. (1980).

Each survey point was located to maximize visibility for the observer and to enable evaluation of representative habitats within and near the Project. Sampling intensity was designed to document use and behavior of birds during the study period. Surveys were carried out during daylight hours, and survey periods varied to cover approximately all daylight hours during a season. To the extent practical, survey effort was roughly consistent across survey points.

Surveys were conducted for 65 minutes (min), with small birds recorded within 100 meters (m; 328 feet [ft]) for the first five min, large birds (including raptors and eagles) recorded out to 800 m (2,625 ft) for the next 20 min, and eagles and sensitive species only recorded for the remaining 40 mins, resulting in 60-min eagle surveys. Sensitive species, if observed, were recorded at any time during the 65-min survey. The 60-min survey methodology for eagles is consistent with the methods recommended in the USFWS ECPG (USFWS 2013). The survey plots used in this evaluation were representative of potential development areas and encompassed approximately 30% of the area under consideration for development (Figure 3).

The following information was recorded during each survey: date, start and end time, and weather information (i.e., temperature, wind speed, wind direction, precipitation, and cloud cover). Additionally, the following data were recorded for each bird observation: species observed (or best possible identification), number of individuals observed, distance from survey point when first observed, closest distance of bird to observer, flight height above ground, flight direction, and activity of bird. Approximate flight height, flight direction, and distance from plot center were recorded when the bird or birds were first observed; the approximate lowest and highest flight heights were recorded at any time during the bird or birds observation.

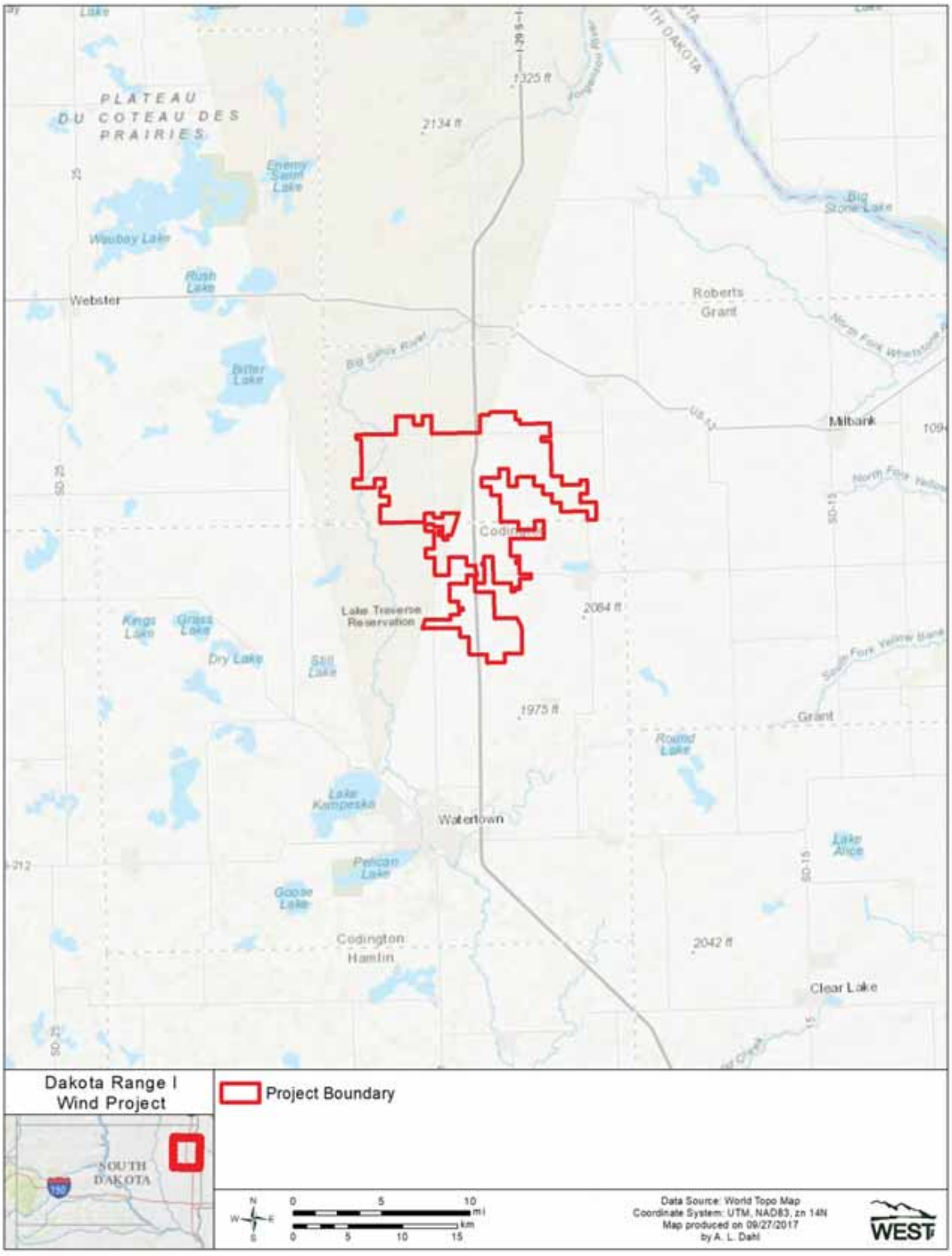

Figure 1. Dakota Range I Wind Project location in Codington and Grant counties, South Dakota.

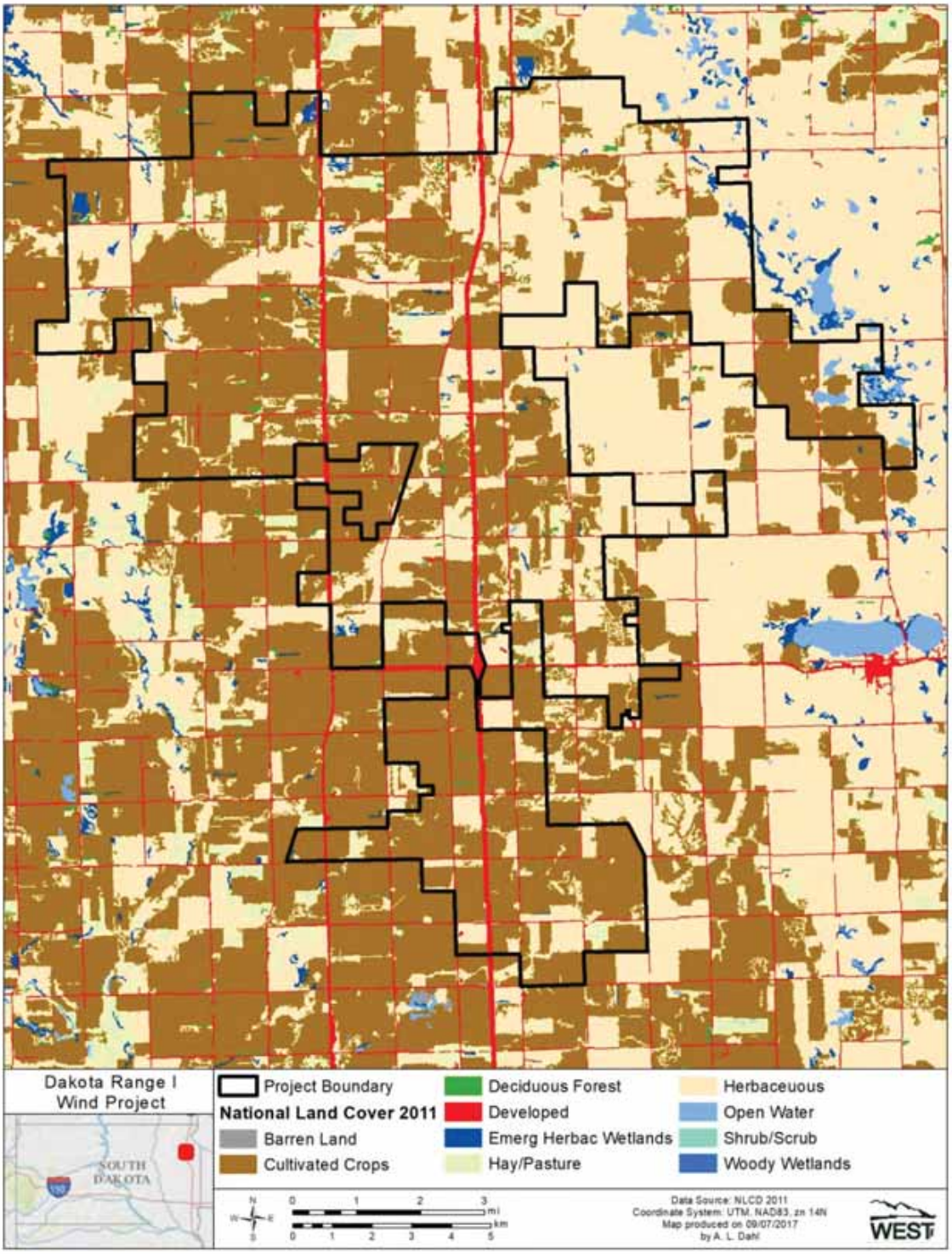

Figure 2. Land cover/use types in and near the Dakota Range I Wind Project in Codington and Grant counties, South Dakota (US Geological Survey National Land Cover Database 2011, Homer et al. 2015).

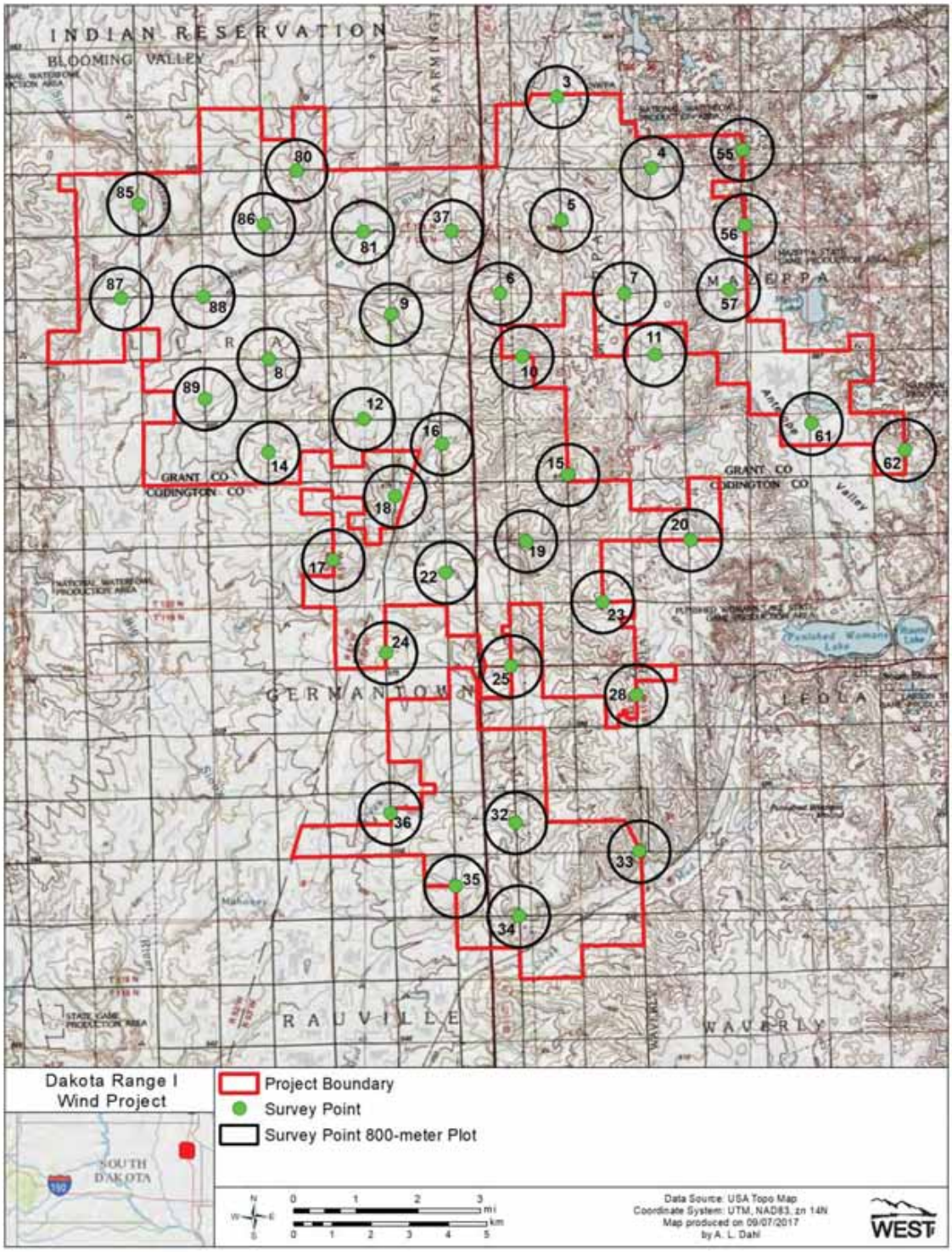

Figure 3. Survey point locations at the Dakota Range I Wind Project in Codington and Grant counties, South Dakota.

Data Analysis

For small birds, a list of species with number of individuals and groups observed during the 5-min survey was compiled.

For large birds, standardized fixed-point bird use estimates were generated based on large birds detected within the 800-m radius plot. Mean bird use was calculated as the number of birds per plot per 20-min survey. These standardized estimates of mean bird use can be used to compare differences between bird types, seasons, survey points, and other studies where similar methods were used. Mean use by season was calculated by summing the total number of birds seen within each plot during a visit, then averaging across plots within each visit, followed by averaging across visits within the season. Frequency of occurrence was calculated as the percent of surveys in which a particular bird type or species was observed. We generated a summary table for large birds, tallying the number of individuals and groups observed by species and season.

A separate summary of eagle minutes (i.e., observations of flying eagles that were recorded within 800-m of the observer and at or below 200 m (656 ft) above ground level), was calculated in accordance with the ECPG (USFWS 2013).

RESULTS

Surveys were conducted in winter and spring from December 3, 2015 – May 30, 2017, resulting in 221 hours of 60-min survey effort (108 hours in winter and 113 hours in spring). Each survey point was surveyed approximately six times, with approximately three surveys during the first winter (25 points from December 3, 2015 – February 25, 2016; 85 survey hours) or second winter (10 points from January 2, 2017 – February 24, 2017; 23 survey hours), followed by approximately three surveys during spring (40 points from March 2, 2017 – May 30, 2017; 113 survey hours).

Small Birds

Twenty small bird species, with 753 observations in 153 groups, were recorded during 5-min surveys (Appendix A). The most commonly observed small bird species were red-winged blackbird (*Agelaius phoeniceus*; 408 observations) and horned lark (*Eremophila alpestris*; 104 observations). No federal or state-listed, BCC, or SGCN small bird species were observed.

Large Birds

Thirty large birds species, with 1,863 observations in 126 groups, were recorded during the 20-min large bird survey (Appendix A). The most commonly recorded species were waterfowl, comprising 84% of the total number of large bird observations (Appendix B). Canada goose (*Branta canadensis*), greater white-fronted goose (*Anser albifrons*), and snow goose (*Chen caerulescens*) accounted for most of those observations. Large bird mean use was somewhat

higher in spring (9.17 birds/800-m plot/20-min survey) than in winter (8.59 birds/800-m plot/20-min survey; Appendix B).

Six diurnal raptor species were identified during the large bird surveys, which accounted for 20 raptor observations (1% of large bird observations; Appendix A). Red-tailed hawk (*Buteo jamaicensis*; 10 observations) was the most commonly observed diurnal raptor, followed by northern harrier (*Circus cyaneus*; four observations). Diurnal raptor use was higher in spring (0.13 birds/800-m plot/20-min survey) than in winter (0.03 birds/800-m plot/20-min survey; Appendix B).

Eagles

One bald eagle (*Haliaeetus leucocephalus*) was observed in winter and one in spring during the 60-min eagle use count surveys. Three eagle minutes were recorded at Point 7 on December 3, 2015, and four were recorded at Point 36 on March 3, 2017 (Table 1). Bald eagle use was 0.006 eagles/800-m plot/60-min survey in winter, and 0.010 eagles/800-m plot /60-min survey in spring (Table 1). Eagle flight paths are shown in Figure 4. No golden eagles (*Aquila chrysaetos*) were observed during surveys.

Table 1. Number of bald eagle observations and minutes where eagles flew below 200 meters (m) above ground level within 800 m of the observer (eagle minutes [min]), survey effort (hours), and eagle use (eagles/800-m plot /60-min survey) observed during large bird surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

Season	Number of Eagle Observations	Eagle Minutes	Survey Effort (hours)	Eagle Use (eagles/plot/60 min)
Winter	1	3	108	0.006
Spring	1	4	113	0.010

Sensitive Species

No federally threatened or endangered species were observed during the study (Endangered Species Act 1973). One state endangered species, peregrine falcon (*Falco peregrinus*; n=1), was documented during surveys (South Dakota Wildlife Action Plan 2017). Four BCC species were documented: (American bittern [*Botaurus lentiginosus*; n=2], bald eagle [n=2], marbled godwit [*Limosa fedoa*; n=6], and peregrine falcon), and four SGCN species were documented (American white pelican [*Pelecanus erythrorhynchos*; n=21], bald eagle, marbled godwit, and peregrine falcon; Table 2).

Table 2. Sensitive species observed during surveys at Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

Species	Number of Observations	BCC	BGEPA	State	SGCN
American bittern	2	X			
American white pelican	21				X
bald eagle	2	X	X		X
marbled godwit	6	X			X
peregrine falcon	1	X		Endangered	X

BCC-Birds of Conservation Concern (US Fish and Wildlife Service 2008)
BGEPA-Bald and Golden Eagle Protection Act (1940)
SGCN-Species of Greatest Conservation Need (South Dakota Wildlife Action Plan 2017)

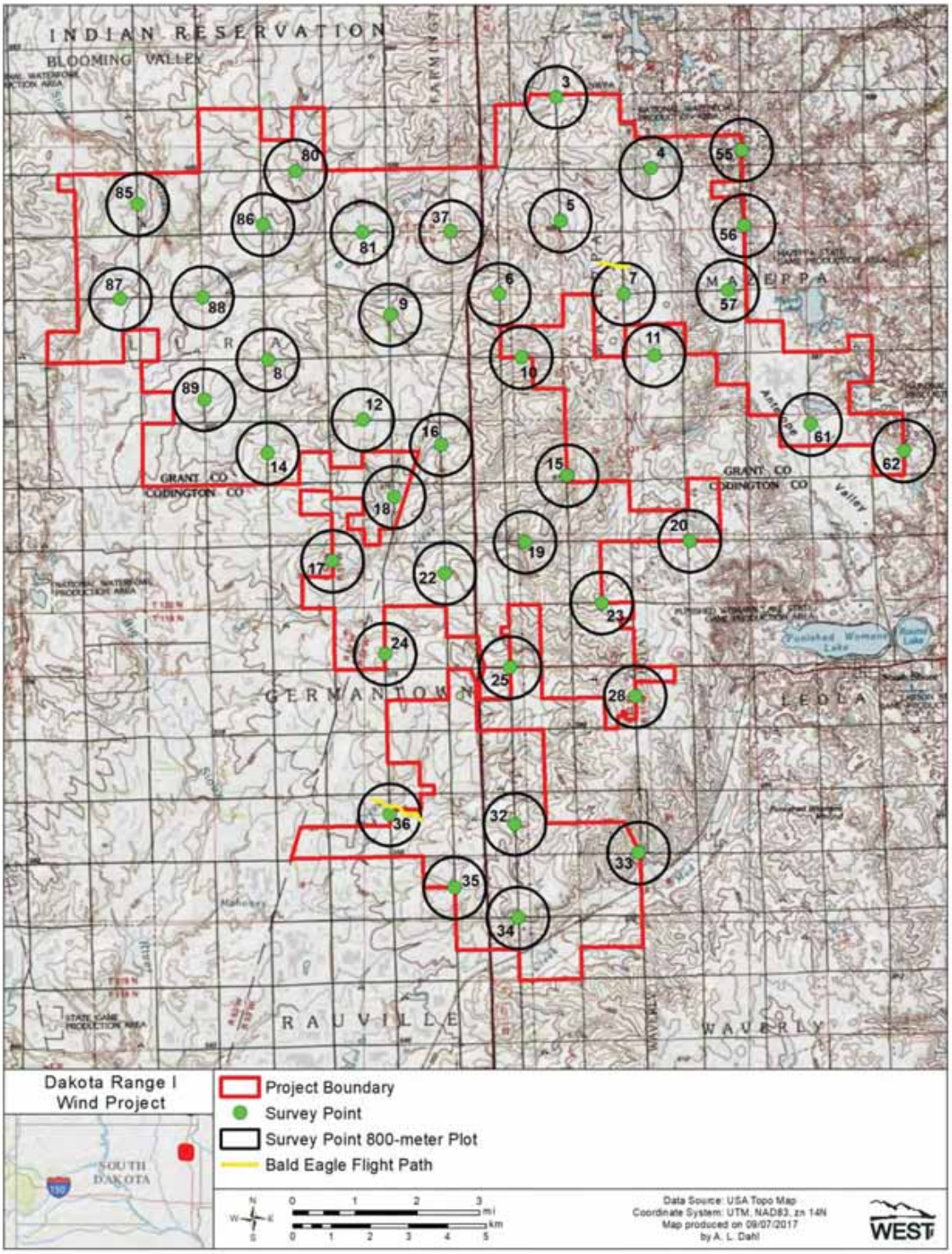

Figure 4. Bald eagle flight paths recorded during surveys at Dakota Range I Wind Project in Codington and Grant counties, South Dakota from December 3, 2015 – May 30, 2017.

DISCUSSION

In general, the bird species observed during the fixed-point bird use surveys at the Project were common species typical of agricultural and grassland environments in this area of South Dakota (Drilling et al. 2016, South Dakota Birds, Birding, and Nature 2017) during winter and spring. No federally threatened or endangered species and one state endangered species (peregrine falcon) were observed during the study. Five BCC and SGCN species were documented in low numbers (American bittern, American white pelican, bald eagle, marbled godwit, peregrine falcon). Direct impacts to avian species are expected to be low as evidenced by data from projects operating in similar habitats (Appendix C).

Diurnal raptors most often observed were relatively common, widespread species and potential impacts from the Project are unlikely to cause significant adverse impacts to local or regional populations. Two bald eagles were observed over 221 hours of surveys. The results of this study combined with other publicly available information within the area (i.e., adjacent Summit Wind project to the north with 231 hrs of study across a full year with no bald eagle and only one golden eagle observation [Derby and Dahl 2014]), suggest that risk to bald eagles is likely to be very low.

Waterfowl use at the Project was mostly comprised of snow geese, white-fronted geese, and Canada geese. In an analysis of 116 studies of bird mortality at over 70 facilities, waterfowl made up 2.7% of 4,975 fatalities (Erickson et al. 2014) suggesting waterfowl are not especially vulnerable to turbine collisions. The presence of similar habitat surrounding the Project suggests any displacement of these species is unlikely to negatively impact their populations.

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Appendix A. Summary of Individual and Group Observations of Small and Large Bird Type and Species by Season, Observed During Bird Surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017

Appendix A1. Summary of individual (# obs) and group (# grps) observations of small bird species and type, by season, observed within 100 meters of the observer, during small bird surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

		Winter		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Blackbird/Orioles		**0**	**0**	**80**	**468**	**80**	**468**
Baltimore oriole	*Icterus galbula*	0	0	1	1	1	1
bobolink	*Dolichonyx oryzivorus*	0	0	3	3	3	3
brown-headed cowbird	*Molothrus ater*	0	0	11	16	11	16
red-winged blackbird	*Agelaius phoeniceus*	0	0	26	408	26	408
western meadowlark	*Sturnella neglecta*	0	0	38	39	38	39
yellow-headed blackbird	*Xanthocephalus xanthocephalus*	0	0	1	1	1	1
Corvids		**1**	**1**	**4**	**4**	**5**	**5**
blue jay	*Cyanocitta cristata*	1	1	4	4	5	5
Finches/Crossbills		**0**	**0**	**1**	**2**	**1**	**2**
American goldfinch	*Spinus tristis*	0	0	1	2	1	2
Flycatchers		**0**	**0**	**4**	**4**	**4**	**4**
eastern kingbird	*Tyrannus tyrannus*	0	0	4	4	4	4
Grassland/Sparrows		**4**	**54**	**25**	**156**	**29**	**210**
clay-colored sparrow	*Spizella pallida*	0	0	1	1	1	1
horned lark	*Eremophila alpestris*	4	54	15	50	19	104
Lapland longspur	*Calcarius lapponicus*	0	0	2	16	2	16
Savannah sparrow	*Passerculus sandwichensis*	0	0	6	9	6	9
snow bunting	*Plectrophenax nivalis*	0	0	1	80	1	80
Shorebirds		**0**	**0**	**11**	**14**	**11**	**14**
Wilson's snipe	*Gallinago delicata*	0	0	11	14	11	14
Swallows		**0**	**0**	**9**	**24**	**9**	**24**
barn swallow	*Hirundo rustica*	0	0	7	22	7	22
tree swallow	*Tachycineta bicolor*	0	0	2	2	2	2
Thrushes		**0**	**0**	**12**	**24**	**12**	**24**
American robin	*Turdus migratorius*	0	0	12	24	12	24
Warblers		**0**	**0**	**1**	**1**	**1**	**1**
yellow-rumped warbler	*Setophaga coronata*	0	0	1	1	1	1
Woodpeckers		**0**	**0**	**1**	**1**	**1**	**1**
unidentified woodpecker		0	0	1	1	1	1
Overall Small Birds		**5**	**55**	**148**	**698**	**153**	**753**

Appendix A2. Summary of individual (# obs) and group (# grps) observations of large bird species and type, by season, observed within 800 meters of the observer, during 20-minute large bird surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

		Winter		Spring		Total	
Type/Species	Scientific Name	# grps	# obs	# grps	# obs	# grps	# obs
Waterbirds		**0**	**0**	**2**	**22**	**2**	**22**
American white pelican	*Pelecanus erythrorhynchos*	0	0	1	21	1	21
great blue heron	*Ardea herodias*	0	0	1	1	1	1
Waterfowl		**7**	**641**	**56**	**917**	**63**	**1,558**
blue-winged teal	*Anas discors*	0	0	9	57	9	57
Canada goose	*Branta canadensis*	3	236	17	95	20	331
gadwall	*Anas strepera*	0	0	3	8	3	8
greater white-fronted goose	*Anser albifrons*	2	260	2	130	4	390
lesser scaup	*Aythya affinis*	0	0	1	6	1	6
mallard	*Anas platyrhynchos*	1	75	15	44	16	119
northern pintail	*Anas acuta*	0	0	2	4	2	4
northern shoveler	*Anas clypeata*	0	0	1	1	1	1
ring-necked duck	*Aythya collaris*	0	0	1	2	1	2
ruddy duck	*Oxyura jamaicensis*	0	0	1	15	1	15
snow goose	*Chen caerulescens*	1	70	4	555	5	625
Shorebirds		**0**	**0**	**1**	**6**	**1**	**6**
marbled godwit	*Limosa fedoa*	0	0	1	6	1	6
Gulls/Terns		**0**	**0**	**7**	**9**	**7**	**9**
ring-billed gull	*Larus delawarensis*	0	0	7	9	7	9
Rails/Coots		**0**	**0**	**1**	**1**	**1**	**1**
American coot	*Fulica americana*	0	0	1	1	1	1
Diurnal Raptors		**5**	**5**	**15**	**15**	**20**	**20**
Buteos		*4*	*4*	*10*	*10*	*14*	*14*
broad-winged hawk	*Buteo platypterus*	0	0	1	1	1	1
red-tailed hawk	*Buteo jamaicensis*	1	1	9	9	10	10
rough-legged hawk	*Buteo lagopus*	3	3	0	0	3	3
Northern Harrier		*1*	*1*	*3*	*3*	*4*	*4*
northern harrier	*Circus cyaneus*	1	1	3	3	4	4
Eagles		*0*	*0*	*1*	*1*	*1*	*1*
bald eagle	*Haliaeetus leucocephalus*	0	0	1	1	1	1

Appendix A2. Summary of individual (# obs) and group (# grps) observations of large bird species and type, by season, observed within 800 meters of the observer, during 20-minute large bird surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

		Winter		Spring		Total	
Type/Species	**Scientific Name**	**# grps**	**# obs**	**# grps**	**# obs**	**# grps**	**# obs**
Falcons		*0*	*0*	*1*	*1*	*1*	*1*
peregrine falcon	*Falco peregrinus*	0	0	1	1	1	1
Owls		**1**	**1**	**1**	**1**	**2**	**2**
great horned owl	*Bubo virginianus*	0	0	1	1	1	1
snowy owl	*Bubo scandiacus*	1	1	0	0	1	1
Vultures		**0**	**0**	**1**	**1**	**1**	**1**
turkey vulture	*Cathartes aura*	0	0	1	1	1	1
Upland Game Birds		**9**	**102**	**5**	**6**	**14**	**108**
ring-necked pheasant	*Phasianus colchicus*	3	5	0	0	3	5
sharp-tailed grouse	*Tympanuchus phasianellus*	1	2	1	2	2	4
wild turkey	*Meleagris gallopavo*	5	95	4	4	9	99
Doves/Pigeons		**7**	**57**	**0**	**0**	**7**	**57**
rock pigeon	*Columba livia*	7	57	0	0	7	57
Large Corvids		**7**	**72**	**2**	**8**	**9**	**80**
American crow	*Corvus brachyrhynchos*	7	72	2	8	9	80
Overall Large Birds		36	878	90	985	126	1,863

Appendix B. Mean Bird Use, Percent of Total Use, and Frequency of Occurrence for Each Large Bird Type and Species by Season During Surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017

Appendix B. Mean bird use (number of birds/800-meter plot/20-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species, by season, during surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

	Mean Use		% of Use		% Frequency	
Type/Species	**Winter**	**Spring**	**Winter**	**Spring**	**Winter**	**Spring**
Waterbirds	**0**	**0.19**	**0**	**2.1**	**0**	**1.7**
American white pelican	0	0.18	0	2	0	0.9
great blue heron	0	<0.01	0	<0.1	0	0.9
Waterfowl	**7.18**	**8.57**	**83.6**	**93.5**	**3.9**	**23.8**
blue-winged teal	0	0.49	0	5.3	0	6
Canada goose	2	0.86	23.3	9.3	3.3	9.6
gadwall	0	0.07	0	0.7	0	2.6
greater white-fronted goose	3.71	1.24	43.2	13.5	1.4	1
lesser scaup	0	0.05	0	0.6	0	0.9
mallard	1.07	0.4	12.5	4.3	1.4	11.3
northern pintail	0	0.03	0	0.4	0	1.7
northern shoveler	0	<0.01	0	<0.1	0	0.9
ring-necked duck	0	0.02	0	0.2	0	0.9
ruddy duck	0	0.13	0	1.4	0	0.9
snow goose	0.4	5.29	4.7	57.6	0.6	1.9
Shorebirds	**0**	**0.05**	**0**	**0.6**	**0**	**0.9**
marbled godwit	0	0.05	0	0.6	0	0.9
Gulls/Terns	**0**	**0.08**	**0**	**0.8**	**0**	**4.3**
ring-billed gull	0	0.08	0	0.8	0	4.3
Rails/Coots	**0**	**<0.01**	**0**	**<0.1**	**0**	**0.9**
American coot	0	<0.01	0	<0.1	0	0.9
Diurnal Raptors	**0.03**	**0.13**	**0.3**	**1.4**	**2.9**	**12.1**
Buteos	*0.02*	*0.09*	*0.3*	*0.9*	*2.3*	*8.5*
broad-winged hawk	0	<0.01	0	<0.1	0	0.9
red-tailed hawk	<0.01	0.08	<0.1	0.8	0.6	7.7
rough-legged hawk	0.02	0	0.2	0	1.7	0
Northern Harrier	*<0.01*	*0.03*	*<0.1*	*0.3*	*0.6*	*2.6*
northern harrier	<0.01	0.03	<0.1	0.3	0.6	2.6
Eagles	*0*	*<0.01*	*0*	*0.1*	*0*	*1*
bald eagle	0	<0.01	0	0.1	0	1

Appendix B. Mean bird use (number of birds/800-meter plot/20-minute survey), percent of total use (%), and frequency of occurrence (%) for each large bird type and species, by season, during surveys at the Dakota Range I Wind Project from December 3, 2015 – May 30, 2017.

	Mean Use		% of Use		% Frequency	
Type/Species	**Winter**	**Spring**	**Winter**	**Spring**	**Winter**	**Spring**
Falcons	*0*	*<0.01*	*0*	*<0.1*	*0*	*0.9*
peregrine falcon	0	<0.01	0	<0.1	0	0.9
Owls	*<0.01*	*<0.01*	*<0.1*	*0.1*	*0.6*	*1*
great horned owl	0	<0.01	0	0.1	0	1
snowy owl	<0.01	0	<0.1	0	0.6	0
Vultures	*0*	*<0.01*	*0*	*<0.1*	*0*	*0.9*
turkey vulture	0	<0.01	0	<0.1	0	0.9
Upland Game Birds	*0.62*	*0.05*	*7.3*	*0.6*	*6.4*	*4.3*
ring-necked pheasant	0.05	0	0.6	0	2.9	0
sharp-tailed grouse	0.01	0.02	0.1	0.2	0.6	0.9
wild turkey	0.56	0.03	6.5	0.4	2.9	3.4
Doves/Pigeons	*0.33*	*0*	*3.8*	*0*	*4*	*0*
rock pigeon	0.33	0	3.8	0	4	0
Large Corvids	*0.42*	*0.08*	*4.9*	*0.8*	*4.8*	*1.9*
American crow	0.42	0.08	4.9	0.8	4.8	1.9
Overall Large Birds	8.59	9.17	100	100		

Appendix C. Raptor and All Bird Fatality Estimates for Wind Facilities in the Midwest

Appendix C. Raptor and all bird fatality estimates (number of fatalties per megawatt [MW] per year) and dominant land cover/use for wind facilities in the Midwest.

Facility/Project Name	All Bird Fatalities/ MW/Year	Raptors Fatalities/ MW/Year	Dominanat Land Cover/Use	Reference
Barton I & II, IA (2010-2011)	5.50	0	agriculture	Derby et al. 2011a
Big Blue, MN (2013)	0.60	0	agriculture	Fagen Engineering 2014
Big Blue, MN (2014)	0.37	0	agriculture	Fagen Engineering 2015
Blue Sky Green Field, WI (2008; 2009)	7.17	0	agriculture	Gruver et al. 2009
Buffalo Ridge I, SD (2009-2010)	5.06	0.20	agriculture/grassland	Derby et al. 2010a
Buffalo Ridge II, SD (2011-2012)	1.99	0	agriculture, grassland	Derby et al. 2012a
Buffalo Ridge, MN (Phase I; 1996)	4.14	0	agriculture	Johnson et al. 2000
Buffalo Ridge, MN (Phase I; 1997)	2.51	0	agriculture	Johnson et al. 2000
Buffalo Ridge, MN (Phase I; 1998)	3.14	0	agriculture	Johnson et al. 2000
Buffalo Ridge, MN (Phase I; 1999)	1.43	0.47	agriculture	Johnson et al. 2000
Buffalo Ridge, MN (Phase II; 1998)	2.47	0	agriculture	Johnson et al. 2000
Buffalo Ridge, MN (Phase II; 1999)	3.57	0	agriculture	Johnson et al. 2000
Buffalo Ridge, MN (Phase III; 1999)	5.93	0	agriculture	Johnson et al. 2000
Cedar Ridge, WI (2009)	6.55	0.18	agriculture	BHE Environmental 2010
Cedar Ridge, WI (2010)	3.72	0.13	agriculture	BHE Environmental 2011
Elm Creek II, MN (2011-2012)	3.64	0	agriculture, grassland	Derby et al. 2012b
Elm Creek, MN (2009-2010)	1.55	0	agriculture	Derby et al. 2010b
Fowler I, IN (2009)	2.83	0	agriculture	Johnson et al. 2010
Grand Ridge I, IL (2009-2010)	0.48	0	agriculture	Derby et al. 2010f
Heritage Garden I, MI (2012-2014)	1.30	NA	agriculture	Kerlinger et al. 2014
Kewaunee County, WI (1999-2001)	1.95	0	agriculture	Howe et al. 2002
Moraine II, MN (2009)	5.59	0.37	agriculture/grassland	Derby et al. 2010c
NPPD Ainsworth, NE (2006)	1.63	0.06	agriculture/grassland	Derby et al. 2007
Pioneer Prairie II, IA (2011-2012)	0.27	0	agriculture, grassland	Chodachek et al. 2012
Prairie Winds ND1 (Minot), ND (2010)	1.48	0.05	agriculture	Derby et al. 2011c
Prairie Winds ND1 (Minot), ND (2011)	1.56	0.05	agriculture, grassland	Derby et al. 2012c
Prairie Winds SD1, SD (2011-2012)	1.41	0	grassland	Derby et al. 2012d
Prairie Winds SD1, SD (2012-2013)	2.01	0.03	grassland	Derby et al. 2013
Prairie Winds SD1, SD (2013-2014)	1.66	0.17	grassland	Derby et al. 2014
Rail Splitter, IL (2012-2013)	0.84	0	agriculture	Good et al 2013a
Rugby, ND (2010-2011)	3.82	0.06	agriculture	Derby et al. 2011b
Summerview, Alb (2005-2006)	1.06	0.11	agriculture	Brown and Hamilton 2006
Top Crop I & II (2012-2013)	1.35	NA	agriculture	Good et al 2013b
Top of Iowa, IA (2003)	0.42	0	agriculture	Jain 2005
Top of Iowa, IA (2004)	0.81	0.17	agriculture	Jain 2005
Wessington Springs, SD (2009)	8.25	0.06	grassland	Derby et al. 2010e
Wessington Springs, SD (2010)	0.89	0.07	grassland	Derby et al. 2011d
Winnebago, IA (2009-2010)	3.88	0.27	agriculture/grassland	Derby et al. 2010d

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TECHNICAL MEMORANDUM

Date: August 29, 2017

To: Jennie Geiger, Apex Clean Energy Management, LLC

From: Western EcoSystems Technology, Inc.

Subject: Dakota Range I Wind Project – Dakota Skipper/Poweshiek Skipperling Habitat Survey Memo

INTRODUCTION

Dakota Range I, LLC, an affiliate of Apex Clean Energy Management, LLC (Apex), is developing the Dakota Range I Wind Project (Project), in Codington and Grant Counties, South Dakota (Figure 1). At Apex's request, Western EcoSystems Technology, Inc. (WEST) conducted a Dakota skipper (DASK; federally threatened) and Poweshiek skipperling (POSK; federally endangered) habitat survey to identify areas warranting avoidance during development and construction of the Project. This report includes results of surveys completed in 2016 and 2017 in the area currently proposed for development.

PROJECT AREA

The Project is approximately 47,483 acres (19,216 hectares) and is located in the Northern Glaciated Plains Level III Ecoregion (U.S. Environmental Protection Agency [USEPA] 2016) with about 92% of the Project in the Big Sioux Basin Level IV Ecoregion and the remainder in the Prairie Coteau. The predominant land cover/use types within the Project include approximately 54% cultivated crops and 38% herbaceous (grassland; Figure 2). The remaining land cover/use types account for less than 5% (U.S. Geological Survey [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015). The most common cultivated cropland in 2016 was corn (*Zea mays*) and soybeans (*Glycine max*; U.S. Department of Agriculture [USDA] National Agricultural Statistics Service [NASS] 2016). Ownership within the Project area is largely private (USGS Protected Areas Database of the United States [PADUS] 2012); however, there are five US Fish and Wildlife Service (USFWS) Dakota Tallgrass Prairie Wildlife Management Areas totaling about 798 acres (323 hectares) within the Project area.

According to the National Wetlands Inventory (NWI; USFWS NWI 2007), about 600 acres (243 hectares) of the Project area is comprised of wetlands, of which about 79% are classified as freshwater emergent wetlands. The next most common wetland type is freshwater pond (10% of wetlands; Figure 2).

Several rivers and streams are within the Project area: the Big Sioux River flows southwest through the northwestern portion of the Project, Soo Creek flows southwest through the central area of the Project, Mahoney Creek flows southwest through the south-central portion of the Project, and Mud Creek flows southwest through the southern portion of the Project (Figure 2).

METHODS

Desktop Review: The Project area was evaluated by a WEST GIS Specialist using desktop analysis of available aerial photography and the *Quantifying Undisturbed (Native) Lands in Eastern South Dakota: 2013* (2013 Undisturbed Lands, Bauman et al. 2013) digital data layer to identify grasslands with potentially suitable DASK and POSK habitat (i.e., areas of untilled grassland). Potentially suitable habitat was defined as areas of grassland, based on a review of the 2016 USDA National Agriculture Imagery Program imagery, verified by review of the 2016 USDA Cropland Data Layer, and then reviewed with the 2013 Undisturbed Lands (Bauman et al. 2013) layer to further evaluate potential for past disturbances.

Field Review: Pedestrian field surveys were then conducted by a qualified WEST biologist to evaluate areas identified during the desktop review as potentially suitable habitat and to confirm areas of unsuitability. To ensure a thorough habitat evaluation of each potentially suitable area, the WEST biologist conducted a walking/meandering survey throughout each grassland area. All grasslands containing characteristics of suitable habitat for each species (see below), if found, were delineated using a sub-meter Trimble GPS unit.

Suitable Habitat Definitions

Dakota Skipper

According to the USFWS *Guidance for Interagency Cooperation under Section 7(a)(2) of the Endangered Species Act for the Dakota Skipper, Dakota Skipper Critical Habitat, and Poweshiek Skipperling Critical Habitat* (USFWS 2016), DASK habitat can be categorized into two general types, Type A and Type B.

Type A habitat typically occurs in wet-mesic portions of grasslands in North Dakota, but may occur in South Dakota. The indicator plant species within Type A habitat are prairie lily (*Lilium philadelphicum*), bluebell bellflower (*Campanula rotundifolia*), and mountain death camas/smooth camas (*Zigadenus elegans*) along with the host plants of native grasses such as little bluestem (*Schizachyrium scoparium*).

Type B habitat, which is more prevalent in South Dakota, includes native grass host plant species such as prairie dropseed (*Sporobolus heterolepis*), little bluestem, and sideoats grama (*Bouteloua curtipendula*) along with a high diversity and abundance of native flowering plants for nectar. The native forbs typical of Type B habitats include purple coneflower (*Echinacea purpurea*), purple prairie clover (*Dalea purpurea*), white prairie clover (*D. candida*), yellow sundrops (*Calylophus serrulatus*), prairie groundsel (*Packera plattensis*), groundplum milkvetch (*Astragalus crassicarpus*), eastern pasqueflower (*Pulsatilla patens*), old man's whiskers (prairie smoke, *Geum triflorum*), western silver aster (*Symphyotrichum sericeum*), dotted blazing star (*Liatris punctata*), tall blazing star (*L. aspera*), meadow zizia/heartleaf golden alexanders (*Zizia aptera*), blanket flower (*Gaillardia sp*.), prairie sagewort (*Artemisia frigida*), and leadplant (*Amorpha canescens*). Of these, purple coneflower is often one of the main forb species.

Poweshiek Skipperling

POSK habitat types are similar to the Type A DASK habitat in that they constitute a high diversity of native grasses and forbs in a more wet-mesic setting (USFWS 2016). Typical flowering plants include purple coneflower, black-eyed susan (*Rudbeckia hirta*), and palespike lobelia (*Lobelia spicata*). Native grass species that are indicators of potential POSK habitat include little bluestem, prairie dropseed, and slender spike rush (*Eleocharis elliptica*). There are no known current populations of POSK in South Dakota.

For field investigations of each habitat type, low densities of scattered individuals of characteristic plants were not deemed to be potential habitat

RESULTS

A total of 8,042.7 acres (4,760.6 acres in 2016 and 3,282.1 acres in 2017) of potentially untilled grassland were identified as warranting field evaluation (Figure 3). Field evaluations of these areas were completed between June 12-June 14, 2016 and June 16-June 19, 2017.

Most grasslands were found to be dominated by cool-season invasive grasses such as bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis).* Some grasslands (e.g., far northeastern half-section of Project area, south half of T120N R51W Sec. 5) were found to have more healthy populations of native grass species, but completely or nearly completely lacked the necessary native forbs for either DASK or POSK.

One 4.6 acre (1.9 hectares) area of potential Type B DASK habitat was identified within the northeast corner of the current Project boundary (Figure 3). Dakota Range I, LLC has determined that the 4.6 acres of potential DASK habitat will be completely avoided through Project design and no further assessment is needed. No other suitable habitat for DASK or POSK was identified within the Project.

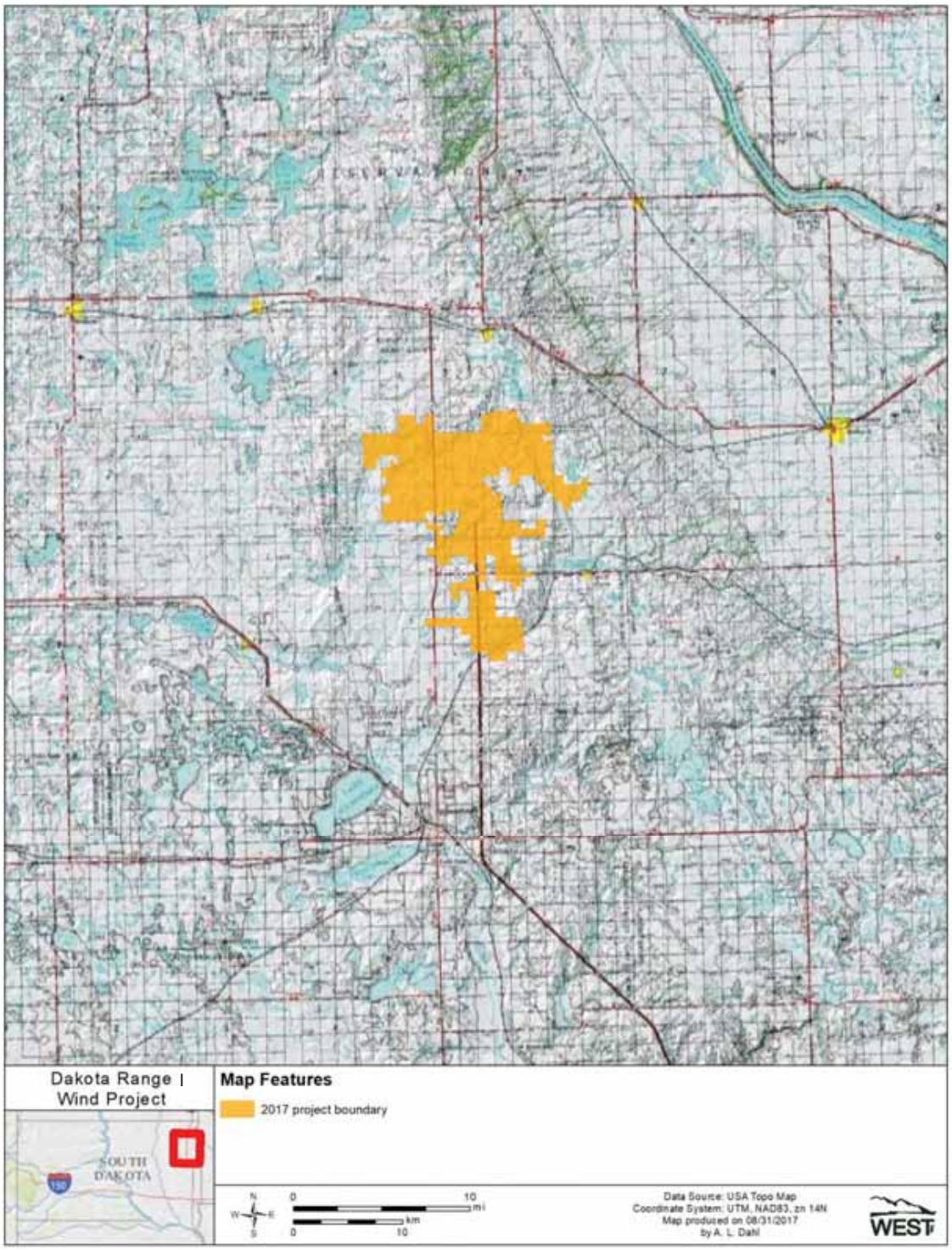

Figure 1. Location of the Dakota Range I Wind Project area in in Grant and Codington Counties, South Dakota.

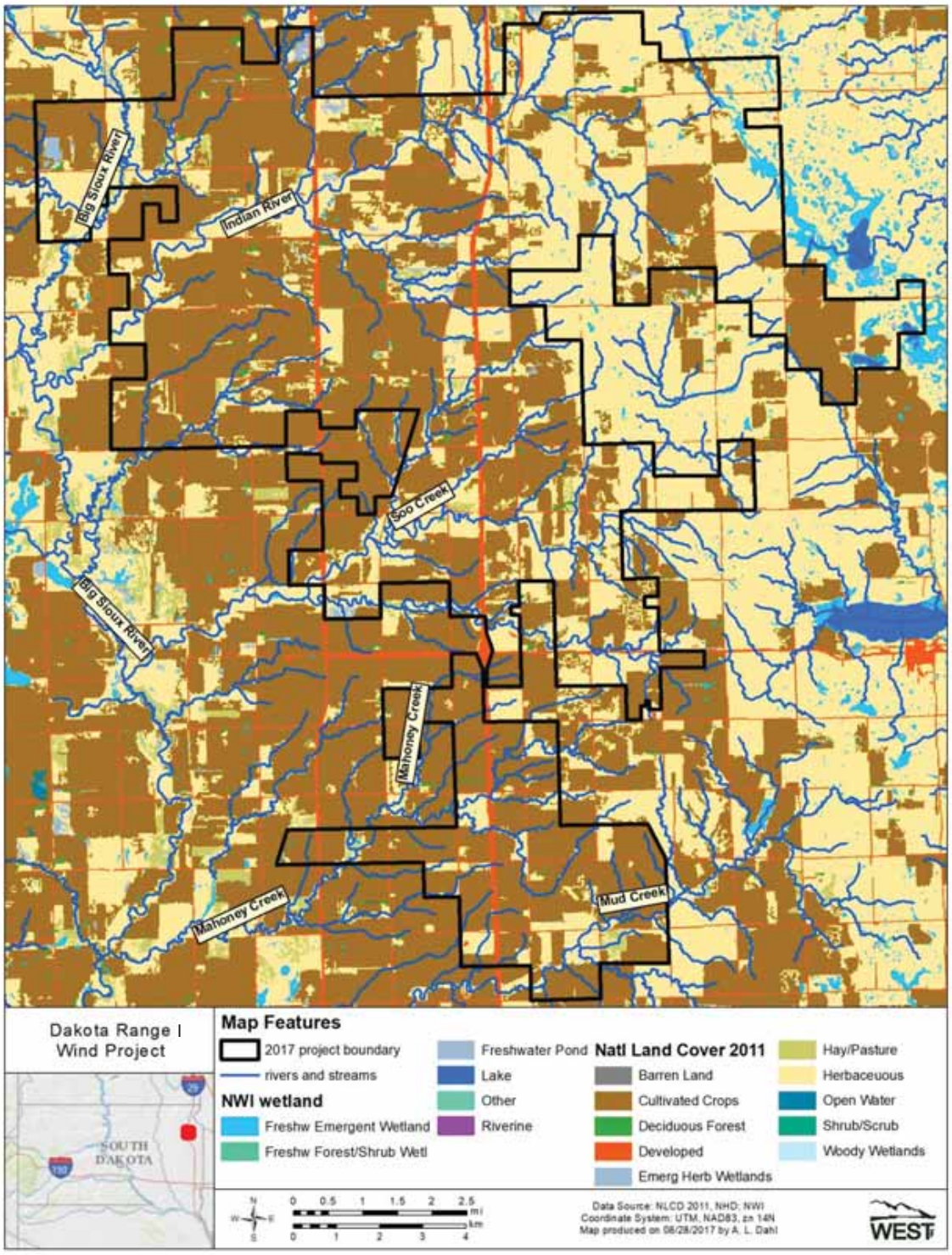

Figure 2. Land cover/use, wetlands, rivers, and streams in the Dakota Range I Wind Project area.

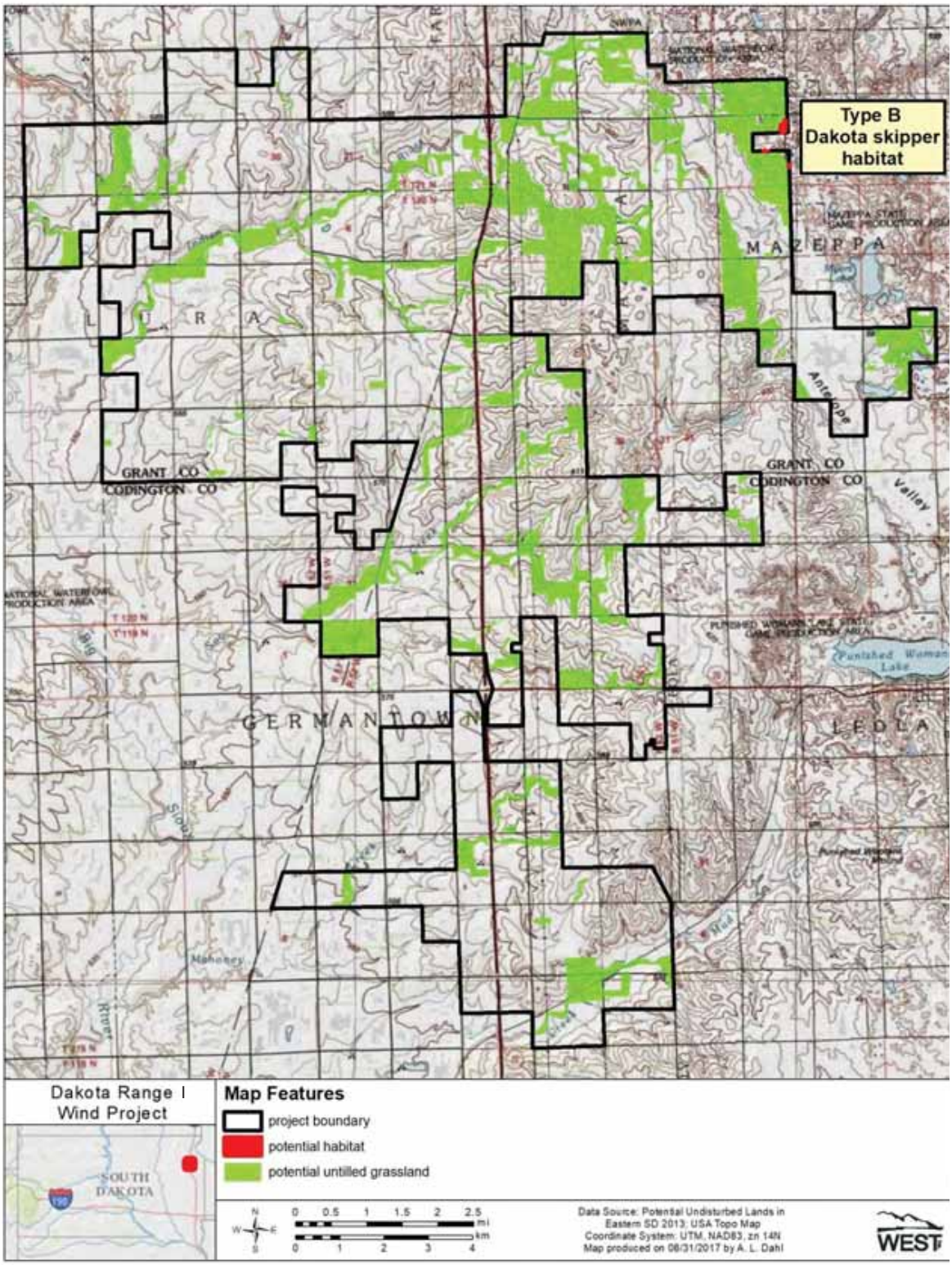

Figure 3. Potential untilled grassland areas evaluated for Dakota skipper and Poweshiek skipperling habitat and identified potential habitat within the Dakota Range I Wind Project area (2016-17).

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ENVIRONMENTAL & STATISTICAL CONSULTANTS
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May 20, 2016

Amanda Miller
Apex Clean Energy, Inc.,
244 East High Street
Charlottesville, VA 22902

RE: Dakota Range Raptor Nest Survey

Dear Ms. Miller,

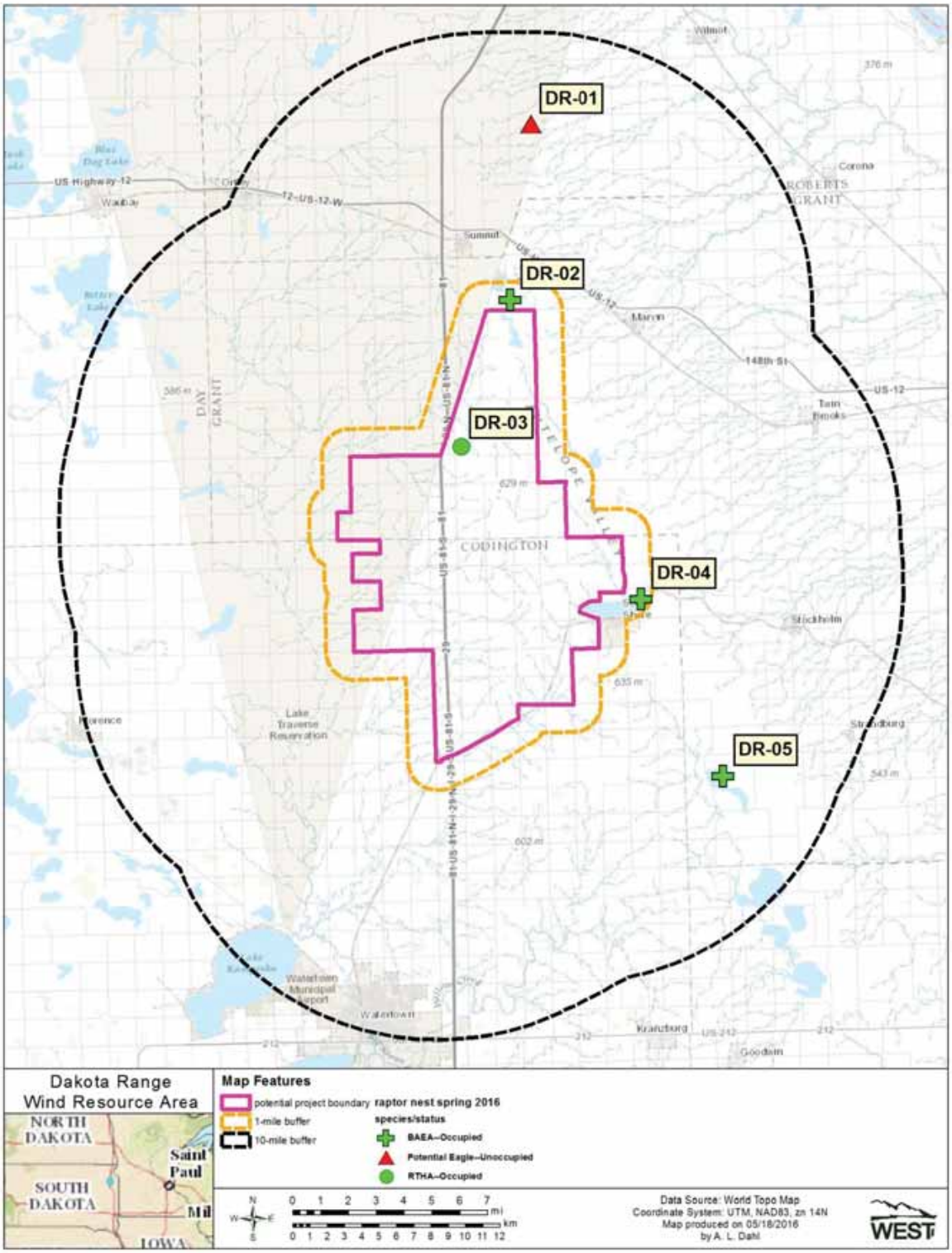
Western EcoSystems Technology, Inc. (WEST) completed the aerial nest survey for Dakota Range Wind Project (Project) on April 2, 2016.

Methods: Surveys were conducted by one qualified biologist flying low level surveys with a helicopter, in accordance with U.S. Fish and Wildlife Service and South Dakota Game, Fish and Parks Department recommendations. All potential nesting structures within the Project area and 1-mile buffer were surveyed for nesting raptor nests (e.g., eagles, buteos, owls). Only eagle nests or potential eagle nests based on size were recorded within a 1-10 mile buffer from the Project.

Results: A total of three occupied raptor nests were recorded within the Project and 1-mile buffer: one red-tailed hawk and two bald eagle nests. One occupied bald eagle nest and one unoccupied potential bald eagle nest were also identified within the 10-mile buffer (see attached map).

Sincerely,

Clayton Derby
Senior Manager


DR-01
DR-02
DR-03
DR-04
DR-05
Dakota Range
Wind Resource Area
NORTH DAKOTA
SOUTH DAKOTA
Saint Paul
IOWA
Map Features
potential project boundary
1-mile buffer
10-mile buffer
raptor nest spring 2016
species/status
BAEA--Occupied
Potential Eagle--Unoccupied
RTHA--Occupied
0 1 2 3 4 5 6 7 mi
0 1 2 3 4 5 6 7 8 9 10 11 12 km
Data Source: World Topo Map
Coordinate System: UTM, NAD83, zn 14N
Map produced on 05/18/2016
by A. L. Dahl
WEST
CODINGTON
DAY
GRANT
ROBERTS
GRANT
Lake Traverse Reservation
Watertown
Watertown Municipal Airport
Summit
Marvin
Corona
Stockholm
Strandburg
Kranzburg
Goodwin
Florence
US Highway 12
US-12
148th St
Twin Brooks

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June 6, 2016

Amanda Miller
Apex Clean Energy, Inc.,
244 East High Street
Charlottesville, VA 22902

RE: Dakota Range Lek Survey

Dear Ms. Miller,

Western EcoSystems Technology, Inc. (WEST) completed the aerial lek survey for sharp-tailed grouse and greater prairie-chickens as part of the Dakota Range Wind Project (Project) development.

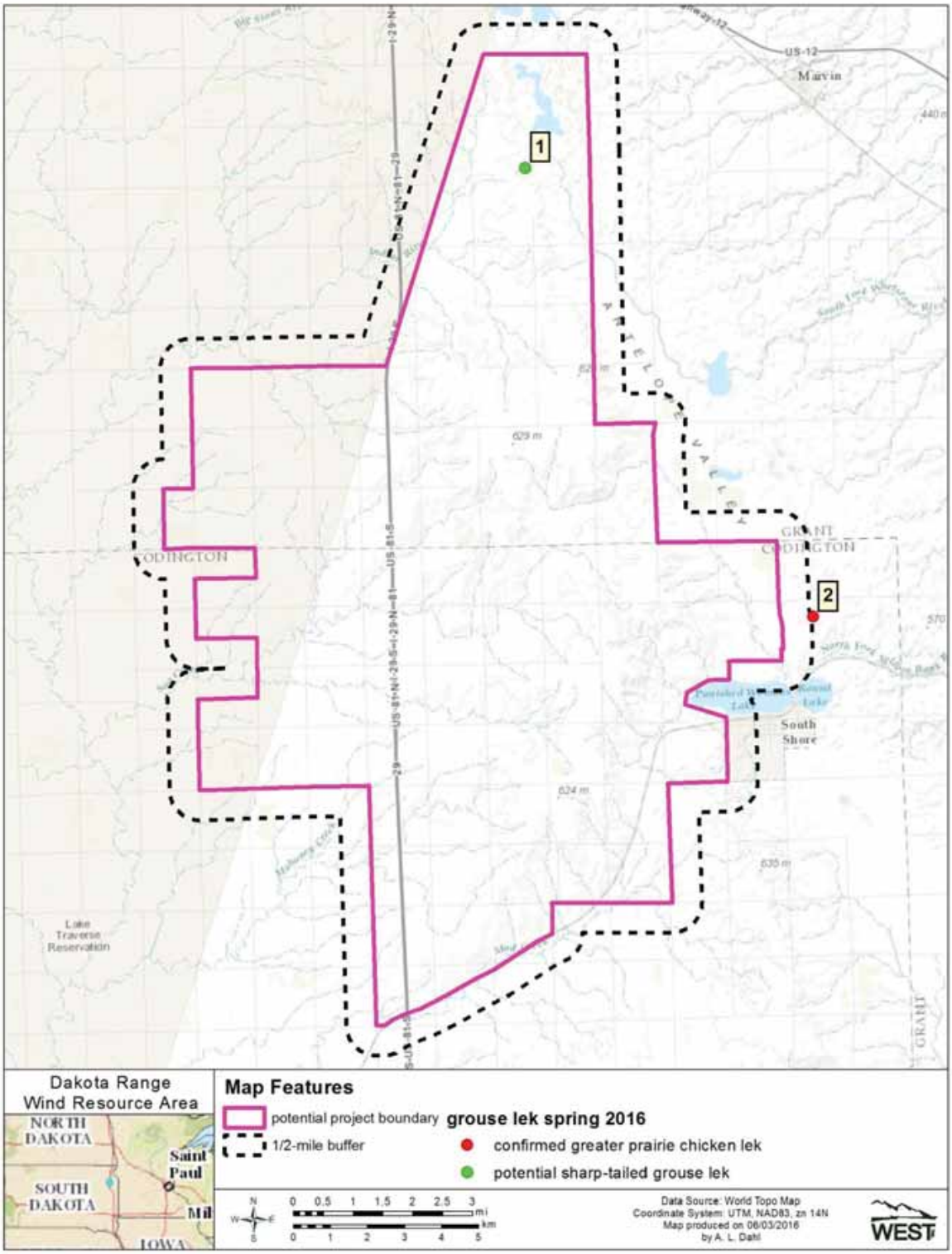
Methods: Surveys were completed by two biologists plus one pilot flying in a small (e.g., Cessna 172) fixed-wing aircraft, in accordance with U.S. Fish and Wildlife Service and South Dakota Game, Fish and Parks Department recommendations. Surveys were initiated in early April but due to weather the actual survey start was delayed until mid-April and resulted in only two of three survey rounds being completed by early May 2016. Surveys were completed between April 12 and May 5, 2016 and conducted by flying parallel north-south transects spaced 400-m apart through the entire Project and 0.5-mile buffer around the Project. Flight height was approximately 75-150 feet above ground level. Surveys were conducted when winds were below 20 mph and rain was not persistent. A potential lek was defined as a location where 3 or more birds are observed; however, leks were confirmed by repeated observations of strutting males.

Results:
A group of approximately 24 sharp-tailed grouse (STG) was observed flushing at Location 1 during the first survey; however, no birds were observed in this area during the second survey; therefore, this location was designated as a potential lek, which may be present in the vicinity.

Six male greater prairie-chicken (GPC) were observed displaying at Location 2 during both surveys, indicating this is a GPC lek location.

Sincerely,

Clayton Derby
Senior Manager


1
2
US-12
Marvin
GRANT
CODINGTON
South
Shore
Lake
Traverse
Reservation
Dakota Range
Wind Resource Area
NORTH
DAKOTA
SOUTH
DAKOTA
Saint
Paul
IOWA
Map Features
potential project boundary
1/2-mile buffer
grouse lek spring 2016
confirmed greater prairie chicken lek
potential sharp-tailed grouse lek
0 0.5 1 1.5 2 2.5 3 mi
0 1 2 3 4 5 km
Data Source: World Topo Map
Coordinate System: UTM, NAD83, zn 14N
Map produced on 06/03/2016
by A. L. Dahl
WEST

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TECHNICAL MEMORANDUM

Date: June 20, 2017

To: Jennie Geiger, Apex Clean Energy Management, LLC

From: Western EcoSystems Technology, Inc.

Subject: Dakota Range Wind Project – Raptor Nest Survey Memo

INTRODUCTION

Apex Clean Energy Management, LLC. (Apex) is developing of the Dakota Range Wind Project (Project), in Coddington and Grant Counties, South Dakota. At Apex's request, Western EcoSystems Technology, Inc. (WEST) conducted an aerial raptor nest survey to record bald eagle (*Haliaeetus leucocephalus*) nests in or within 10 miles and other raptor nests in or within 1 mile of the Project. The purpose of the raptor nest survey report is to characterize the raptor nesting community in the Project vicinity for use in risk analysis and siting of facilities. The aerial survey was conducted in accordance with the guidance provided in the U.S. Fish and Wildlife Service (USFWS) *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (ECPG; USFWS 2013), the USFWS *Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations* (Pagel et al. 2010), and by South Dakota Game, Fish and Parks Department.

PROJECT AREA

The Project, at the time of the raptor nest survey, was about 46,450 acres (18,798 hectares). The Project is located in the Northern Glaciated Plains Level III Ecoregion (U.S. Environmental Protection Agency [USEPA] 2016) with about 92% of the Project in the Big Sioux Basin Level IV Ecoregion and the remainder in the Prairie Coteau. The predominant land cover/use types within the Project include approximately 56% cultivated crops and 37% herbaceous (grassland; Figure 1). The remaining land cover/use types account for less than 5%, respectively (U.S. Geological Survey [USGS] National Land Cover Database [NLCD] 2011, Homer et al. 2015). The most common cultivated cropland in 2016 was corn (*Zea mays*) and soybeans (*Glycine max*; U.S. Department of Agriculture [USDA] National Agricultural Statistics Service [NASS] 2016). Ownership within the Project area is largely private (USGS Protected Areas Database of the United States [PADUS] 2012); however

there are five Dakota Tallgrass Prairie Wildlife Management Areas totaling about 860 acres (348 hectares) within the Project.

According to the National Wetlands Inventory (NWI; USFWS NWI 2007), about 624 acres (253 hectares) of the Project area is composed of wetlands, of which about 78% of those wetlands are classified as freshwater emergent wetlands. The next most common wetland type was freshwater pond (10% of wetlands). The Big Sioux River flows through the northwestern portion of the Project. Mahoney Creek flows through the southern portion before joining the Big Sioux River. Mud Creek is within the Project, farther south than Mahoney Creek. Soo Creek flows through the central area of the Project before joining the Big Sioux River.

METHODS

One aerial survey was conducted from an R44 helicopter between April 11-14, 2017, a period before leaf-out when raptors would be actively tending to a nest or incubating eggs. An experienced raptor ecologist and a helicopter pilot skilled in wildlife surveys conducted the survey. Raptors are defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls (Buehler 2000). Raptor nest surveys focused on locating stick nest structures in suitable raptor nesting substrate (trees, transmission lines, cliff faces, etc.) within and around the proposed Project (Figure 2). The survey within the Project boundary and 1-mile (mi; 1.6 kilometer [km]) buffer documented all potential raptor nests, including bald eagles, while the surveys out to the 10-mi (16.1 km) buffer focused only on identifying potential bald eagle nests.

In general, all potential bald eagle and raptor nest habitat was surveyed by flying meandering transects between 0.25 and 1.0 mi (0.8 and 1.6 km) apart, flying at speeds of approximately 46 miles per hour (mph; 74 km per hour). Surveys were typically conducted between 07:00 hours and 18:00 hours. The helicopter was positioned to allow thorough visual inspection of the habitat, and in particular, to provide a view of the tops of the tallest dominant trees where bald eagles generally prefer to nest (Buehler 2000). The locations of all potential raptor nests were recorded using a hand-held Global Positioning System. To determine the status of a nest, the biologist evaluated behavior of adults on or near the nest, and presence of eggs, young, whitewash, or fresh building materials. Attempts were made to identify the species of raptor associated with each active nest. Raptor species, nest type, nest status, nest condition, and nest substrate were recorded at each nest location to the extent possible. Efforts were made to minimize disturbance to breeding raptors and nestlings; the greatest possible distance at which the species could be identified was maintained, with distances varying depending upon nest location and wind conditions.

Terminology

Included below are descriptions of terms used during the documentation of nests (see Results section), in accordance with the USFWS Eagle Conservation Plan Guidance (ECPG; USFWS 2013).

Nest ID - WEST assigned a unique nest identification number for each nest documented.

Species - A species was assigned to each nest when possible, otherwise, it was classified as an unknown raptor nest. Nests documented as unknown raptor species are defined as any stick nest that did not have an occupant associated with it at the time of the survey. Unknown raptor nests, including old nests or nests that could become suitable for raptors, are documented in order to populate a nest database to ensure that future surveys include all potentially suitable nest sites.

Nest Condition - Nest condition was categorized as either "good" or in "disrepair". Although the determination of nest condition can be subjective and may vary between observers, it gives a general sense of when a nest or nest site may have last been used. Nests in disrepair were sloughing or sagging heavily, and they would require some level of effort to rebuild in order to be suitable for successful nesting. Nests in good condition are those that appear to have been well maintained, have a well-defined bowl shape, are not sagging or sloughing, and appear to be suitable for nesting.

Substrate - The substrate in which a nest was observed was recorded to provide observers a visual reference. Substrates can range from human-made structures (such as power lines, nest platforms, etc.) to biological and physical structures (conifer and deciduous tree species or cliff faces).

Nest Status - WEST categorizes basic nest use consistent with definitions from the ECPG. Nests were classified as occupied if any of the following were observed at the nest structure: (1) an adult in an incubating position, (2) eggs, (3) nestlings or fledglings, (4) occurrence of a pair of adults (or, sometimes, sub-adults), (5) a newly constructed or refurbished stick nest in the area where territorial behavior of a raptor had been observed early in the breeding season, or (6) a recently repaired nest with fresh sticks (clean breaks) or fresh boughs on top, and/or droppings and/or molted feathers on its rim or underneath. Occupied nests were further classified as active if there was an adult on the nest in incubating position, an egg or eggs had been laid or nestlings were observed, or inactive if no eggs or chicks were present. A nest that does not meet the above criteria for "occupied" was classified as "unoccupied".

RESULTS

Five occupied bald eagle nests were observed in 2017 (Table 1; Figure 2). Another bald eagle nest, occupied and active in 2016, was unoccupied this year. None of the nests were located within the Project or 1-mile buffer, with the nearest occupied bald eagle nest located 1.8 miles to the west of the Project area.

Fifteen occupied and 17 unoccupied non-eagle raptor nests were located within the Project and 1-mile buffer (Table 1). The occupied nests were primarily common species (11 red-tailed hawk, three great horned owl, and one unknown non-eagle raptor).

Table 1. Summary details of raptor nests observed during aerial surveys at the Dakota Range Wind Project in April 2017. The projection for the Eastings and Northings is UTM, NAD83, zone 14N, units meters.

Nest ID	Date	Species	Nest Status	Nest Condition	Nest Substrate	Easting	Northing	Comments
DR-02	4/14/2017	Bald Eagle-	Unoccupied and Inactive	Good	Tree	656683	5015346	historic nest, empty nest at present
DR-04	4/11/2017	Bald Eagle	Occupied and Active	Good	Tree	664183	4998089	incubating
DR-05	4/12/2017	Bald Eagle	Occupied and Active	Good	Tree	668982	4987799	incubating
DR-06	4/14/2017	Bald Eagle	Occupied and Active	Good	Tree	657338	5026118	adult eagle incubating, recently repaired nest with fresh sticks
DR-07	4/12/2017	Bald Eagle	Occupied and Active	Good	Tree	627065	5012621	two adults, 1 sitting on nest & 1 in nearby tree, recently repaired nest w/fresh sticks
DR-08	4/12/2017	Bald Eagle	Occupied and Active	Good	Tree	645705	4997072	incubating
DR-09	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	657228	5011325	
DR-10	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	650370	5010853	incubating
DR-11	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	647920	5010051	
DR-12	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	649315	5008179	
DR-13	4/11/2017	Great Horned Owl	Occupied and Active	Good	Tree	652161	5007756	brooding
DR-14	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	660063	5005748	incubating
DR-15	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	662673	5005132	
DR-16	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	642188	5005440	
DR-17	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Disrepair	Tree	640664	5004526	
DR-18	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	646958	5004800	incubating
DR-19	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	648079	5004596	
DR-20	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	653328	5004388	
DR-21	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	656794	5004083	incubating
DR-22	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	658226	5004311	

Table 1. Summary details of raptor nests observed during aerial surveys at the Dakota Range Wind Project in April 2017. The projection for the Eastings and Northings is UTM, NAD83, zone 14N, units meters.

Nest ID	Date	Species	Nest Status	Nest Condition	Nest Substrate	Easting	Northing	Comments
DR-23	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Disrepair	Tree	646617	5003232	2 nests at this point
DR-24	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Disrepair	Tree	644743	4999907	
DR-25	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	659675	5000201	incubating
DR-26	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	651360	4999427	
DR-27	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	652970	4998674	
DR-28	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Disrepair	Tree	656956	4998512	
DR-29	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	658719	4998526	incubating
DR-30	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	650203	4996885	incubating
DR-31	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	655736	4997111	
DR-32	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	654779	4996743	
DR-33	4/11/2017	Great Horned Owl	Occupied and Active	Good	Tree	657473	4995369	brooding
DR-34	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	656486	4993632	incubating
DR-35	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Disrepair	Tree	656753	4993641	
DR-36	4/11/2017	Great Horned Owl	Occupied and Active	Good	Tree	648722	4991537	brooding
DR-37	4/11/2017	Unknown Raptor	Occupied and Inactive	Disrepair	Tree	651712	4990376	
DR-38	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	653503	4988308	
DR-39	4/11/2017	Unknown Raptor	Unoccupied and Inactive	Good	Tree	656428	4988601	
DR-40	4/11/2017	Red-tailed Hawk	Occupied and Active	Good	Tree	654616	4987289	incubating

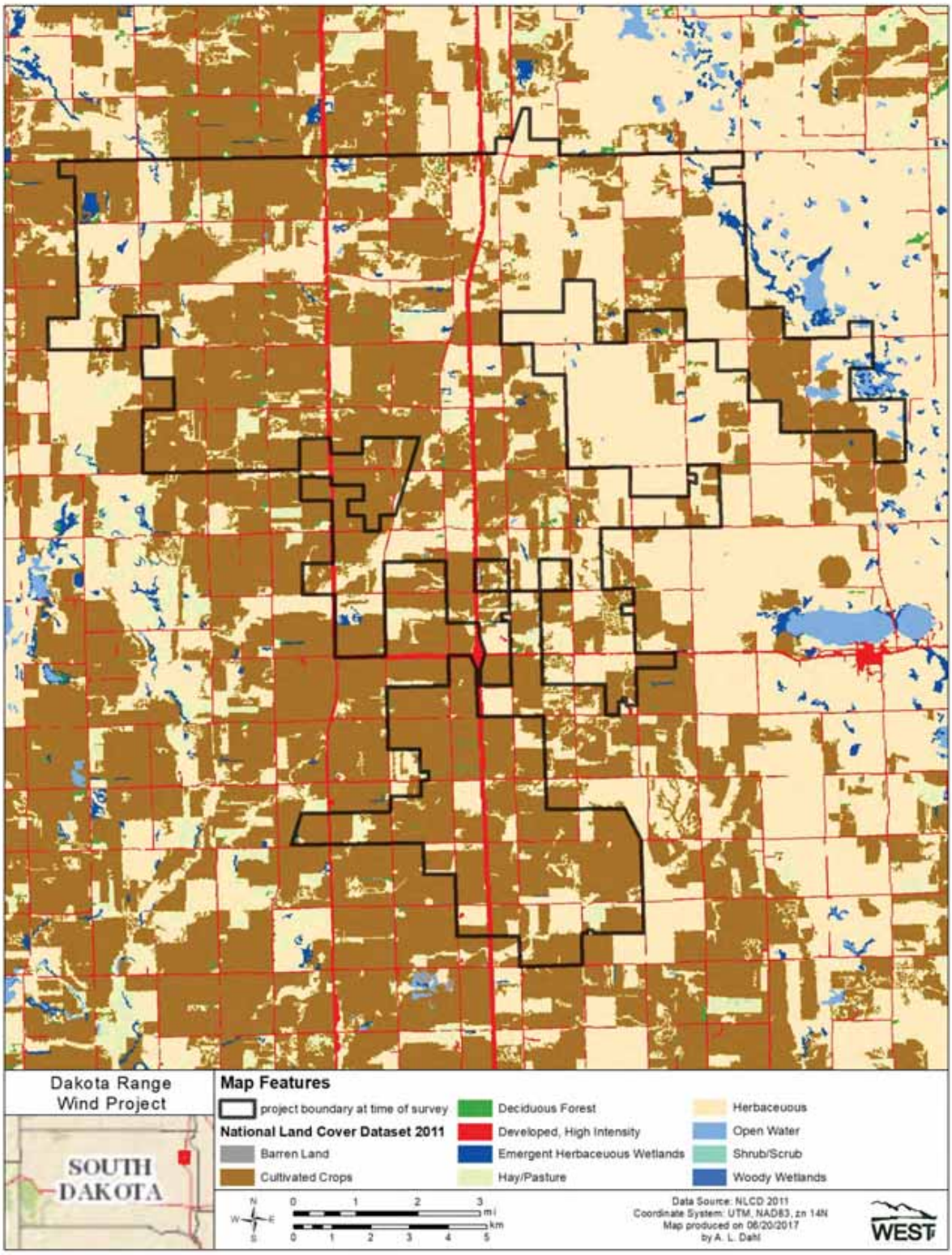

Figure 1. Land cover and use at the Dakota Range Wind Project.

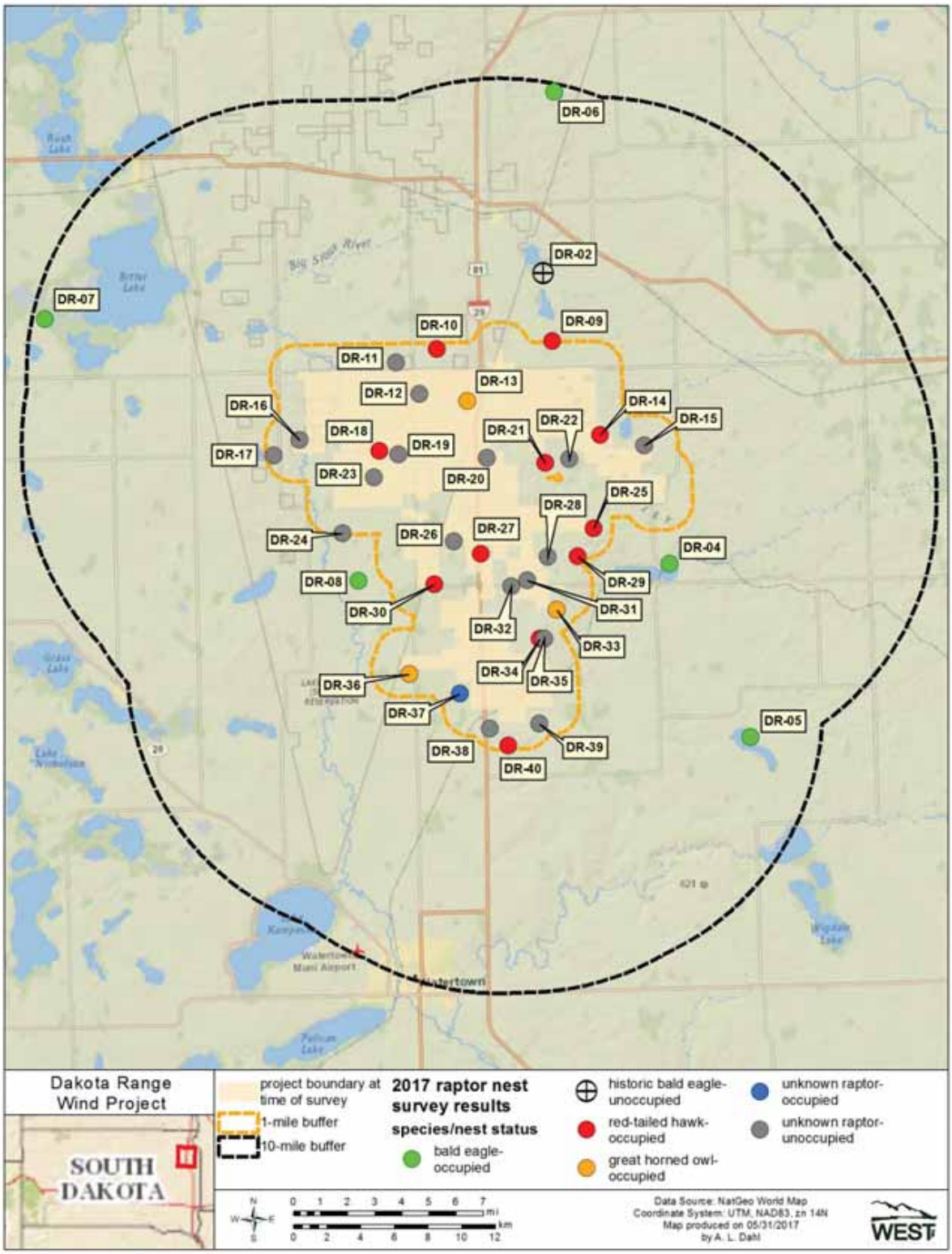

Figure 2. Raptor nests observed during aerial surveys at the Dakota Range Wind Project in April 2017.

CONCLUSIONS

Red-tailed hawks, great horned owls, and bald eagles are common raptor species that breed throughout South Dakota. Lack of bald eagle nests within the Project or within two miles of the Project minimizes potential impacts to the species.

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TECHNICAL MEMORANDUM

Date: June 28, 2017

To: Jennie Geiger, Apex Clean Energy Management, LLC

From: Western EcoSystems Technology, Inc.

Subject: Dakota Range I Wind Project – Prairie Grouse Lek Survey Memo

Introduction

In 2016, Western EcoSystems Technology, Inc. completed an aerial-based survey for sharp-tailed grouse and greater prairie-chicken leks for the Dakota Range I Wind Project (Project). The Project boundary was modified since the 2016 surveys to include additional area; therefore, the unsurveyed portion of the Project was evaluated in 2017 using a ground-based methodology. In addition, previously documented leks from 2016 were revisited to evaluate 2017 status (Figure 1).

Methods

Surveys were completed three times between April 8 and May 9, 2017, in the areas shown in Figure 1, and two times in a small portion of this area because it was added in late April. The 2017 survey area included the unsurveyed portions of the Project and a 0.5-mile buffer. Public roads were driven by a biologist from 30 minutes prior to sunrise until approximately two hours after sunrise. The biologist stopped for a minimum of five minutes approximately every half-mile (more often in hilly terrain, less in flat) to listen and look for displaying birds. If a lek was located, the observer would then map the location (to the best of their ability from the road) and record the number of males, females, and birds of unknown sex attending the lek. When possible, surveys were completed on relatively calm mornings with little to no rain. Leks documented in 2016 that were outside the 2017 survey area were also visited to evaluate 2017 status.

Leks were classified as “potential” when three or more birds were observed in one location during the morning surveys. Leks were classified as “confirmed” if the biologists observed males engaged in lek attendance behavior (e.g., dancing, calling) more than one time. Leks were classified as “historic” if they were known leks that could not be found during the surveys.

Results

One confirmed (Lek 3) and one potential (Lek 4) sharp-tailed grouse lek was documented within the 2017 survey area. Lek 4 was a potential sharp-tailed grouse lek with a maximum of seven birds (3 male, 4 unknown sex) observed during the first survey; however, no males were

exhibiting courtship behavior. Two previously documented leks (Leks 1 and 2) were not located in 2017 and classified as historic. Survey results are shown in Table 1 and Figure 2.

Lek 3 was the only confirmed lek with a maximum of 15 sharp-tailed grouse observed during the second and third survey.

Summary

Results of the 2016 and 2017 surveys indicate that both sharp-tailed grouse and greater prairie chickens are present at low density in and within 0.5 mile of the Project.

Table 1. 2017 Lek survey results (M=number of males, F=number of females, Unk=number of unknown birds, and Total=total number of birds) for the Dakota Range Wind Project.

			SURVEY 1 (4/8/17 to 4/21/17)				Survey 2 (4/22/17 to 5/4/17				Survey 3 (5/5/17 to 5/9/17)			
Lek ID	Lek Status	Species	M	F	Unk	Total	M	F	Unk	Total	M	F	Unk	Total
1	Historic	Sharp-tailed grouse	0	0	0	0	0	0	0	0	0	0	0	0
2	Historic	Greater prairie-chicken	0	0	0	0	0	0	0	0	0	0	0	0
3	Confirmed	Sharp-tailed grouse	-	-	-	-	9	2	4	15	6	unknown	2	8
4	Potential	Sharp-tailed grouse	3	0	4	7	0	0	0	0	0	0	1	1

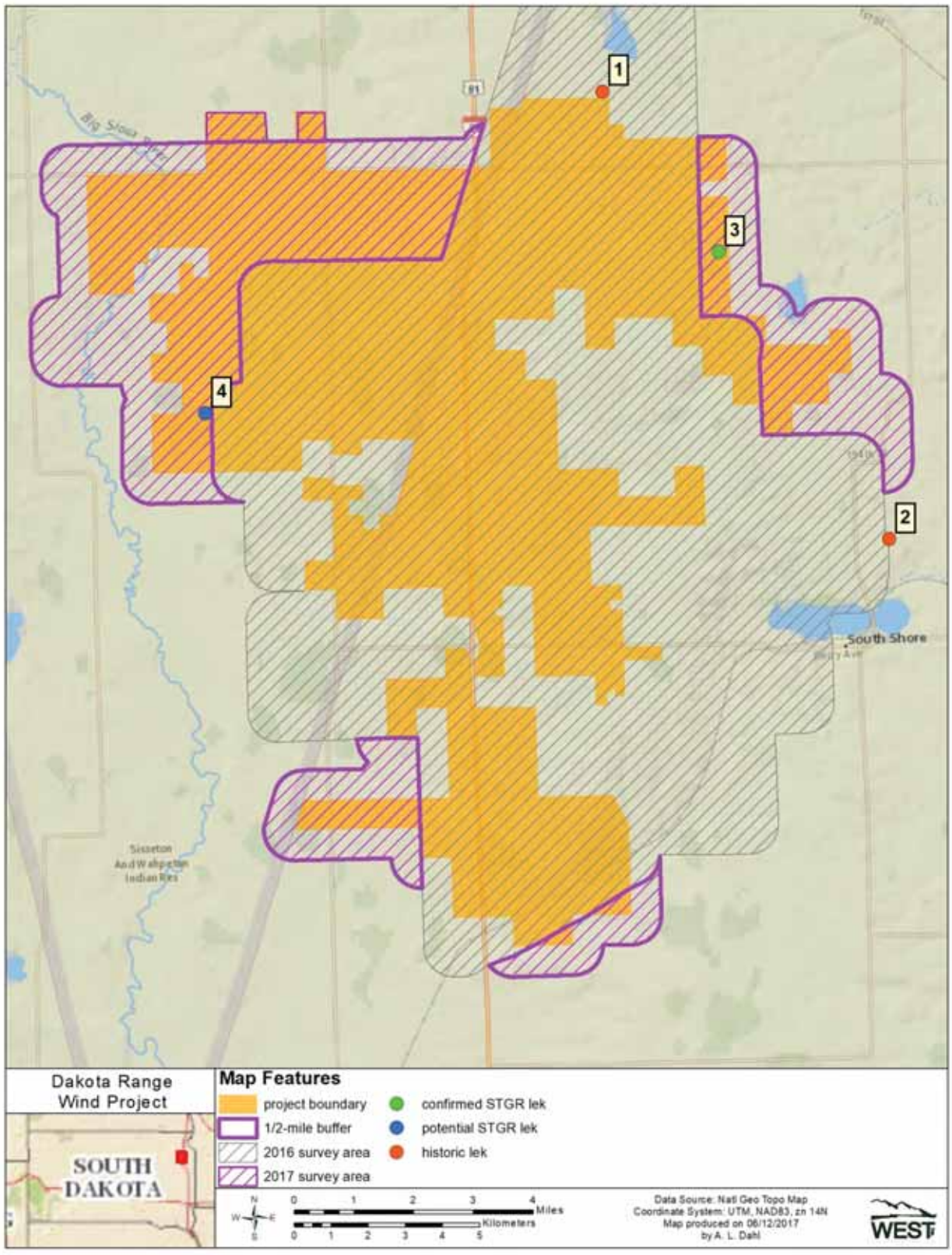

Figure 1. Location of grouse lek survey areas and lek locations for unsurveyed portions of the Dakota Range Wind Project. Surveys occurred from April 8 to May 9, 2017.

Spring 2018 Aerial Survey Report

Dakota Range Wind Farm

Grant and Codington Counties, South Dakota

Prepared for:

Xcel Energy℠

May 2018

TETRA TECH

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Appendices

1.0 Introduction

Tetra Tech, Inc. (Tetra Tech) conducted an aerial survey for eagle nests at Xcel Energy's proposed Dakota Range Wind Farm (Project) in Grant and Codington Counties, South Dakota from March 21, 2018 through March 24, 2018. The primary objective for the eagle nest survey was to inventory any bald eagle (*Haliaeetus leucocephalus*) nests within the Project footprint and a surrounding 10-mile buffer (nest survey area). Additionally, all raptor nests within the Project footprint were recorded during the survey.

Aerial surveys were previously conducted by WEST, Inc. during spring of 2016 and 2017 (WEST 2016, WEST 2017). The spring 2016 and 2017 aerial surveys recorded all raptor nests within a 1-mile buffer of the Project Area and only eagle nests within a 1 to 10-mile buffer of the Project Area. It should be noted that the Project Area boundary has changed over time.

2.0 Methods

The survey was conducted by Mike Wallgren and Greg Thompson (Tetra Tech) from a Bell-206 Jet Ranger helicopter (Double M Helicopters) that was flown between 60 - 200 feet (18 - 60 meters [m]) above ground level at an approximate speed of 50 miles per hour (80 kilometers per hour). A search for all eagle nests was conducted within the nest survey area along north-south transects spaced 1 mile apart, covering a total of 718 transect miles. When needed, transects were deviated from in order to conduct more intensive searches of areas with trees likely to support nesting eagles.

To aid in navigation and data recording, a global positioning system (Garmin 60CSx GPS) receiver using North American 1983 Datum and Universal Trans Mercator (UTM) coordinates was used. Additionally, a Project overview map, an optically stabilized digital camera, and standardized data collection forms were used to record information. Data collected within the nest survey area included all eagle nests (in-use or alternate) and any observations of eagles. Eagles observed that were not affiliated with a nest were recorded as "incidental". When a nest was found, the following data were collected:

- **Nest Identification Number:** corresponding with GPS waypoint number.
- **Raptor Species:** using 4-letter American Ornithologists' Union codes (e.g., BAEA = bald eagle, UNKN = unknown species).
- **Presence of Adults:** number of adults observed on the nest or near the nest.
- **Eggs or Young:** number of eggs or young observed.

- **Nest Substrate:** structure in which nest was located (e.g., elm tree, cut bank, transmission pole, etc.).

- **Nest Height:** in meters (m), distance from nest to ground.

Nest Activity: To assess nest activity, the following criteria were used (USFWS 2016):

- **In-use nest**: a bald or golden eagle nest characterized by the presence of one or more eggs, dependent young, or adult eagles on the nest.

- **Alternate nest:** one of potentially several nests within a nesting territory that is not an in-use nest at the current time. When there is no in-use nest, all nests in the territory are alternate nests.

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

- **Excellent:** defined cup or nest bowl with a well-maintained rim. Adult or young present.

- **Good:** nest bowl intact and rim defined; minor repair needed for nest to be used; margins of nest in loose configuration, minor slumping occurring.

- **Fair:** nest bowl intact and nest not dilapidated; but needs significant repair in order to be used; material is slumping or sliding.

- **Poor:** loose structure of nest bowl still present; nest walls and side falling out; nest is in need of major repair to be used.

- **Remnant:** nest bowl not defined; scant material remaining and not usable unless fully rebuilt.

3.0 Results

The survey was conducted from March 21, 2018 to March 24, 2018 at which time trees in the area did not have leaves enabling good visibility of nests. The weather on Wednesday, March 21 was partly cloudy (visibility approximately 10 miles) with moderate winds (10-12 mph), Thursday, March 22 was overcast (visibility approximately 10 miles) with strong winds (15-20 mph), Friday, March 23 surveys were grounded due to snow and winds, and Saturday March 24, was overcast (visibility approximately 10 miles) with strong winds (15-20 mph). The survey commenced at 1523 hours and finished at 1900 hours on Wednesday, commenced at 1500 hours and finished at 1835 hours on Thursday, and commenced at 1130 hours and finished at 1730 hours on Saturday.

Eagle Nests: No bald eagle or golden eagle nests were located within the Project footprint (Appendix A: Figure 1, Table 1). No golden eagle and seven bald eagle nests (4 in-use and 3 alternate) were located within the 10-mile buffer of the Project footprint. One of the bald eagle nests was occupied by a great-horned owl but was previously occupied by bald eagles in spring 2017 (WEST 2017). Additionally, 37 adult and 2 juvenile bald eagles, and no golden eagles, were observed incidentally during the survey. Photos of the nests are found in Appendix B.

Nests of Other Raptor Species: There were a total of two other raptor nests located within the Project footprint (Table 2, Figure 1). Both raptor nests were alternate unknown nests. Photos of the nests are found in Appendix B.

Nest Summary: The status of all raptor nests observed within the Dakota Range Wind Farm Project footprint and 10-mile buffer area during aerial surveys from April 2016 through March 2018 are included in Table 3. Bald eagle nests recorded for the Project are depicted on Figure 2 with their status over time.

Table 1. Bald eagle nests observed within the Dakota Range Wind Farm Project footprint and 10-mile buffer area, during aerial surveys in March 2018.

Nest Number	Activity	Distance from Project footprint (miles)	Adults Present	Number of Eggs/Young	Nest Substrate	Nest Height (meters)	Condition	Comments
2016-2 (DR-02)	In-use	2.3	1 adult sitting on nest; other adult perched in tree nearby.	Unknown	Deciduous Tree	25	Excellent	
2016-4 (DR-04)	In-use	3.1	1 adult sitting on nest	Unknown	Deciduous Tree	20	Excellent	
2016-5 (DR-05)	Alternate	8.8	None	None	Deciduous Tree	24	Good	
2017-1 (DR-06)	In-use	9.0	1 adult sitting on nest; other adult perched in tree nearby.	2 eggs	Deciduous Tree	22	Excellent	Adult flew from nest as helicopter approached.
2017-3 (DR-08)	Alternate	4.5	1 adult GHOW sitting on nest	Unknown	Deciduous Tree	25	Excellent	Adult GHOW observed sitting on nest. Nest was large enough to be a bald eagle nest and was previously occupied by bald eagles in spring 2017[1].
2018-1	Alternate	9.6	None	None	Deciduous Tree	20	Good	
2018-2	In-use	7.2	1 adult sitting on nest; other adult perched in tree nearby.	Unknown	Deciduous Tree	22	Excellent	

[1]WEST, 2017 – Nest Number in (parenthesis) is former WEST Nest ID

Table 2. Other raptor nests observed within the Dakota Range Wind Farm Project footprint during aerial surveys in March 2018.

Nest Number	Species	Activity	Distance from Project footprint (miles)	Adults Present	Number of Eggs/Young	Nest Substrate	Nest Height (meters)	Condition	Comments
2017-15 (DR-20)	UNKN	Alternate	Within	None	None	Deciduous Tree	20	Good	
2018-3	UNKN	Alternate	Within	None	None	Deciduous Tree	15	Fair	

Table 3. Status of all raptor nests observed within the Dakota Range Wind Farm Project footprint and 10-mile buffer area during aerial surveys from April 2016 through March 2018.

Nest Number	Species	Nest Status[1]		
		April 2016	April 2017	March 2018
2016-1 (DR-01)	UNKN	Unoccupied	Not Found	Not Surveyed
2016-2 (DR-02)	BAEA	Occupied Active	Unoccupied	In-use
2016-3 (DR-03)	RTHA	Occupied Active	Not Found	N/A
2016-4 (DR-04)	BAEA	Occupied Active	Occupied Active	In-use
2016-5 (DR-05)	BAEA	Occupied Active	Occupied Active	Alternate
2017-1 (DR-06)	BAEA	N/A	Occupied Active	In-use
2017-2 (DR-07)	BAEA	N/A	Occupied Active	Not Surveyed
2017-3 (DR-08)	BAEA	N/A	Occupied Active	Alternate
2017-4 (DR-09)	RTHA	N/A	Occupied Active	Not Surveyed
2017-5 (DR-10)	RTHA	N/A	Occupied Active	Not Surveyed
2017-6 (DR-11)	UNKN	N/A	Unoccupied	Not Surveyed
2017-7 (DR-12)	UNKN	N/A	Unoccupied	Not Found
2017-8 (DR-13)	GHOW	N/A	Occupied Active	Not Found
2017-9 (DR-14)	RTHA	N/A	Occupied Active	Not Surveyed
2017-10 (DR-15)	UNKN	N/A	Unoccupied	Not Found
2017-11 (DR-16)	UNKN	N/A	Unoccupied	Not Surveyed
2017-12 (DR-17)	UNKN	N/A	Unoccupied	Not Surveyed
2017-13 (DR-18)	RTHA	N/A	Occupied Active	Not Surveyed
2017-14 (DR-19)	UNKN	N/A	Unoccupied	Not Surveyed

Nest Number	Species	Nest Status[1]		
2017-15 (DR-20)	UNKN	N/A	Unoccupied	Alternate
2017-16 (DR-21)	RTHA	N/A	Occupied Active	Not Surveyed
2017-17 (DR-22)	UNKN	N/A	Unoccupied	Not Surveyed
2017-18 (DR-23)	UNKN	N/A	Unoccupied	Not Surveyed
2017-19 (DR-24)	UNKN	N/A	Unoccupied	Not Surveyed
2017-20 (DR-25)	RTHA	N/A	Occupied Active	Not Found
2017-21 (DR-26)	UNKN	N/A	Unoccupied	Not Surveyed
2017-22 (DR-27)	RTHA	N/A	Occupied Active	Not Surveyed
2017-23 (DR-28)	UNKN	N/A	Unoccupied	Not Surveyed
2017-24 (DR-29)	RTHA	N/A	Occupied Active	Not Surveyed
2017-25 (DR-30)	RTHA	N/A	Occupied Active	Not Surveyed
2017-26 (DR-31)	UNKN	N/A	Unoccupied	Not Found
2017-27 (DR-32)	UNKN	N/A	Unoccupied	Not Found
2017-28 (DR-33)	GHOW	N/A	Occupied Active	Not Surveyed
2017-29 (DR-34)	RTHA	N/A	Occupied Active	Not Surveyed
2017-30 (DR-35)	UNKN	N/A	Unoccupied	Not Surveyed
2017-31 (DR-36)	GHOW	N/A	Occupied Active	Not Surveyed
2017-32 (DR-37)	UNKN	N/A	Occupied Inactive	Not Surveyed
2017-33 (DR-38)	UNKN	N/A	Unoccupied	Not Surveyed
2017-34 (DR-39)	UNKN	N/A	Unoccupied	Not Surveyed
2017-35 (DR-40)	RTHA	N/A	Occupied Active	Not Surveyed

Nest Number	Species	Nest Status[1]		
2018-1	BAEA	N/A	N/A	Alternate
2018-2	BAEA	N/A	N/A	In-use
2018-3	UNKN	N/A	N/A	Alternate

[1]Nest status: "Not surveyed" raptor nests indicate that these nests were not within the area surveyed for nests. "N/A" indicates not applicable

Note: Final rule (USFWS 2016) changed nest activity criteria to in-use or alternate. All nest activity for nests surveyed before 2017 were categorized as occupied active, occupied inactive, or unoccupied. Occupied active correlates to in-use and occupied inactive and unoccupied correlate to alternate.

4.0 Literature Cited

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APPENDIX A

FIGURES

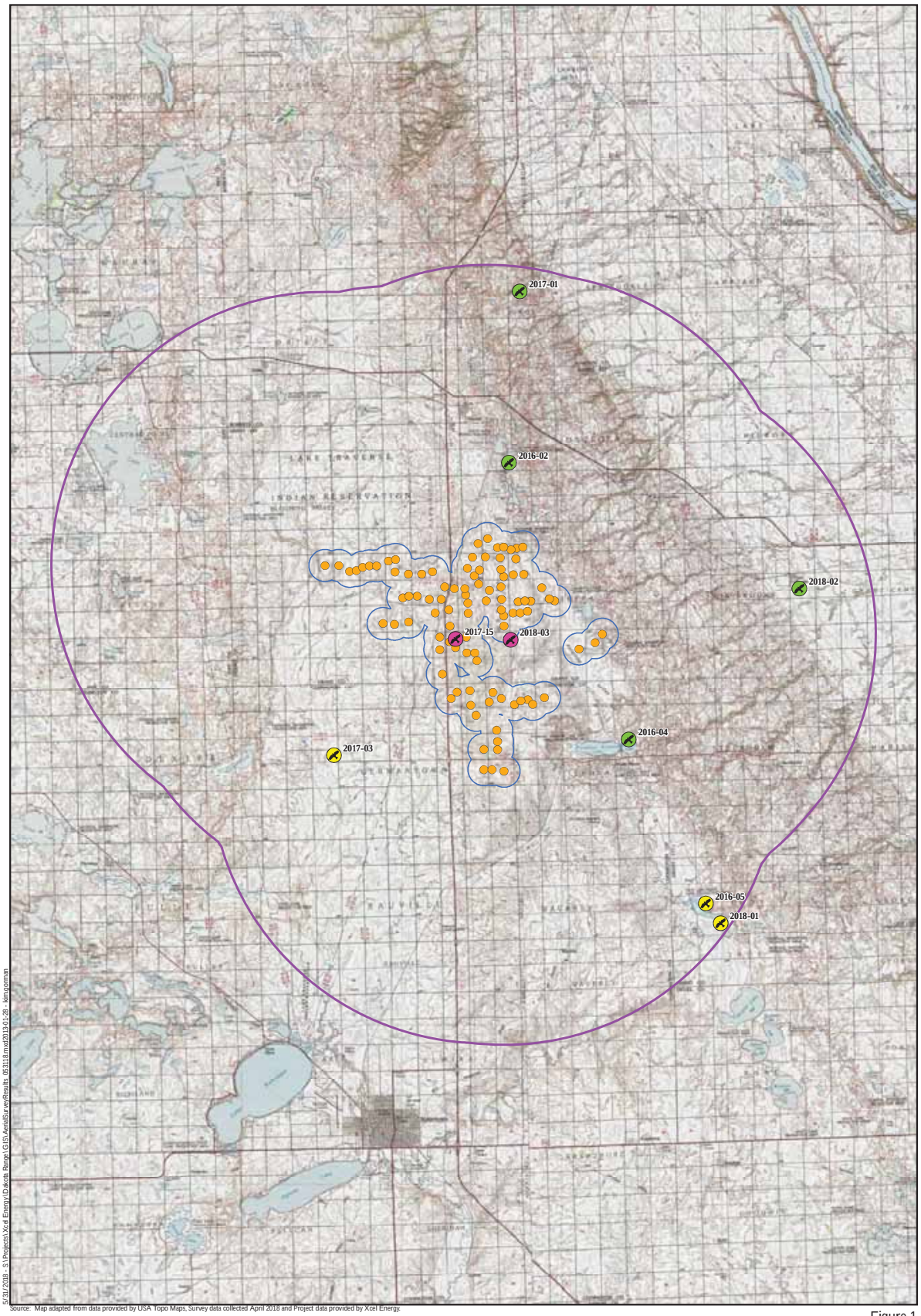
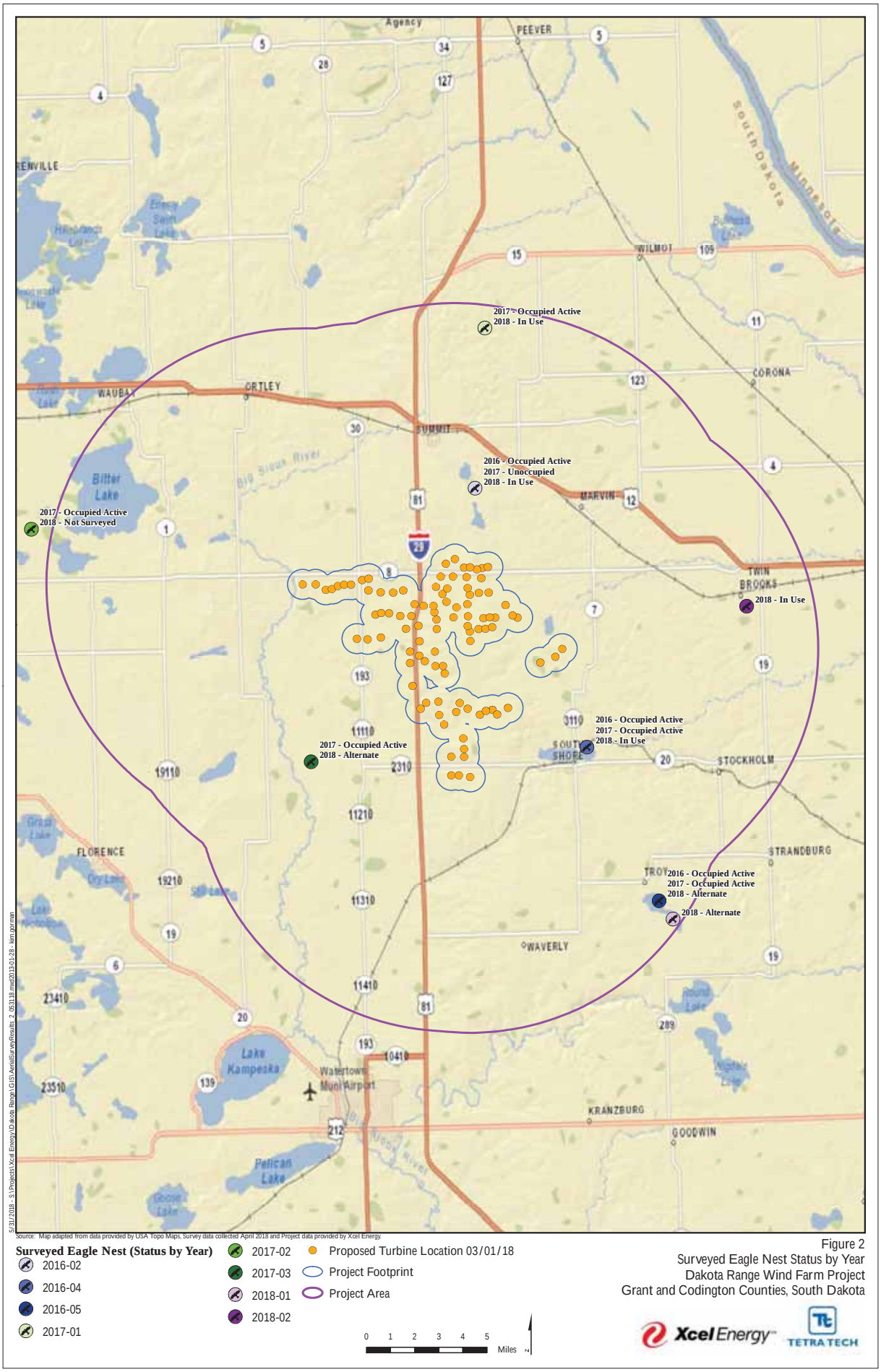


Figure 1
Spring 2018 Aerial Nest Survey
Dakota Range Wind Farm Project
Grant and Codington Counties, South Dakota



Source: Map adapted from data provided by USA Topo Maps, Survey data collected April 2018 and Project data provided by Xcel Energy.

Surveyed Eagle Nest (Status by Year)

- 2016-02
- 2016-04
- 2016-05
- 2017-01
- 2017-02
- 2017-03
- 2018-01
- 2018-02

- Proposed Turbine Location 03/01/18
- Project Footprint
- Project Area

0 1 2 3 4 5 Miles

Figure 2
Surveyed Eagle Nest Status by Year
Dakota Range Wind Farm Project
Grant and Codington Counties, South Dakota

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APPENDIX B

SITE PHOTOGRAPHS

Nest 2016-2: In-use bald eagle nest located approximately 2.3 miles north of the Project footprint. One adult bald eagle was observed sitting on the nest and other adult was observed perched in a tree nearby.

Nest 2016-4: In-use bald eagle nest located approximately 3.1 miles east of the Project footprint. One adult bald eagle was observed sitting on the nest.

Nest 2016-5: Alternate bald eagle nest located approximately 8.8 miles southeast of the Project footprint. Nest was empty and no adults were observed in the vicinity of the nest.

Nest 2017-1: In-use bald eagle nest located approximately 9 miles north of the Project footprint. One adult bald eagle flew from the nest and the nest contained two eggs.

Nest 2017-3: Alternate bald eagle nest located approximately 4.5 miles west of the Project footprint. One adult great-horned owl was observed sitting on the nest.

Nest 2018-1: Alternate bald eagle nest located approximately 9.6 miles southeast of the Project footprint. Nest was empty and no adults were observed in the vicinity of the nest.

Nest 2018-2: In-use bald eagle nest located approximately 7.2 miles east of the Project footprint. One adult bald eagle was observed sitting on the nest and other adult was observed perched in a tree nearby.

Nest 2017-15: Alternate raptor nest located within the Project footprint. Nest was empty and no raptors were observed in the vicinity of the nest.

Nest 2018-3: Alternate raptor nest located within the Project footprint. Nest was empty and no raptors were observed in the vicinity of the nest.

Xcel Energy®

2018 – 2019 Eagle Use Survey Report Dakota Range Wind Farm

TETRA TECH

January 10, 2020

2018 – 2019 Eagle Use Survey Report
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

January 10, 2020

PRESENTED TO

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
BGEPA	Bald and Golden Eagle Protection Act
ECP	Eagle Conservation Plan
GIS	Geographic Information Systems
MBTA	Migratory Bird Treaty Act
Project	Dakota Range
USFWS	United States Fish and Wildlife Service
WEG	Wind Energy Guidelines
Xcel	Xcel Energy

1.0 INTRODUCTION

Tetra Tech, Inc. (Tetra Tech) was contracted by Xcel Energy (Xcel) to conduct two years of eagle use surveys at the Dakota Range Wind Farm (Project) which is currently being developed in Grant and Codington counties, South Dakota. This report summarizes the surveys the objectives of which were to estimate the seasonal, spatial, and temporal use of the Project footprint (proposed turbine layout dated March 7, 2018 plus a 1-kilometer buffer) by bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*). Tetra Tech used standardized protocols for these surveys that were designed to be responsive to the level of effort recommended in Tier 3 of the voluntary U.S. Fish and Wildlife Service (USFWS) *Land-Based Wind Energy Guidelines* (WEG; USFWS 2012), Stage 2 of the *Eagle Conservation Plan Guidance, Module 1—Land-based Wind Energy Guidelines: Version 2* (ECP Guidance; USFWS 2013), and the 2016 Eagle Rule Revision (USFWS 2016). Bald eagles and golden eagles are protected under the federal Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA).

1.1 EAGLES AND WIND ENERGY

Bald eagles as well as golden eagles may occur in South Dakota as breeders, winter residents, migrants, or year-round residents (Buehler 2000, Kochert et al. 2002). The nesting period for both species range between January with nest building or maintenance and ends when the young fledge, in which can be as late as August (USFWS 2014). Bald eagles often gather in large numbers near open water areas where fish and other prey are abundant. Wintering bald eagles can be found roosting up to 20 miles from foraging sites depending on abundance of prey (Buehler 2000). Bald eagles are opportunistic foragers that prey primarily on fish but also feed on other aquatic and terrestrial vertebrates as well as on carrion (Buehler 2000). Golden eagles prey mainly on small to medium-sized mammals including hares, rabbits, ground squirrels, prairie dogs, and marmots (Kochert et al. 2002). Eagle fatalities resulting from collisions with wind turbines have been documented at wind energy projects and, in general, eagle use prior to construction was higher at projects that eventually reported eagle fatalities compared to projects with no eagle fatalities (USFWS 2012, Allison 2012). Both bald and golden eagles have been killed at wind farms, with the number of golden eagle fatalities exceeding bald eagles (Pagel et al. 2013).

1.2 PROJECT DESCRIPTION

The Project is located approximately 12 miles north of the city of Watertown in Grant and Codington counties, South Dakota. The Project footprint includes 28,873 acres of land (Figure 1) and was based on a proposed turbine layout (March 7, 2018) that contains 97 turbine locations. The land cover within the Project footprint observed during eagle surveys consisted primarily of grasslands, agricultural lands used for grain crops, developed land (farmsteads), and wetlands. A mix of deciduous trees planted for windbreaks surround most farmsteads within the Project footprint. Topography in the Project footprint is generally flat, and the vegetation cover is uniformly low.

2.0 METHODS

In order to meet the requirements of ECP Guidance (USFWS 2013), Tetra Tech surveyed 30.5 percent of the Project footprint (proposed turbine layout dated March 6, 2018 plus a 1-kilometer buffer). Eagle use surveys were conducted once per month from March 19, 2018 through November 21, 2018 and March 22, 2019 through November 27, 2019 at 18 survey locations distributed throughout the Project footprint (Figure 1). These dates were chosen to account for the Spring (3/15-6/14), Summer (6/15-8/15), and Fall (8/16-11/15) seasons. Each survey location consisted of an 800 meter radius circular plot, around a point located along a publicly accessible road. Surveys were conducted throughout daylight hours, with the order of the survey schedule varying between visits so that each survey location was surveyed at all periods of the day during the year. Surveys were conducted for 60 minutes at each location for a total of 324 hours.

During each eagle use survey, the biologist continuously scanned the surrounding landscape for eagle activity using an unlimited viewshed within the 800-meter radius circular plot. For each eagle observed, the biologist recorded the species, age class (adult, juvenile, or unknown), time first and last observed, minimum and maximum flight heights, and flight behavior. Based on the ECP Guidance, all eagle flights were recorded as one of two height categories (less than or equal to 200-meters and greater than 200-meters above ground). The time an observed eagle spent flying within the 800-meter radius at each of these height categories was recorded and rounded up, in 1-minute intervals. In accordance with the ECP Guidance, eagle minutes were defined as the number of minutes that an eagle was observed flying at or below 200-meters within the 800-meter-radius circular plot. Flight paths were drawn for each eagle within the viewshed on an aerial map of the survey radius and later digitized into geographic information system (GIS) software.

All bald eagle and golden eagle sightings that were observed incidentally in, or near the Project footprint (such as when a biologist was traveling between observation points) were noted but no flight paths were recorded. Incidental observations were not recorded as eagle minutes.

3.0 RESULTS

3.1 GOLDEN EAGLE ACTIVITY

No golden eagles were observed either incidentally or during the surveys.

3.2 BALD EAGLE ACTIVITY

During the 2018-2019 eagle use surveys, two bald eagles were observed; one adult bald eagle at point count location 8 and another adult bald eagle at point count location 13 (Figure 1 - 3). Both bald eagles were observed during survey period 1 (March 19-21, 2018), below 200 meters and within the 800-meter radius of the point count locations accounting for a total of three bald eagle minutes. No bald eagles were observed incidentally (Table 3-1 and 3-2).

Table 3-1. Bald eagles observed within the 800-meter radius circular plots during eagle use surveys at Dakota Range Wind Farm, March 19, 2018 to November 21, 2018, and March 22, 2019 to November 27, 2019.

Survey Visit	Dates	Length of Surveys (Hours)	Number of bald eagles within 800 meters of observation location	Minutes of bald eagle flight within 800 meters of observation location		Incidental
				Below 200 meters	Above 200 meters	
1	3/19 – 3/21, 2018	18	2	3	0	0
2	4/16 – 4/18, 2018	18	0	0	0	0
3	5/14 – 5/16, 2018	18	0	0	0	0
4	6/11 – 6/12, 2018	18	0	0	0	0
5	7/16 – 7/17, 2018	18	0	0	0	0
6	8/27 – 8/29, 2018	18	0	0	0	0
7	9/17 – 9/19, 2018	18	0	0	0	0
8	10/15 – 10/17, 2018	18	0	0	0	0
9	11/19 – 11/21, 2018	18	0	0	0	0
10	3/22 – 3/23, 2019	18	0	0	0	0
11	4/26 – 4/28, 2019	18	0	0	0	0
12	5/28 - 5/30, 2019	18	0	0	0	0
13	6/24 - 6/26, 2019	18	0	0	0	0
14	7/22 – 7/24, 2019	18	0	0	0	0
15	8/28 – 8/30, 2019	18	0	0	0	0
16	9/24 – 9/26, 2019	18	0	0	0	0
17	10/23 – 10/25, 2019	18	0	0	0	0
18	11/25 – 11/27, 2019	18	0	0	0	0
TOTAL	**NA**	**324**	**2**	**3**	**0**	**0**

Table 3-2. Number of observations of bald eagles and golden eagles flying at or below 200-meters within the 800-meter-radius circular plot by point count location at the Dakota Range Wind Farm, March 19, 2018 to November 21, 2018, and March 12, 2019 to November 27, 2019.

Point Count Location	Eagles Observed		Eagle Minutes	
	Bald Eagle	Golden Eagle	Bald Eagle	Golden Eagle
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
6	0	0	0	0
7	0	0	0	0
8	1	0	2	0
9	0	0	0	0
10	0	0	0	0
11	0	0	0	0
12	0	0	0	0
13	1	0	1	0
14	0	0	0	0
15	0	0	0	0
16	0	0	0	0
17	0	0	0	0
18	0	0	0	0
TOTAL	**2**	**0**	**3**	**0**

4.0 DISCUSSION

Only two adult bald eagles, and no golden eagles, were observed during 324 hours of surveys over two years which indicates a low use of the Project footprint during the spring, summer and fall seasons. However, spring aerial surveys (Tetra Tech 2019), recorded seven bald eagle nests within 10-miles of the Project footprint. None of these

nests were recorded within the Project footprint. Some of these nests have been active since at least 2016, and since bald eagles use the same breeding territory, and often the same nest, for many years (Buehler et al 2000) it is reasonable to assume that bald eagles will continue to use these breeding areas into the future. The Project footprint surveyed in this study is mostly agriculture and contains very few bodies of water which would attract bald eagles, which may explain the very low eagle use recorded at the Project. However, land use changes in the future which result in prey availability, nesting, or roosting site availability could increase the risk of bald eagles using the Project.

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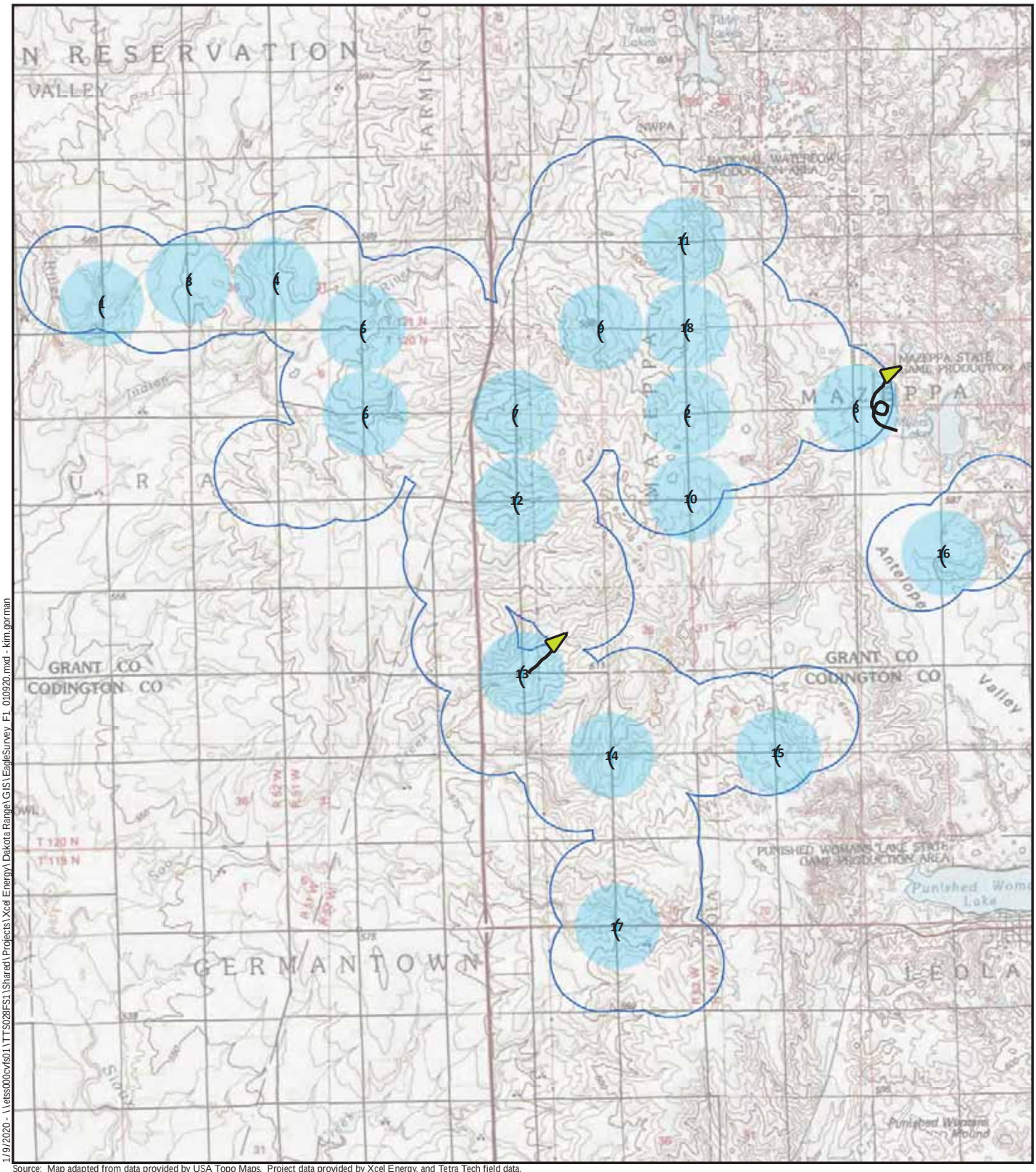

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Source: Map adapted from data provided by USA Topo Maps, Project data provided by Xcel Energy, and Tetra Tech field data.

Bald Eagle Flight Paths Below 200 Meters
Point Count Location
Point Count Buffer - 800 Meters
Project Footprint (1km Turbine Buffer)

0 1 2 3 Miles

Figure 1: Bald Eagle Flight Paths
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

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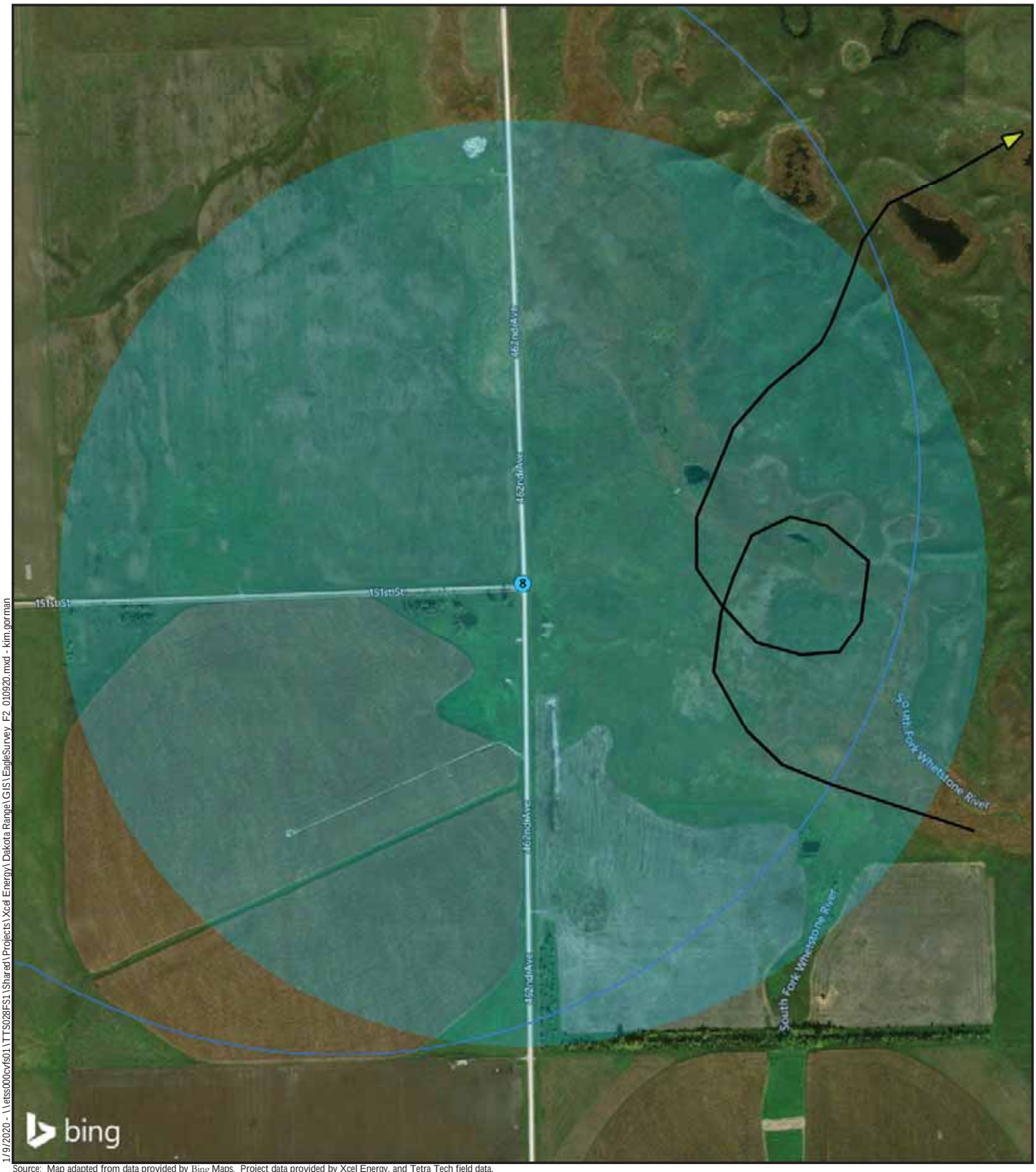

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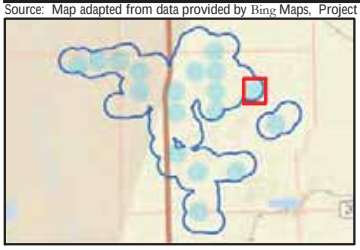

Bald Eagle Flight Paths Below 200 Meters
Point Count Location
Point Count Buffer - 800 Meters
Project Footprint (1km Turbine Buffer)

0 100 200 300 Meters

Figure 2: Eagle Flight Path at Point Count Location 8
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

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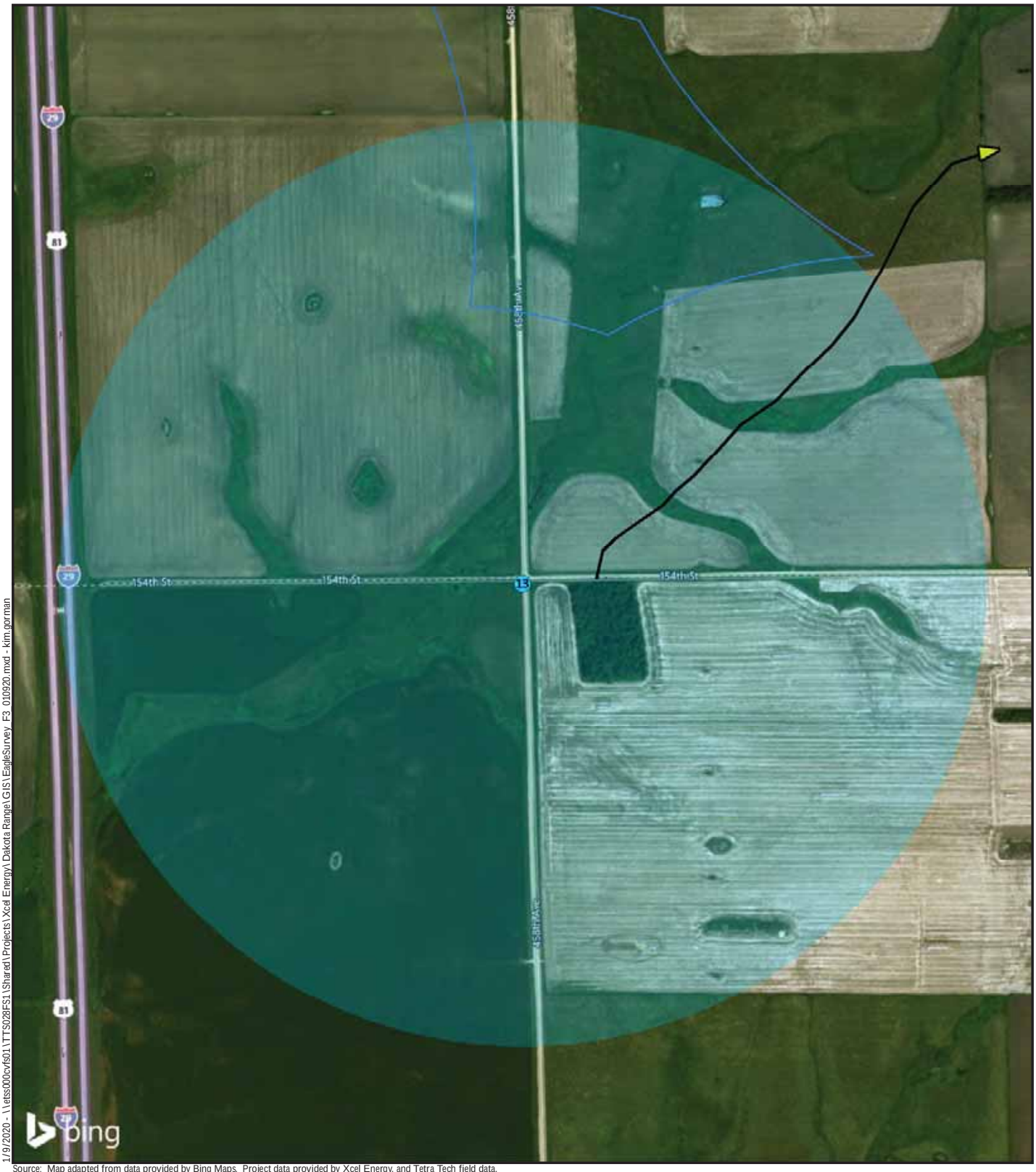

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Source: Map adapted from data provided by Bing Maps, Project data provided by Xcel Energy, and Tetra Tech field data.

Bald Eagle Flight Path Below 200 Meters
Point Count Location
Point Count Buffer - 800 Meters
Project Footprint (1km Turbine Buffer)

0 100 200 300 Meters

Figure 3: Eagle Flight Path at Point Count Location 13
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

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2018 Fall Avian Survey Report

Dakota Range Wind Farm

Grant and Codington County, South Dakota

December 7, 2018

PRESENTED TO

Xcel Energy
414 Nicollet Avenue
Minneapolis, Minnesota 55401

PRESENTED BY

Tetra Tech
2001 Killebrew Drive, Suite 141
Bloomington, Minnesota 55425

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APPENDICES

1.0 INTRODUCTION

Xcel Energy (Xcel) is proposing to construct the Dakota Range Wind Farm (Project) in Grant and Codington counties, South Dakota. The Project is located approximately 12 miles north of Watertown, South Dakota (Appendix A: Figure 1) and is anticipated to be up to 302.4 megawatt (MW) in size and will include up to 72 turbines located within approximately 28,873 acres (the Project footprint). Xcel is committed to environmental due diligence and contracted Tetra Tech, Inc. (Tetra Tech) to conduct bi-weekly fixed-point avian use surveys in the Project footprint from August 27, 2018 through October 30, 2018. This report contains the results of those surveys and provides data for characterizing avian use in the Project footprint during fall migration allowing quantification of the potential avian impacts associated with building and/or operating the Project.

Impacts to avian species as a result of wind energy development can occur both directly and indirectly as: 1) direct impacts to habitat from the footprint of the facilities and infrastructure, 2) impacts by displacement of individuals through mechanisms not yet determined, and 3) direct mortality from turbine collision (Erickson et al. 2014, Graff et al. 2016, Smith and Dwyer 2016). Because avian impacts depend on a number of factors (project size, turbine models used, geographic location, etc.), assessment of risks to avian species are analyzed on a project-by-project basis. Surveys were conducted based on recommendations in the U.S Fish and Wildlife Service (USFWS) Land-based Wind Energy Guidelines (WEG; USFWS 2012).

2.0 PROJECT FOOTPRINT

The Project footprint is located in the Northern Glaciated Plains ecoregion, which is characterized by a flat to gently rolling landscape composed of glacial drift (USGS 2016). Sub-humid conditions foster a grassland which is transitional between tall and shortgrass prairie. High concentrations of temporary and seasonal wetlands create favorable conditions for duck nesting and migration stopover. Though the till soil is very fertile, agricultural success is subject to annual climatic fluctuations.

The land cover of the Project footprint was consistent with the land cover described for the ecoregion as a whole and consisted primarily of grasslands, agricultural lands used for grain crops, developed land (farmsteads), and wetlands. A mix of deciduous trees planted for windbreaks surround most farmsteads within the Project footprint. Topography in the Project footprint is generally flat, and the vegetation cover is uniformly low.

The Project footprint is located within the Central Flyway, one of the four main migratory bird routes in the United States (USFWS 2015). During spring and fall migration, most birds that move along the Central Flyway travel between breeding grounds as far north as northern Canada and wintering grounds as far south as the tropics of South America. The Project footprint lies within North American Bird Conservation Region (BCR) 11 (Prairie Potholes) which provides the most important waterfowl production habitat on the North American continent (NABCI 2016). BCR 11 comprises the core of the breeding range of most dabbling duck and several diving duck species, as well as providing critical breeding and migration habitat for over 200 other bird species (NABCI 2016).

3.0 METHODS

3.1 POINT COUNT SURVEYS

The objective of the point count surveys was to estimate bird use in the Project footprint during the fall migration period by recording species occurrence and mean avian use, and potential risk by recording activity in the estimated turbine rotor swept area (RSA).

3.1.1 Survey Design

Tetra Tech distributed 18 point count locations across the Project footprint to obtain representative coverage of the habitat types present and were sited to give the greatest possible view shed at each location (Appendix A: Figure 2). Surveys at each point count location lasted for 20 minutes, during which time a biologist continuously scanned for birds and recorded any visual or auditory observations within an 800-meter buffer around the survey point. Tetra Tech chose 20-minute surveys because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 minutes may lead to double-counting (i.e., counting the same individual more than once) because individuals may appear and disappear from view. For example, if a horned lark is detected perched on a fence then disappears from view and, 6 minutes later, a horned lark is seen flying, these birds are recorded as separate observations because it is not possible to distinguish individuals. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-minute survey, not number of distinct individual birds.

A site visit by a Tetra Tech biologist was conducted on March 19, 2018 to assess the habitat within the Project footprint as well as to take photographs from survey point count locations (see Appendix D).

Data recorded at each survey point included: date, start and end time of the observation period, and weather (temperature, wind speed, wind direction, precipitation, visibility, and cloud cover). For all birds seen or heard within an 800-meter radius of a point count location, information was recorded on: species (identified to the lowest possible taxonomic level), number of individuals, behavior, distance from observer, flight height, and flight direction (Appendix C). Rangefinders and reference points were used to calculate flight height and distance of birds from each point count location. Surveys were conducted bi-weekly from August 27 to October 30, 2018 to coincide with the fall migration period at the Project footprint.

The survey protocol was designed to collect data on all diurnal bird species as opposed to targeting specific taxa, and to provide results that are comparable with other studies of avian use at wind farms. Surveys encompassed all daylight hours and the order in which the point counts were surveyed was varied so that roughly equal numbers of surveys at each point were conducted throughout the day.

Detectability varies among species and potentially not all individuals within the 800-m radius were counted. This variation in detectability results in an overestimate of mean use for conspicuous species and an underestimate of mean use for reclusive species (Thompson 2002). Birds not easily identifiable, such as those seen under low light

conditions or small birds seen at a distance were identified to the lowest taxonomic level possible and are included in the results.

3.1.2 Analysis

Tetra Tech derived avian mean use by calculating the number of birds observed per 20-minute survey at each point and totaled by species, species groups (songbirds, pigeons/doves, raptors, waterbirds, gamebirds, shorebirds), point count location, and the Project footprint. To evaluate the diversity and composition of avian species using the Project footprint, Tetra Tech calculated the total number of individuals and species seen at all points during the survey period. The number of observations made during each survey was also calculated, where an observation was either an individual bird or a discrete flock of birds. This information helps evaluate if the number of individuals observed, or the mean use is driven by a few or a single event (e.g., a large flock of birds moving through the Project footprint during migration). Because individual birds are not uniquely marked and identified, population size or abundance cannot be determined since individuals may be counted multiple times during a survey or across survey periods, thus avian mean use does not equate to abundance.

Flight behavior was evaluated by calculating the proportion of flying birds that were observed below, within, or above the RSA which is defined as the height interval through which turbine blades are expected to pass. Xcel is currently considering a variety of turbine models for use within the Project footprint. For the purposes of estimating risk to avian species, Tetra Tech used a RSA of 25 meters to 175 meters above ground surface to account for the range of potential turbine model choice. A bird was considered to have flown within the RSA if any of its recorded heights overlapped the RSA.

4.0 RESULTS

4.1 AVIAN USE OF THE PROJECT FOOTPRINT

Each of the 18 point count locations were surveyed 6 times, resulting in a total of 108, 20-minute surveys. A total of 1,470 birds from 47 species (including 21 unidentified birds of 2 categories) were observed within the Project footprint for an overall avian mean use of 13.61 birds/20 minutes (Table 1). The number of birds seen at individual points was distributed fairly evenly across the Project footprint (Table 2) and ranged from 9.8% of the total (point count location 7) to 2% of the total (point count location 10).

Songbirds exhibited the highest mean use (10.06 birds/20 minutes) of any group, and 73.88% of the total birds observed were songbirds. The three species with the highest mean use were songbirds: barn swallow (*Hirundo rustica*, 2.92 birds/20 minutes), red-winged blackbird (*Agelaius phoeniceus,* 2.30 birds/20 minutes, and brown-headed cowbird (*Molothrus ater*, 1.12 birds/20 minutes). All other songbirds had a mean use of 0.71 birds/20 minutes or less (Table 1).

Waterfowl, and pigeons/doves each had a mean use of the Project footprint of 0.90 birds/20 minutes and each comprised 6.6% of the total birds recorded. Three species of waterfowl, plus one unidentified species, were

recorded, with Canada goose (*Branta canadensis*) having the highest mean use among waterfowl (0.68 birds/20 minutes). All other waterfowl species had a mean use of 0.13 birds/20 minutes or less (Table 1). Two species of pigeon/dove were recorded; mourning dove (*Zenaida macroura,* 0.70 birds/20 minutes) and rock pigeon (*Columba livia,* 0.20 birds/20 minutes). All other species groups had mean use of 0.71 birds/20 minutes or less (Table 1).

Table 1. Avian Species Observed During Fall 2018 Avian Surveys

Species Grouping	Number of Birds	Number of Observations	Mean Use (# birds/20 minutes)	Percent Composition (# birds/grand total)
Songbirds	**1,086**	**178**	**10.06**	**73.88%**
Barn swallow	315	25	2.92	21.43%
Red-winged blackbird	248	25	2.30	16.87%
Brown-headed cowbird	121	5	1.12	8.23%
Western meadowlark	77	29	0.71	5.24%
Dark-eyed junco	54	4	0.50	3.67%
Horned lark	40	11	0.37	2.72%
European starling	37	3	0.34	2.52%
American goldfinch	36	17	0.33	2.45%
Field sparrow	31	15	0.29	2.11%
Tree swallow	28	4	0.26	1.90%
Cedar waxwing	16	2	0.15	1.09%
American robin	15	8	0.14	1.02%
Blue jay	12	5	0.11	0.82%
Harris' sparrow	12	1	0.11	0.82%
House sparrow	12	2	0.11	0.82%
American crow	10	6	0.09	0.68%
Unidentified sparrow	7	2	0.06	0.48%
Sedge wren	5	5	0.05	0.34%
Northern flicker	3	3	0.03	0.20%
Song sparrow	2	2	0.02	0.14%
Western kingbird	2	1	0.02	0.14%

Species Grouping	Number of Birds	Number of Observations	Mean Use (# birds/20 minutes)	Percent Composition (# birds/grand total)
Clay-colored sparrow	1	1	0.01	0.07%
Common yellowthroat	1	1	0.01	0.07%
Gray catbird	1	1	0.01	0.07%
Waterfowl	**97**	**13**	**0.90**	**6.60%**
Canada goose	73	7	0.68	4.97%
Unidentified duck	14	3	0.13	0.95%
Mallard	7	2	0.06	0.48%
Blue-winged teal	3	1	0.03	0.20%
Pigeons/Doves	**97**	**30**	**0.90**	**6.60%**
Mourning dove	76	20	0.70	5.17%
Rock pigeon	21	10	0.20	1.43%
Waterbirds	**77**	**11**	**0.71**	**5.24%**
American white pelican	51	3	0.47	3.47%
Ring-billed gull	14	4	0.13	0.95%
Franklin's gull	10	2	0.09	0.68%
Great blue heron	1	1	0.01	0.07%
Great egret	1	1	0.01	0.07%
Raptors	**52**	**40**	**0.48**	**3.54%**
Northern harrier	17	15	0.16	1.16%
Red-tailed hawk	13	13	0.12	0.88%
American kestrel	11	5	0.10	0.75%
Turkey vulture	7	4	0.06	0.48%
Bald eagle	2	1	0.02	0.14%
Coopers hawk	1	1	0.01	0.07%
Ferruginous hawk	1	1	0.01	0.07%
Gamebirds	**34**	**14**	**0.31**	**2.31%**
Ring-necked pheasant	22	12	0.20	1.50%
Wild turkey	12	2	0.11	0.82%

Species Grouping	Number of Birds	Number of Observations	Mean Use (# birds/20 minutes)	Percent Composition (# birds/grand total)
Shorebirds	**27**	**16**	**0.25**	**1.84%**
Killdeer	25	14	0.23	1.70%
Common snipe	1	1	0.01	0.07%
Marbled godwit	1	1	0.01	0.07%
Grand Total	**1,470**	**302**	**13.61**	**100%**

4.1.1 Species of Concern

No federal or state endangered, threatened, or candidate species were observed during the fall avian surveys. Two bald eagles (*Haliaeetus leucocephalus*) were observed within the Project footprint during the fall avian surveys (Table 1). Although the bald eagle is no longer protected under the Endangered Species Act (ESA), the bald eagle is afforded special protection by the Bald and Golden Eagle Protection Act (BGEPA).

4.1.2 Raptors

Seven raptor species were observed within the Project footprint during the fall avian surveys. Overall mean use for raptors was 0.48 birds/20 minutes, and the raptor species with the highest mean use was the northern harrier (0.16 birds/20 minutes) (Table 1).

4.2 FLIGHT BEHAVIOR

Behavioral data was collected for all individuals observed and of these, 88.2% exhibited some form of flight behavior. Of the 41 species (including 2 unidentified categories) observed in flight, nine were observed flying within the RSA (including one unidentified category). Thirty-two species were observed only in low altitude flight below the RSA and no species was observed only in high altitude flight above the RSA (Table 3). The two species most frequently observed flying within the RSA were American white pelican (*Pelecanus erythrorhynchos*) and Canada goose. The two bald eagles observed during fall avian surveys were observed flying within the RSA (Table 3). Other raptors observed within the RSA were turkey vulture and red-tailed hawk.

Table 2. Number of Individuals Recorded by Point Count Location During Fall 2018 Avian Surveys

Species	Point Count Location																		Total Number of Individuals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Barn swallow	34		11	25	21		12	42	11	4	12	25	17	13	75	6	6	1	315
Red-winged blackbird				19	39	7	58	8	7	17	6	18	13	22	1		20	13	248
Brown-headed cowbird							27					15		43		31		5	121
Western meadowlark	3	6	2	1	2	9		12	8	2	9	6	2	4	2		1	8	77
Mourning dove		3	5		3	2	12	21	1	1		3	3	6		11		5	76
Canada goose		2	24	9			18							2		18			73
Dark-eyed junco		14			5											4		31	54
American white pelican	13					38													51
Horned lark	3				2				15		1	4	2	11				2	40
European starling		12							17			8							37
American goldfinch	2				5	3		2						9	3	3	8	1	36
Field sparrow	7		2	2	1	1	10	1	1	1			2	1				2	31
Tree swallow	12		5					10	1										28
Killdeer		1	1	5	4				1	2	2			1	1	1	4	2	25
Ring-necked pheasant		1	1		4		5		2			2			5		1	1	22
Rock pigeon	7	1		2		1		2				3	1					4	21
Northern harrier	1	1			1			3	2	1		1	1	3	2	1			17
Cedar waxwing		11															5		16
American robin			1					1	1				3	1		5	3		15

Species	Point Count Location																		Total Number of Individuals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Ring-billed gull						7										6	1		14
Unidentified duck																12	2		14
Red-tailed hawk	1	1			1	1	1	1					3				3	1	13
Blue jay		3				3					5						1		12
Harris' sparrow											12								12
House sparrow				3											9				12
Wild turkey	1																11		12
American kestrel		6						4				1							11
American crow	1												3			3		3	10
Franklin's gull						10													10
Mallard						1										6			7
Turkey vulture								1			1		4	1					7
Unidentified sparrow								1										6	7
Sedge wren					1			1					1	1	1				5
Blue-winged teal																3			3
Northern flicker													1	1	1				3
Bald eagle											2								2
Song sparrow														1			1		2
Western kingbird										2									2
Clay-colored sparrow																		1	1
Cooper's hawk																	1		1

Species	Point Count Location																		Total Number of Individuals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Common snipe															1				1
Common yellowthroat						1													1
Ferruginous hawk													1						1
Great blue heron												1							1
Gray catbird					1														1
Great egret																		1	1
Marbled godwit							1												1
Totals	**85**	**62**	**52**	**66**	**90**	**84**	**144**	**110**	**67**	**30**	**50**	**87**	**57**	**120**	**101**	**110**	**68**	**87**	**1,470**
Percent of Overall Total (%)	**5.8**	**4.2**	**3.5**	**4.5**	**6.1**	**5.7**	**9.8**	**7.5**	**4.6**	**2.0**	**3.4**	**5.9**	**3.9**	**8.2**	**6.9**	**7.5**	**4.6**	**5.9**	**100%**

Table 3. Avian Flight Height Characteristics in Relation to the RSA

Species Grouping	Number Observed in Flight	Percent Flying Below RSA	Percent Flying Above RSA	Percent Flying Within RSA
Waterbirds	**76**	**25.0%**	**0%**	**75.0%**
American white pelican	51	0%	0%	100%
Franklin's gull	10	40.0%	0%	60.0%
Ring-billed gull	13	100%	0%	0%
Great blue heron	1	100%	0%	0%
Great egret	1	100%	0%	0%
Waterfowl	**20**	**40.0%**	**0%**	**60.0%**
Canada goose	11	0%	0%	100%
Unidentified duck	2	50.0%	0%	50.0%
Mallard	7	100%	0%	0%
Raptors	**47**	**76.6%**	**0%**	**23.4%**
Bald eagle	2	0%	0%	100%
Turkey vulture	7	0%	0%	100%
Red-tailed hawk	10	80.0%	0%	20.0%
American kestrel	10	100%	0%	0%
Coopers hawk	1	100%	0%	0%
Northern harrier	17	100%	0%	0%
Pigeons/Doves	**95**	**98.9%**	**0%**	**1.1%**
Rock pigeon	21	95.2%	0%	4.8%
Mourning dove	74	100%	0%	0%
Songbirds	**1,041**	**99.8%**	**0%**	**0.2%**
American crow	10	80%	0%	20.0%
American goldfinch	35	100%	0%	0%
American robin	14	100%	0%	0%
Barn swallow	315	100%	0%	0%
Brown-headed cowbird	121	100%	0%	0%
Blue jay	9	100%	0%	0%

Species Grouping	Number Observed in Flight	Percent Flying Below RSA	Percent Flying Above RSA	Percent Flying Within RSA
Clay-colored sparrow	1	100%	0%	0%
Cedar waxwing	16	100%	0%	0%
Dark-eyed junco	54	100%	0%	0%
European starling	37	100%	0%	0%
Field sparrow	28	100%	0%	0%
Gray catbird	1	100%	0%	0%
Harris' sparrow	12	100%	0%	0%
Horned lark	26	100%	0%	0%
House sparrow	12	100%	0%	0%
Northern flicker	1	100%	0%	0%
Red-winged blackbird	248	100%	0%	0%
Tree swallow	28	100%	0%	0%
Unidentified sparrow	7	100%	0%	0%
Western kingbird	2	100%	0%	0%
Western meadowlark	64	100%	0%	0%
Gamebirds	**1**	**100%**	**0%**	**0%**
Wild turkey	1	100%	0%	0%
Shorebirds	**17**	**100%**	**0%**	**0%**
Common snipe	1	100%	0%	0%
Killdeer	15	100%	0%	0%
Marbled godwit	1	100%	0%	0%
Totals	**1,297**	**93.6%**	**0%**	**6.4%**

Note: Percentage presented in table is of the number of birds in flight, not of the total number of birds recorded.

5.0 DISCUSSION AND CONCLUSIONS

The mix of grassland and wetland habitat observed within the Project footprint provides habitat for breeding and migrating birds. Species observed in the Project footprint with the highest mean use are consistent with those species that prefer grassland and wetland habitats.

Songbirds exhibited the highest mean use among the species groups observed, although only one species (American crow) was recorded flying within the RSA (Table 3). Studies have found higher fatality rates at wind projects for songbirds than any other taxa, although less than one-tenth of one percent of the continent-wide population of each songbird species is estimated to be killed annually by collisions with wind turbines (Erickson et al. 2014). The three most commonly observed songbird species (barn swallow, red-winged blackbird, and brown-headed cowbird), detected during this study have stable populations, likely due to their adaptability to changing habitats and human disturbance (Rosenberg et al. 2016; Sauer et al. 2017). Given their wide-spread occurrence, high numbers, and stable populations, population-level impacts to any of the songbirds observed during this study are unlikely as a result of turbine-related mortality that may occur at the Project. Waterfowl were also seen during the fall avian surveys and 60.0% of the individuals flew within the RSA (Table 3). Although turbine-related fatalities may occur to waterfowl, their wide-spread distribution, high numbers, and stable populations, make population level impacts unlikely (Sauer et al. 2017).

Special consideration is often given to raptor species at wind farms because diurnal raptors are generally at higher risk for collision with turbines than are many other avian species (AWWI 2015). High raptor use has been associated with high raptor mortality at new generation wind farms (Erickson 2007), and conversely, raptor mortality appears to be low when raptor use is low, defined by Erickson (2007) as less than 1.0 birds/20 min. Based on the low mean use recorded (0.48 birds/20 min), the Project would be considered a low risk site for fall raptor mortality (Table 1). However, two bald eagles were observed within the Project footprint and flying within the RSA (Table 3). This risk is of concern as bald eagles are protected by BGEPA.

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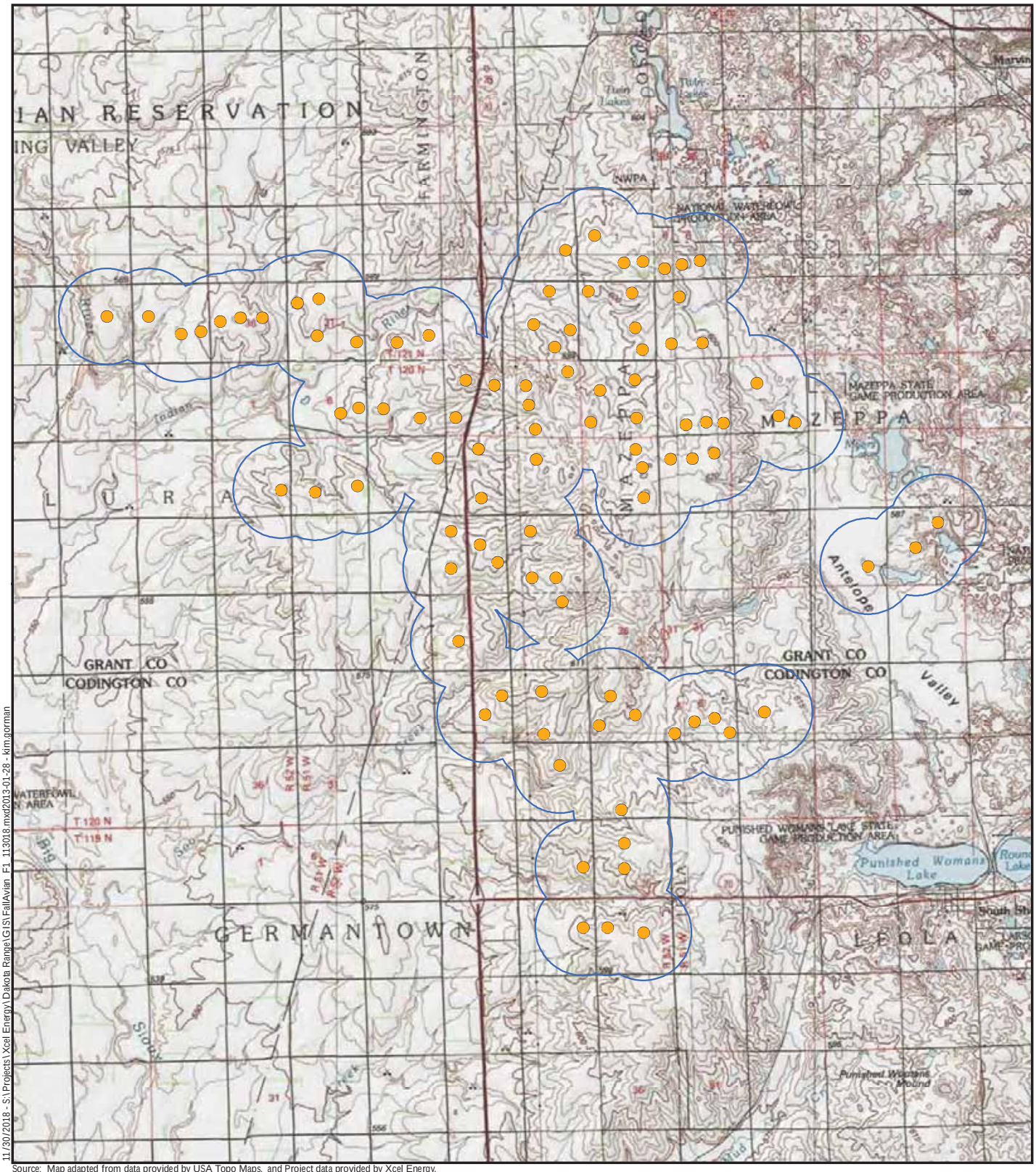
APPENDIX A. FIGURES



11/30/2018 - S:\Projects\Xcel Energy\Dakota Range\GIS\FallAvian_F1_113018.mxd2013-01-28 - kim.gorman

Source: Map adapted from data provided by USA Topo Maps, and Project data provided by Xcel Energy.

Proposed Turbine Location 3/7/2018

Project Footprint (1km Turbine Buffer)

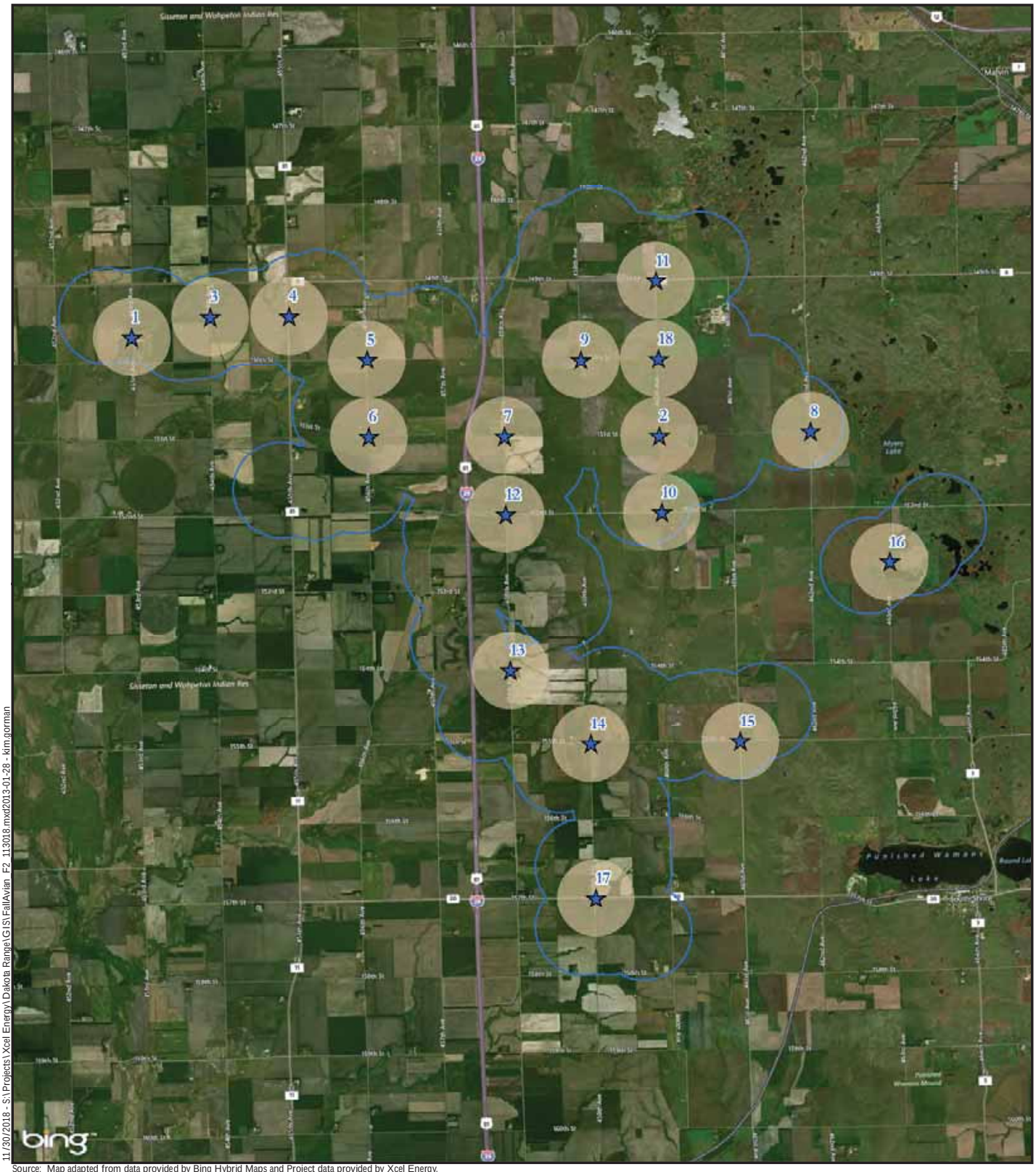
0 1 2 3 Miles

N

Figure 1: Site Vicinity
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

Xcel Energy

TETRA TECH



11/30/2018 - S:\Projects\Xcel Energy\Dakota Range\GIS\FallAvian_F2_113018.mxd2013-01-28 - kim.gorman

Source: Map adapted from data provided by Bing Hybrid Maps and Project data provided by Xcel Energy.

Avian Point Count Location (n=18)
800-Meter Survey Buffer
Project Footprint (1km Turbine Buffer)

0 1 2 3 Miles

N

Figure 2: Avian Point Count Locations
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

Xcel Energy
TETRA TECH

APPENDIX B. AVIAN POINT COUNT SURVEY PROTOCOL

TETRA TECH

Avian Point Count Survey Protocol

1.0 Methods

The methodology employed here is a wind industry standard avian point count survey designed to determine the overall avian use of the area. To this end, 20-minute (min) point counts within an 800-meter (m) radius over the course of 1-2 days (depending on number of points) are utilized.

1.1. Prior to Conducting Surveys

Land Owner Contact

In many cases, projects will have a lease agent which will provide you with information. If you are asked to contact landowners directly, ask the following:

- Are there any locked gates? If so, what is the combination?
- Are there any places that I should not go?
- Are there hunters on the property?
- Are there any time restrictions as to when I can be on the property?
- Is there anything else that I should know (e.g., road conditions, fences, cattle, lambing season)?

Equipment List

- Binoculars
- Watch that displays in 24-hour time
- GPS unit
- Compass
- Field map with turbine strings if available
- Field notebook
- Digital camera
- Pens/Pencils
- Flagging tape
- Clip board (preferably with weather protection)
- Bird book
- Range finder that registers both horizontal and vertical (for example, OPTi-LOGIC 1000 LH Rangefinder Hypsometer)
- Anemometer (Kph)
- Thermometer
- Data sheets (point count, incidental, point count schedule, distance/height calibration worksheet)
- List of 4-letter species codes/List of unknown bird codes

Tetra Tech, Inc.
2001 Killebrew Drive, Sutie 141, Bloomington, MN 55425
Tel (612) 643-2200 Fax (612) 643-2201 tetratech.com

1.2. Conducting Surveys

Key Points

- Your safety is the highest priority. If there is a situation that feels unsafe (e.g., lightning storm, confrontational person, washed-out road), do not survey that point and remove yourself to a safe location.
- Documenting bird use of the area is the goal of the point count survey. Thus, the priority is to identify "Species", "Number of individuals" and "Activity." Individual birds' characteristics are secondary.
- Surveys are meant to capture avian use throughout the day and, therefore, are conducted during all weather (except when visibility is reduced (see section 1.2.2) or the situation is unsafe) and during all daylight hours. *Keep track of when during the day points are surveyed using the Time Tracker Data Table.*
- For any weekly survey all points must be surveyed within 7 days and there shall be no less than 4 days from the date of the last survey to the beginning of next survey week.
- Legible handwriting is key; please make every effort to write legibly, preferably using a dark pencil or waterproof pen.
- If you observe any federal or state-listed Threatened & Endangered species, take detailed notes of observations on the appropriate data sheet.

1.2.1. Point Count Datasheets

All fields

- All blanks on the datasheet should be filled in. If you are unable to determine a value (e.g., sex or age) then draw a dash in the box so that it is clear that the information was not available and not that the observer forgot to write it down. You must check the data sheet for errors and omitted information from top to bottom following the survey before moving on to the next point location.

Point data (top of the datasheet):

Date:

- Date survey was conducted.

Observer:

- Initials of the surveyor of record.
- NOTE: If there are two people at a point, one person is the official observer and the other person should act only as the recorder.

Start time and End time:

- Time survey begins and ends. If at any time during the survey period you are interrupted for less than 1 minute you may suspend the survey and continue when the interruption has ended. Record the time that the interruption occurred and the time it ended. However, if an interruption lasts more than 1 minute you will need to stop the survey and restart the 20- (or 30-) min survey clock. The data you collected prior to the interruption are no longer valid.

Visibility:

- Distance in meters you are able to see.
- If you are able to see the entire 800-m circle during your survey, mark "Clear"
- If you did not mark "Clear":
    - As overall visibility may change within a survey period, we ask you to record both the minimum (Min) and maximum (Max) visibility you had during the survey period.
        - Example: If you can see 1000m to the north, but only 200m to the south , write "Min: 200m and Max: 1000m".
        - Example: If you can see 400m in the beginning of the survey and 700m by the end write "Min:400m and Max: 700m".
- If at any time you are unable to see less than 50% of the 800-m radius circle and/or the cloud ceiling drops below 100m, you either need to postpone or stop the survey. When you are able to see at least 50% of the circle and the cloud ceiling is higher than 100m you may resume the survey. However, if the break was greater than 1min you will need to start the survey over again. The data you collected prior to the reduction in visibility are no longer valid.

Wind Direction:

- Record the direction the wind is originating from (not the direction it is traveling).

Wind Speed (km/h):

- Record the range of wind speeds that occur during the survey period. Fill in both a minimum and maximum wind speed. All wind speed data must be recorded in kilometers per hour (km/h).

Precipitation:

- Circle the appropriate precipitation. If "other" please define in the Notes section.
    - Do not conduct survey if the precipitation limits your visibility to less than 50% of the 800-m circle.

Temp (°F):

- Temperature during survey period. Please record all temperatures in degrees Fahrenheit.

Cloud Cover (%):

- Record the percentage of clouds covering the 800-m circle.
    - Do not conduct survey if the cloud cover is 100% and the cloud ceiling is lower than 150 m.

Observation data(bottom section of datasheet): Species codes:

- A state-specific species list with the codes we use will be provided to you at the beginning of the field season. We use the 4-letter codes from Pyle's *Identification guide to North American Birds*". Most of these codes are the same as BBL codes; however, there are some differences. Please check your codes the first time out to ensure that you use the correct code.
- If you are unable to identify the species, a separate list for unknown birds is provided.
- If you are unsure of the species code, write the full name of the bird you saw in the Notes section and fill in the appropriate code when you are able to check the code list sent you.
- If a mixed species flock is observed, please note the observation by recording each species on a separate line and estimating the number of individuals for each species. You should write in the notes column that the species was part of a mixed species flock (see example datasheet).
- For unidentified species please write out any additional information that might refine the possibilities in the notes column. For example, if you record UNSW, in the Notes column, you might write "tree swallow or violet-green swallow."

Time:

- Time is the time you first saw the bird.
- Time is recorded using a 24-hour clock (to avoid am/pm time confusion).

Sex:

- Field should be filled in as male (M), female (F), or both (B).
- If you know the number of males and females, write in the Notes.
- If unknown, draw a line through the box.

Age:

- Field should be filled in as adult (A) or juvenile (J) or both (B).

- If you know the number of adults and/or juveniles, write in the notes column.
- If unknown, draw a line through the box.

Number of individuals:

- Always fill in this field, even in "auditory-only" detections.
- Estimate this number when uncertain.
- Estimates are most accurate at time of observation and do not need any numerical symbols (e.g., ~ or ±) to accompany them.

Activity:

- Circle the first activity observed.
- Put a check mark over the second activity.
  - Walking: bird was on the ground (height is 0).
  - Perching: bird was perched above ground (e.g., tree, fence).
  - Flying: bird was in the air.
  - Other: only select if the activity could not be categorized as an activity listed (e.g., swimming). Please explain any "OT" selection in the Notes..
    - e.g., "mobbing" is a flying activity so select "FL" and write in Notes "mobbing").
- Additional, relevant behavioral information should be included in Notes.

Height data:

- Use a range finder to measure reference heights within the point count circle.
  - When driving by tall structures not on point counts (e.g., telephone poles, met towers, barns) use the range finder to test your ability to estimate heights.
- Two heights are recorded: lowest and highest.
- Heights should be filled in for all birds observed.
- If a bird's height does not change while observed (e.g., a perched bird), simply write the same height in each column.
- Heights should be recorded in meters (m).
- If you cannot see a bird and, therefore, cannot estimate its height, draw lines through the blanks.

Flight direction:

- This applies only to birds that do not land within the 800-m circle.
  - Example: If you see a flock of sandhill cranes flying through or above the count circle.
  - Example: You see a TUVU circle soaring and moving with thermals.
- If a bird is making localized flight movements (e.g., tree to tree) or if a bird is not flying, simply put a line through this space on the data sheet.
  - Example: If a robin changed perches by flying from one tree to another.
  - Example: A flock of blackbirds gets flushed by a passing car and settles nearby.

- Flight direction is the direction to which the bird is flying.
  - If the bird is flying from the north to the south, then the flight direction would be south.
  - The overall directionality of a circle soaring bird should be filled out (as opposed to recording "variable").

Horizontal distance:

- This is a key piece of information!
- Distance is recorded as first distance and closest distance.
- If first and closest distance are the same, use ditto marks (") in the blank.
- Record all distances in meters (m).
- Use a rangefinder and topographic map to identify the distances of distinctive features in the landscape to help with distance estimation.

Habitat types:

- Circle the primary habitat type in which birds were seen.
- Check second habitat type in which birds where seen.
- Other: only select if the habitat could not be categorized as a habitat listed (e.g., agriculture). Please explain any "OT" selection in the Notes.
- NOTE: Habitat types and codes should be identified prior to first survey. Use Habitat Codes Table for code selection. Point count description sheets should be filled out and sent in to Tetra Tech office with first survey.

Aud?/Vis? Columns:

- Check the auditory box if the bird(s) were heard.
- Check the visual box if the bird(s) was seen.
- Check both if the bird(s) was seen and heard.

Notes:

- Use the Notes column for any additional details you consider important.
- This may include, but is not limited to:
  - Behavior of the bird (e.g., male displaying to female).
  - Location of the bird (e.g., kestrel sitting on wire).
  - Taxonomic grouping of bird if species is unknown (e.g., *Buteo*).
  - If species is unknown, any characters you observed or hunches about what it was (e.g., light head, dark body, song a descending trill; or likely a HOLA or LALO).
  - Full species name, if uncertain about 4-letter code (e.g., ring-necked pheasant, unknown *Buteo*).

Additional Notes:

- Use this section at the bottom of the page for any notes that relate to the survey in general (e.g., "Snowing on and off").
- Additionally, use this section if you run out of room in the notes column for a specific observation. If you use it for this reason, write the observation number in the Obs #/Time column.

1.2.2. Pausing and/or Halting a Point Count

There may be times while conducting your point count surveys that you will need to pause or halt a point count survey(s). Some example circumstances are:

- Weather/Visibility
  - If you are unable to see at least 50% of the point count circle and/or the cloud ceiling has dropped below 100m.
  - If you are unable to reach a point due to road conditions.
- Interruptions
  - If someone approaches you to speak to you while you are conducting a survey and the interruption last more than 1 min.
  - Some activity (e.g., equipment moving through the area, field within the circle is being actively plowed) interferes with your ability to conduct the survey.
  - You get a flat tire and are unable to delay getting help until after you have finished your surveys.

Depending on the particular circumstances there are several options as to how to proceed:

- If the situation is temporary (e.g., fog rapidly moving through the area), then either wait for the situation to clear or proceed surveying other unaffected points and return to the affected point(s). Note: If you already started to survey a point and the interruption lasts more than 1 minute, you must restart the 20- (or 30-) min survey clock. The data you collected prior to the interruption are no longer valid.
- If this situation is likely to persist for the weekly survey (the number of days it typically takes you to completely survey all points) simply send a blank datasheet(s) for this point(s) with the other data you collected with an explanation written in the Notes as to why you skipped the point(s).

1.2.3. Examples of Common Problems During Surveys and What to do Someone stops and talks to you during a survey

- If survey is stopped for greater than 1 minute, the survey must start over. The data collected prior to the interruption are no longer valid.
- Talk to the person. Be polite, respectful and discrete. Remember that wind farms can be controversial and the all information you have, including survey data, is confidential.
- Tell the person, "I am in the middle of a bird survey right now and I have five minutes left. I can talk to you when I am finished if you would like to wait?"
- Record in your notes the name the person you spoke with.
- Refer the person to the development company's (client) contact.
- As maps contain confidential information, keep them out of view.

You are unsure if you have counted a bird

- Try to keep track of each bird.
- If you lose track, assume they are new individuals.
- Each unique bird should only have one line of data; therefore, if the activity/behaviors or habitat use changes during the survey, check or add in the appropriate information on the original line of data. Do not create a new line for this existing bird.
- QUICK TIP: To help keep track of birds, in the Notes box write the direction the bird was observed in.
    - Example: You have 1 singing male 200 m away to the north and 2 singing males 30 m away to the south. In 15 minutes when you hear a singing male 100 m away to the northeast, you can assume it is a new male.

You are unsure how many individuals are present

- The "number of individuals" field always MUST be filled in.
- Exact numbers are better, but if exact numbers are not possible, make a reasonable estimate.
- Using orders of magnitude (e.g., 1, 10, 50, 100) is an appropriate tool for estimating. Remember, without a number, we cannot count a record.
- "At least 1" is acceptable.
- QUICK TIP: To estimate large flocks of birds, count a group of birds (e.g., 50 individuals) and get an idea of what a group of 50 looks like. Then begin counting in groups of 50.
- QUICK TIP: To estimate singing males when there is an abundance of singing occurring, imagine dividing the circle into a pie. Concentrate on listening to one slice of that pie or one quadrant. Estimate the number of males in that quadrant only and put those male as one line item on the data sheet (noting the direction you were listening in the Comments box, so you don't lose track). Then continue in the next quadrant until you have covered the entire circle.

You are unsure of the species

- Record the species to the most specific taxonomic level possible (e.g., unidentified warbler is more specific than unidentified passerine, unidentified *Buteo* is more specific than unidentified hawk).
- Examples of possible choices, from broadest to most specific:
  - Unknown hawk
  - Unknown *Buteo*
  - Red-tailed hawk
- Check the species list to look for the appropriate unknown code.
- If an appropriate code is not listed, leave the code blank and put your species determination in the Notes field.

How do you record a perching bird?

- Perched birds should be recorded at the height they are perched.
  - Example: a bird is perched on a fence post at 1.5 m height. It flies to 4 m and lands on the ground.
    - First behavior = perching (circled)
    - Second behavior = flying (checked)
    - Third behavior = walking (checked)
    - Low height = 0 m (landed on the ground)
    - High height = 4 m
  - Example: a bird is perched on a fence post at 1.5 m height. It flies to 4 m and returns to the same fence post.
    - First behavior = perching (circled)
    - Second behavior = flying (checked)
    - Low height = 1.5 m
    - High height = 4 m

How do you record flight heights over variable topography?

- Record the height above the ground over which the bird is directly located.
- No negative height values should be recorded.

The weather changes during the survey

- If the change is dramatic then note the time and continue the survey unless the situation is dangerous or visibility is obscured in greater than 50% of the survey circle.
- If the situation is dangerous, 50% of the 800-m circle is obscured, or there is 100% cloud cover with a cloud ceiling of less than 100 m, cancel survey and return later.

Common problems with data we receive from field biologists

- Number of individuals is missing.
- Species codes are incorrect.
- Species are missing.
- Low height is higher than the maximum height observed.
- Activity or habitat is “Other”, but is not explained in the Notes.
- Activity or habitat has been left blank.

1.2.4. Incidental Observation Datasheets

Not all birds need to be recorded! Only record observations of state or federal threatened and endangered species, novel species not seen during point counts, raptors or other large birds, grouse species, common birds behaving in a way that puts them at higher risk of being affected by a turbine or large flocks (25+ individuals). Do not record unidentified birds!

- Record birds viewed outside of survey time, outside of 800-m radius of survey circle and those seen while traveling between points.

  - These observations should be made in transit. Do not stop to go birding.
- If you see a threatened or endangered species, provide detailed notes on the data sheet.
- You may also include observations of non-bird species that are of particular interest (e.g., the observation of a carcass near a point as it may draw in birds). We do not have 4-letter codes for non-bird species so if a non-bird observation is important, write the species in the Notes column and record all pertinent info.
- Familiarize yourself with general habitats outside the project area, and think about how they may be affecting the bird activity within the site (e.g., large reservoir within a mile of the site likely drawing in the water fowl flocks you are seeing). Include any information such as this you deem helpful in understanding the big picture of the site on incidental forms.

1.2.5. Time Tracker Data Table

To ensure that all points are being visited at different times of the day and that all daylight hours are being covered, record the hour in which each point was visited in the Time Tracker data table. Include this table with your last data set for the survey season.

- Record the survey date above the appropriate survey number.
- Sunrise and sunset times can be found on-line (http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html). Obtain before going into the field.
- At the time the point is surveyed, write the HOUR in the given cell. If the survey covers two hours, then write the hour that is in the majority.
  - Example: If you start the survey at 6:10am, write 6.
  - Example: If you start the survey at 2:30pm, write 14.
  - Example: If you start the survey at 2:55pm, write 15.
- All points should be visited in the first hour after sunrise at least once during the season.
- Surveys can begin approximately 15 minutes before sunrise, depending on weather and lighting conditions.
- IMPORTANT: If you are driving to the field in the morning and it is already light, you are starting surveys too late!
- IMPORTANT: If unforeseen events prevent a survey from being conducted at the normal scheduled time, two consecutive surveys must be at least 4 days apart.
  - Example: Snow prevented you to go to the field on week 1. Therefore you needed to do survey 1 on week 2. Then survey 2 must not occur until 4 days have elapsed. Survey 2 can be conducted on the 5th day.

1.2.6 Quality Assurance/Quality Control (QA/QC)

In order to produce the highest quality data Tetra Tech asks surveyors to carefully adhere to the following QA/QC standards.

- Data should **NEVER** be transcribed from one datasheet to another or from a notebook to a datasheet. We recognize the nature of fieldwork and expect sheets with cross outs, dirt. etc. If for some unavoidable reason you transcribed data, you **MUST** send both the datasheet you transcribed the data to and the original sheet the data were originally collected on (even if it is a napkin)!
- DO NOT ERASE DATA ON DATASHEETS-If you make an error simply put a line through it.
- Check your data sheets at the end of each point before moving on to the next point in order to catch any missing information while you still remember what happened.
- If data are unavailable, then please place a dash the appropriate space on the datasheet so that it is clear that this piece of data was not forgotten during the data collection.
- Each week prior to surveys, calibrate yourself for height measurements using your range finder to determine accuracy. Because we use height data to determine bird activity within the rotor swept area, it is imperative that height information is accurate. Whenever possible, determine the height of known objects within the point count circle for reference and familiarize yourself with these heights each time that point is surveyed. Additionally, practice on objects outside of the point count circle to verify your accuracy.

Note: Do not be surprised if you get an email from the person entering the data from your project asking for data clarifications.

APPENDIX C. SAMPLE AVIAN SURVEY DATA SHEET

Philip Wind Project
Haakon County, SD

Avian Fixed Point Observation Data Sheet

Date (mmddyy) _____ **Observer (init.)** _____ **Start Time** _____ **End Time** _____ **Obs Pt.**

Visibility: Clear or Min _____ Max_____ (m) **Page** ____ of ____

Wind Direction from (circle one): Calm N NE E SE S SW W NW Variable **Speed**: Low____ High _____ (km/h)

Precipitation (circle one): none light rain rain snow sleet hail fog other **Temp:** _____ (ºF) **Cloud Cover**: _____%

Obs #	Species Code	Time	Sex	Age	# of ind.	Activity (circle 1st, X others)		Height (m) Low	Height (m) High	Flight Dir (to)	Horizontal Distance (m) 1st	Horizontal Distance (m) closest	Habitat Type (circle 1st, X others)			Aud?	Vis?	Notes
1						WA	PE											
						FL	OT											
2						WA	PE											
						FL	OT											
3						WA	PE											
						FL	OT											
4						WA	PE											
						FL	OT											
5						WA	PE											
						FL	OT											
6						WA	PE											
						FL	OT											
7						WA	PE											
						FL	OT											
8						WA	PE											
						FL	OT											
9						WA	PE											
						FL	OT											
10						WA	PE											
						FL	OT											
11						WA	PE											
						FL	OT											
12						WA	PE											
						FL	OT											

Activity Codes: WA-walking on ground, PE-perched above ground, FL-flying, OT-other (please specify)
Habitat Codes:

OBS. # (Time)	ADDITIONAL NOTES

APPENDIX D. SITE PHOTOGRAPHS

Dakota Range Wind Farm

Photograph 1: A view from point count location 1 to the north.

Photograph 2: A view from point count location 1 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 3: A view from point count location 1 to the south.

Photograph 4: A view from point count location 1 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 5: A view from point count location 2 to the north.

Photograph 6: A view from point count location 2 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 7: A view from point count location 2 to the south.

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photograph 12: A view from point count location 3 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photograph 16: A view from point count location 4 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photograph 24: A view from point count location 6 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Date Photos Taken: March 19, 2018

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Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Photographer: Greg Thomson

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Photographer: Greg Thomson

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Photograph 52: A view from point count location 13 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photograph 54: A view from point count location 14 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

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Date Photos Taken: March 19, 2018

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Photographer: Greg Thomson

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Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Spring 2019 Aerial Survey Report

Dakota Range Wind Farm

Grant and Codington Counties, South Dakota

Prepared for:

Xcel Energy

June 2019

TETRA TECH

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Appendices

1.0 Introduction

Tetra Tech, Inc. (Tetra Tech) conducted an aerial survey for eagle nests at Xcel Energy's proposed Dakota Range Wind Farm (Project) in Grant and Codington Counties, South Dakota (Appendix A: Figure 1) from April 3, 2019 through April 5, 2019. The primary objective for the eagle nest survey was to inventory bald eagle (*Haliaeetus leucocephalus*) and golden eagle (*Aquila chrysaetos*) nests within the Project footprint and a surrounding 10-mile buffer (Nest Survey Area; Figure 1) following the U.S. Fish and Wildlife Service Eagle Conservation Plan Guidelines (ECPG, USFWS 2013). Additionally, all raptor nests within the Project footprint were recorded during the survey.

Aerial surveys were previously conducted by WEST, Inc. during spring of 2016 and 2017 (WEST 2016, WEST 2017). The spring 2016 and 2017 aerial surveys recorded all raptor nests within a 1-mile buffer of the Project Area and only eagle nests out to a 10-mile buffer of the Project Area. It should be noted that this Project Area boundary was modified over time. Aerial surveys were also conducted by Tetra Tech during spring of 2018 (Tetra Tech 2018). The spring 2018 aerial surveys recorded all eagle nests within the Nest Survey Area, along with all raptor nests found within the Project footprint.

2.0 Methods

The survey was conducted by Connor Maloney and Ted Woods (Tetra Tech) from a Bell-206 Jet Ranger helicopter (Double M Helicopters) that was flown between 60 - 200 feet (18 - 60 meters [m]) above ground level at an approximate speed of 50 miles per hour (80 kilometers per hour). A search for all eagle nests was conducted within the Nest Survey Area (Figure 1) along north-south transects spaced 1 mile apart, covering a total of 718 transect miles. When needed, transects were deviated from in order to conduct more intensive searches of areas with trees likely to support nesting eagles.

To aid in navigation and data recording, a global positioning system (Garmin 60CSx GPS) receiver using North American 1983 Datum and Universal Trans Mercator (UTM) coordinates was used. Additionally, a Project overview map, an optically stabilized digital camera, and standardized data collection forms were used to record information. Data collected within the nest survey area included all eagle nests (in-use or alternate) and any observations of eagles. Eagles observed that were not affiliated with a nest were recorded as "incidental". When a nest was found, the following data were collected:

- **Nest Identification Number:** corresponding with GPS waypoint number.
- **Raptor Species:** using 4-letter American Ornithologists' Union codes (e.g., BAEA = bald eagle, RTHA = Red-tailed Hawk, UNKN = unknown species).
- **Presence of Adults:** number of adults observed on the nest or near the nest.

- **Eggs or Young:** number of eggs or young observed.
- **Nest Substrate:** structure in which nest was located (e.g., deciduous tree, cut bank, transmission pole, etc.).
- **Nest Height:** in meters (m), distance from nest to ground.

Nest Activity: To assess nest activity, the following criteria were used (USFWS 2016):

- **In-use nest**: a bald or golden eagle nest characterized by the presence of one or more eggs, dependent young, or adult eagles on the nest.
- **Alternate nest:** one of potentially several nests within a nesting territory that is not an in-use nest at the current time. When there is no in-use nest, all nests in the territory are alternate nests.

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

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

3.0 Results

The survey was conducted from April 3, 2019 to April 5, 2019 at which time trees in the area did not have leaves enabling good visibility of nests. The weather on Wednesday, April 3 was partly cloudy (visibility approximately 10 miles) with low winds (2-6 mph), Thursday, April 4 was overcast (visibility approximately 10 miles) with moderate winds (6-10 mph), and Friday, April 5 was partly cloudy (visibility approximately 10 miles) with moderate winds (8-12 mph). The survey commenced at 830 hours and

finished at 1530 hours on Wednesday, commenced at 830 hours and finished at 945 hours on Thursday, and commenced at 1230 hours and finished at 1530 hours on Friday.

Eagle Nests: No bald eagle or golden eagle nests were located within the Project footprint (Appendix A: Figure 1, Table 1). Seven bald eagle nests (3 in-use and 4 alternate), and no golden eagle nests, were located within the 10-mile buffer of the Project footprint. Alternate bald eagle nest 2016-5 was occupied by a great-horned owl (*Bubo virginianus*). This nest had been previously occupied by bald eagles in spring 2017 (Figure 2, WEST 2017). Additionally, 6 adult and 1 juvenile bald eagle, and no golden eagles, were observed incidentally during the survey. Nest photos are found in Appendix B.

Nests of Other Raptor Species: One raptor nest was located within the Project footprint which was in-use by a red-tailed hawk (*Buteo jamaicensis*; Table 2, Figure 1). A photo of the nest is found in Appendix B.

Nest Summary: The status of all raptor nests observed within the Dakota Range Wind Farm Project footprint and 10-mile buffer area during aerial surveys from April 2016 through April 2019 are included in Table 3. Bald eagle nests recorded for the Project are depicted on Figure 2 with their status over time.

Table 1. Bald eagle nests observed within the Dakota Range Wind Farm Project footprint and 10-mile buffer area, during aerial surveys in April 2019.

Nest Number[1]	Activity	Distance from Project footprint (miles)	Adults Present	Number of Eggs/Young	Nest Substrate	Nest Height (meters)	Condition	Comments
2016-2 (DR-02)	Alternate	2.3	None	None	Deciduous Tree	25	Fair	
2016-4 (DR-04)	In-use	3.1	1 adult bald eagle sitting on nest.	Unknown	Deciduous Tree	20	Excellent	
2016-5 (DR-05)	Alternate	8.8	1 adult Great horned owl sitting on nest.	1 egg	Deciduous Tree	25	Excellent	Nest was large enough to be a bald eagle nest and was previously occupied by bald eagles in spring 2017[2].
2017-1 (DR-06)	In-use	9.0	1 adult bald eagle sitting on nest.	Unknown	Deciduous Tree	22	Excellent	
2017-3 (DR-08)	Alternate	4.5	None	None	Deciduous Tree	25	Good	
2018-1	In-use	9.6	1 adult bald eagle sitting on nest; 1 other adult bald eagle perched in tree nearby.	None	Deciduous Tree	20	Excellent	
2018-2	Alternate	7.2	None	None	Deciduous Tree	22	Good	

[1] Nest Number in (parenthesis) is former WEST Nest ID

[2] WEST, 2017

Table 2. Other raptor nests observed within the Dakota Range Wind Farm Project footprint during aerial surveys in April 2019.

Nest Number	Species	Activity	Distance from Project footprint (miles)	Adults Present	Number of Eggs/Young	Nest Substrate	Nest Height (meters)	Condition	Comments
2017-15 (DR-20)	RTHA	In-use	Within	1 adult RTHA sitting on nest.	Unknown	Deciduous Tree	20	Excellent	Nest present in 2017 and 2018 but not occupied at time of surveys in those years.

Table 3. Status of all raptor nests observed within the Dakota Range Wind Farm Project footprint and 10-mile buffer area during aerial surveys from April 2016 through April 2019.

Nest Number	Species[2]	Nest Status[1]			
		April 2016	April 2017	March 2018	April 2019
2016-1 (DR-01)	UNKN	Unoccupied	Not Found	Not Surveyed	Not Surveyed
2016-2 (DR-02)	BAEA	Occupied Active	Unoccupied	In-use	Alternate
2016-3 (DR-03)	RTHA	Occupied Active	Not Found	N/A	N/A
2016-4 (DR-04)	BAEA	Occupied Active	Occupied Active	In-use	In-use
2016-5 (DR-05)	GHOW	Occupied Active	Occupied Active	Alternate	Alternate
2017-1 (DR-06)	BAEA	N/A	Occupied Active	In-use	In-use
2017-2 (DR-07)	BAEA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-3 (DR-08)	BAEA	N/A	Occupied Active	Alternate	Alternate
2017-4 (DR-09)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-5 (DR-10)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-6 (DR-11)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-7 (DR-12)	UNKN	N/A	Unoccupied	Not Found	Not Found
2017-8 (DR-13)	GHOW	N/A	Occupied Active	Not Found	Not Found
2017-9 (DR-14)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-10 (DR-15)	UNKN	N/A	Unoccupied	Not Found	Not Found
2017-11 (DR-16)	UNKN	N/A	Unoccupied	Not Surveyed	Not surveyed
2017-12 (DR-17)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-13 (DR-18)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-14 (DR-19)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed

Nest Number	Species[2]	Nest Status[1]			
		April 2016	April 2017	March 2018	April 2019
2017-15 (DR-20)	RTHA	N/A	Unoccupied	Alternate	In-use
2017-16 (DR-21)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-17 (DR-22)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-18 (DR-23)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-19 (DR-24)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-20 (DR-25)	RTHA	N/A	Occupied Active	Not Found	Not Found
2017-21 (DR-26)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-22 (DR-27)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-23 (DR-28)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-24 (DR-29)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-25 (DR-30)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-26 (DR-31)	UNKN	N/A	Unoccupied	Not Found	Not Found
2017-27 (DR-32)	UNKN	N/A	Unoccupied	Not Found	Not Found
2017-28 (DR-33)	GHOW	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-29 (DR-34)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-30 (DR-35)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-31 (DR-36)	GHOW	N/A	Occupied Active	Not Surveyed	Not Surveyed
2017-32 (DR-37)	UNKN	N/A	Occupied Inactive	Not Surveyed	Not Surveyed
2017-33 (DR-38)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed
2017-34 (DR-39)	UNKN	N/A	Unoccupied	Not Surveyed	Not Surveyed

Nest Number	Species[2]	Nest Status[1]			
		April 2016	April 2017	March 2018	April 2019
2017-35 (DR-40)	RTHA	N/A	Occupied Active	Not Surveyed	Not Surveyed
2018-1	BAEA	N/A	N/A	Alternate	In-use
2018-2	BAEA	N/A	N/A	In-use	Alternate
2018-3	UNKN	N/A	N/A	Alternate	Not Found

[1]Nest status: "Not surveyed" raptor nests indicate that these nests were not within the nest survey area during that year. "N/A" indicates not applicable
Note: Final rule (USFWS 2016) changed nest activity criteria to in-use or alternate. All nest activity for nests surveyed before 2017 were categorized as occupied active, occupied inactive, or unoccupied. Occupied active correlates to in-use and occupied inactive and unoccupied correlate to alternate.
[2]Species: UNKN = Unknown, BAEA = Bald Eagle, RTHA = Red-tailed Hawk, GHOW = Great Horned Owl

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APPENDIX A

FIGURES

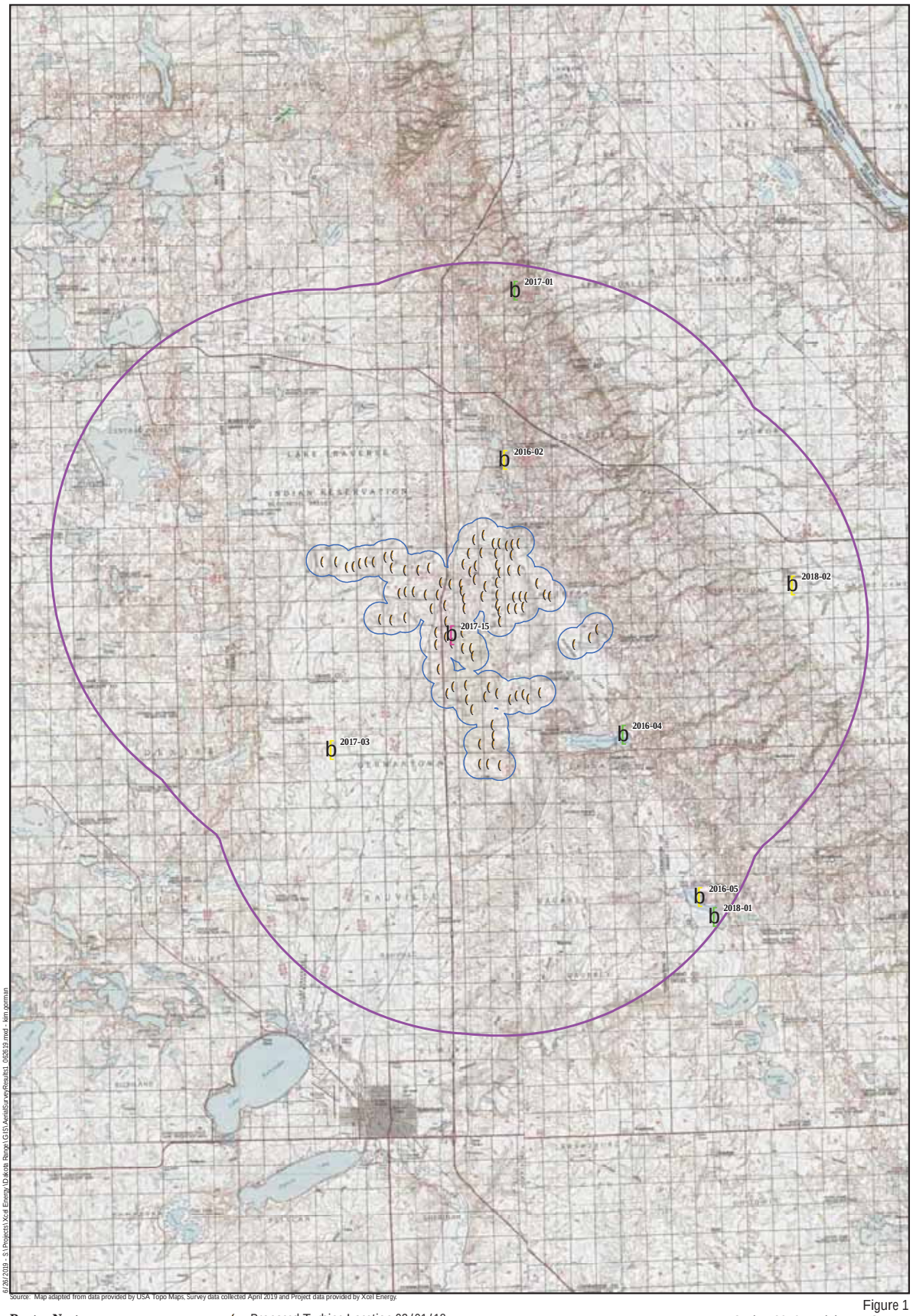
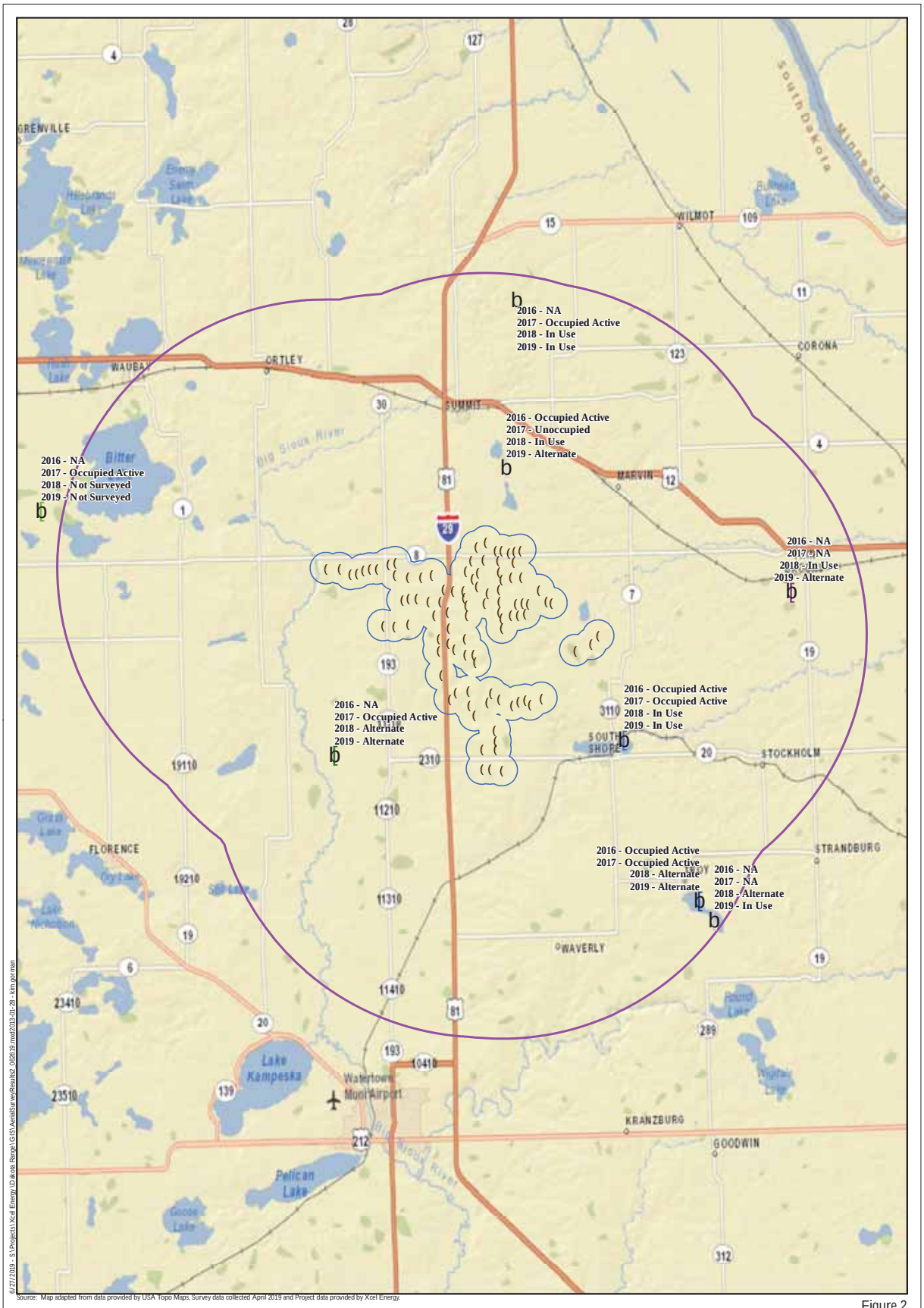


Figure 1
Spring 2019 Aerial Nest Survey
Dakota Range Wind Farm Project
Grant and Codington Counties, South Dakota



Surveyed Eagle Nest (Status by Year)

- 2016-02
- 2016-04
- 2016-05
- 2017-01
- 2017-02
- 2017-03
- 2018-01
- 2018-02

Proposed Turbine Location 03/01/18
Project Footprint
Nest Survey Area

0 1 2 3 4 5 Miles

Figure 2
Surveyed Eagle Nest Status by Year
Dakota Range Wind Farm Project
Grant and Codington Counties, South Dakota

Xcel Energy™ TETRA TECH

APPENDIX B

SITE PHOTOGRAPHS

Nest 2016-2: Alternate bald eagle nest located approximately 2.3 miles north of the Project footprint. Nest was empty, and no adults were observed in the vicinity of the nest.

Nest 2016-4: In-use bald eagle nest located approximately 3.1 miles east of the Project footprint. One adult bald eagle was observed sitting on the nest.

Nest 2016-5: Alternate bald eagle nest located approximately 8.8 miles southeast of the Project footprint. One adult great-horned owl was observed sitting on the nest.

Nest 2017-1: In-use bald eagle nest located approximately 9 miles north of the Project footprint. One adult bald eagle was observed sitting on nest.

Nest 2017-3: Alternate bald eagle nest located approximately 4.5 miles west of the Project footprint. Nest was empty, and no adults were observed in the vicinity of the nest.

Nest 2018-1: In-use bald eagle nest located approximately 9.6 miles southeast of the Project footprint. One adult bald eagle was observed sitting on the nest and other adult was observed perched in a tree nearby.

Nest 2018-2: Alternate bald eagle nest located approximately 7.2 miles east of the Project footprint. Nest was empty, and no adults were observed in the vicinity of the nest.

Nest 2017-15: In-use raptor nest located within the Project footprint. One adult red-tailed hawk was observed sitting on the nest.

2019 Fall Avian Survey Report

Dakota Range Wind Farm

Grant and Codington Counties, South Dakota

January 7, 2020

PRESENTED TO

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APPENDICES

1.0 INTRODUCTION

Xcel Energy (Xcel) is proposing to construct the Dakota Range Wind Farm (Project) in Grant and Codington counties, South Dakota. The Project is located approximately 12 miles north of Watertown, South Dakota and is anticipated to be up to 302.4 megawatt (MW) in size and will include up to 72 turbines located within approximately 28,873 acres (the Project footprint; Appendix A:Figure 1). Xcel is committed to environmental due diligence and contracted Tetra Tech, Inc. (Tetra Tech) to conduct fixed-point avian use surveys in the Project footprint. Two phases of surveys were chosen to evaluate avian use of the Project footprint. Six rounds were conducted between August 27, 2018 through October 30, 2018 and summarized in a 2018 Fall Avian Survey Report (Tetra Tech 2018). This report contains the results of the six rounds of avian surveys conducted from August 28, 2019 through November 7, 2019. This baseline study provides data for characterizing the avian use at the Project footprint during fall migration season to quantify potential avian impacts associated with construction and/or operation of the proposed Project.

Nationally, research and monitoring completed to date has revealed the following potential impacts to avian species as a result of wind energy development: 1) direct impacts to habitat from the Project's facilities and infrastructure, 2) indirect impacts by displacement through mechanisms not yet determined, and 3) direct mortality from turbine collision (Erickson et al. 2014, Graff et al. 2016, Smith and Dwyer 2016). However, because potential avian impacts depend on a number of factors (project size, turbine models used, geographic location, etc.), assessment of risks to avian species must be analyzed on a project-by-project basis.

2.0 PROJECT FOOTPRINT

The Project footprint is located in the Northern Glaciated Plains ecoregion, which is characterized by a flat to gently rolling landscape composed of glacial drift (USGS 2016). Sub-humid conditions foster a grassland which is transitional between tall and shortgrass prairie. High concentrations of temporary and seasonal wetlands create favorable conditions for duck nesting and migration stopover. Though the till soil is very fertile, agricultural success is subject to annual climatic fluctuations.

The land cover within the Project footprint observed during avian surveys was consistent with the land cover described for the ecoregion as a whole and consisted primarily of grasslands, agricultural lands used for grain crops, developed land (farmsteads), and wetlands. A mix of deciduous trees planted for windbreaks surround most farmsteads within the Project footprint. Topography in the Project footprint is generally flat, and the vegetation cover is uniformly low. Photographs of the Project footprint taken from the point count locations are included as Appendix D.

The Project is located within the Central Flyway, one of the four main migratory bird routes in the United States (United States Fish and Wildlife Service [USFWS] 2015). During spring and fall migration, most birds that move along the Central Flyway travel between breeding grounds as far north as northern Canada and wintering grounds as far south as the tropics of South America. The Project lies within North American Bird Conservation Region

(BCR) 11 (Prairie Potholes) which provides the most important waterfowl production habitat on the North American continent (NABCI 2016). BCR 11 comprises the core of the breeding range of most dabbling duck and several diving duck species, as well as providing critical breeding and migration habitat for over 200 other bird species (NABCI 2016).

3.0 METHODS

3.1 POINT COUNT SURVEYS

The objective of the point count surveys was to estimate bird use in the Project footprint during the fall migration period (August 28-November 7, 2019) and followed recommendations in the U.S. Fish and Wildlife Service (USFWS) Voluntary Land-based Wind Energy Guidelines (WEG; USFWS 2012).

3.1.1 Survey Design

Tetra Tech distributed 18 point count locations across the Project footprint to obtain representative coverage of the habitat types and were sited to give the greatest possible view shed at each location (Appendix A: Figure 2, Appendix D). Surveys at each point count location lasted for 20 minutes, during which time the biologist continuously scanned for birds and recorded any visual or auditory observations within a 800-meter survey buffer. Tetra Tech chose 20-minute survey periods because they provide adequate time to detect both raptors and non-raptors. However, time periods of 20 minutes may lead to double-counting (i.e., counting the same individual more than once) because individuals may appear and disappear from view. For example, if a horned lark is detected perched on a fence then disappears from view and, 6 minutes later, a horned lark is seen flying, these birds are recorded as separate observations because it is not possible to distinguish individuals. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-minute survey, not number of distinct individual birds.

Rangefinders and reference points were used to identify flight height and distance of birds from the point count location. Data recorded during each survey included: date, start and end time, and weather (temperature, wind speed, wind direction, precipitation, visibility, and cloud cover). Additional data were collected for each individual observation of a bird; species (identified to the lowest possible taxonomic level), age, sex, time of observation, number of individuals, activity (walking, flying, perched, other), distance from observer, flight height, flight direction, habitat type, and if the detection was auditory and/or visual (Appendix C). Surveys were conducted bi-weekly from August 28, to November 7, 2019 to coincide with the fall migration period at the Project footprint.

The survey protocol was designed to collect data on all diurnal bird species as opposed to targeting specific taxa, and to provide results that are comparable with other studies of avian use at wind farms. Surveys encompassed all daylight hours and the order in which the point counts were surveyed was varied so that roughly equal numbers of surveys at each point were conducted throughout the day. Detectability varies among species and potentially not all individuals within the 800-m radius were counted which could result in an overestimate of mean use for

conspicuous species and an underestimate of mean use for reclusive species (Thompson 2002). Birds not easily identifiable, such as those seen under low light conditions or small birds seen at a distance were identified to the lowest taxonomic level possible and are included in the results.

3.1.2 Analysis

Tetra Tech derived avian use (mean use) of the Project footprint by calculating the number of birds observed by species per 20-minute survey at each point. To evaluate the diversity and composition of avian species using the Project footprint, Tetra Tech calculated the total number of individuals and species seen at all points during the survey period. In addition, the number of observations was also calculated, where an observation can be either an individual bird or a discrete flock of birds. This information helps evaluate if the number of individuals observed, or high mean use, is driven by a single event (e.g., a large flock of birds moving through the Project footprint during migration). Because individual birds are not uniquely marked and identified, actual population size or abundance cannot be determined. Since individuals may be counted multiple times during a survey period or across survey periods, avian mean use does not equate to abundance.

Flight behavior was evaluated by calculating the proportion of flying birds that were observed below, within, or above the turbine rotor swept area (RSA) which is defined as the height interval through which turbine blades are expected to pass. Xcel is currently considering a variety of turbine models for use within the Project footprint. For the purposes of estimating risk to avian species, Tetra Tech used an RSA of 25 meters to 175 meters above ground surface to account for flexibility in turbine model choice. A bird was considered to have flown within the RSA if any of its recorded heights overlapped the RSA.

4.0 RESULTS

4.1 AVIAN USE OF THE PROJECT FOOTPRINT

The 18 point count locations were surveyed 6 times each, resulting in 108, 20-minute surveys. A total of 2,732 birds from 45 species (including 107 birds identified only to species group) were observed within the Project footprint. Overall mean use was 25.30 birds/20 minutes, for the combined identified and unidentified birds (Table 1). Songbirds exhibited the highest mean use (14.32 birds/20 minutes), with 56.63 percent of the total birds observed belonging to this group. The three songbird species with the highest mean use were European starling (*Sturnus vulgaris*, 3.83 birds/20 minutes), brown-headed cowbird (*Molothrus ater*, 3.52 birds/20 minutes), and horned lark (*Eremophila alpestris*, 2.75 birds/20 minutes). All other songbird species had a mean use of 0.55 birds/20 minutes or less (Table 1).

Waterfowl had the second highest mean use by species group (7.84 birds/20 minutes). Two species of waterfowl, plus one unidentified species, were recorded, with Canada goose (*Branta canadensis*), having the highest mean use among all birds (7.38 birds/20 minutes), followed by mallard (*Anas platyrhynchos,* 0.24 birds/minutes) (Table 1).

Shorebirds exhibited the third highest mean use of any species group (1.30 birds/20 minutes). Two species were recorded; killdeer (*Charadrius vociferus,* 1.24 birds/20 minutes) and Wilson's snipe (*Gallinago delicata,* 0.06 birds/20 minutes). All other species groups had mean use of less than 0.77 birds/20 minutes (Table 1).

Avian use was not evenly distributed across the Project footprint with 2 point count locations (10 and 11) accounting for 37% of the total birds observed (Table 2). Point count location 11 accounted for the highest percentage of birds observed (23.5%) while the smallest percentage of birds was observed at point count location 5 (0.5%; Table 2).

Table 1. Avian Species Observed During 2019 Fall Avian Surveys

Species Grouping	Number of Birds	Number of Observations	Mean Use (# birds/20 minutes)	Percent Composition (# birds/grand total)
Songbirds	**1,547**	**137**	**14.32**	**56.63%**
European starling	414	6	3.83	15.15%
Brown-headed cowbird	380	13	3.52	13.91%
Horned lark	297	21	2.75	10.87%
Barn swallow	59	9	0.55	2.16%
Western meadowlark	58	26	0.54	2.12%
Red-winged blackbird	56	6	0.52	2.05%
Cliff swallow	55	3	0.51	2.01%
Tree swallow	51	8	0.47	1.87%
Unidentified blackbird	46	3	0.43	1.68%
Unidentified swallow	20	1	0.19	0.73%
Dark-eyed junco	18	1	0.17	0.66%
Unidentified sparrow	17	5	0.16	0.62%
Dickscissel	16	3	0.15	0.59%
American goldfinch	13	7	0.12	0.48%
American crow	9	4	0.08	0.33%
Field sparrow	8	5	0.07	0.29%
Yellow-headed blackbird	7	1	0.06	0.26%
Blue jay	5	3	0.05	0.18%
Common yellowthroat	3	1	0.03	0.11%
Harris' sparrow	3	1	0.03	0.11%
Northern flicker	3	3	0.03	0.11%
Song sparrow	3	2	0.03	0.11%
House sparrow	2	1	0.02	0.07%
American robin	1	1	0.01	0.04%
Chipping sparrow	1	1	0.01	0.04%
Common grackle	1	1	0.01	0.04%

Species Grouping	Number of Birds	Number of Observations	Mean Use (# birds/20 minutes)	Percent Composition (# birds/grand total)
Grasshopper sparrow	1	1	0.01	0.04%
Waterfowl	**847**	**28**	**7.84**	**31.00%**
Canada goose	797	21	7.38	29.17%
Mallard	26	3	0.24	0.95%
Unidentified duck	24	4	0.22	0.88%
Shorebirds	**140**	**13**	**1.30**	**5.12%**
Killdeer	134	12	1.24	4.90%
Wilson's Snipe	6	1	0.06	0.22%
Pigeons/Doves	**83**	**23**	**0.77**	**3.04%**
Rock pigeon	61	12	0.56	2.23%
Mourning dove	22	11	0.20	0.81%
Waterbirds	**48**	**7**	**0.44**	**1.76%**
Ring-billed gull	26	3	0.24	0.95%
Franklin's gull	18	1	0.17	0.66%
Great egret	3	2	0.03	0.11%
Great blue heron	1	1	0.01	0.04%
Raptors	**41**	**38**	**0.38**	**1.50%**
Red-tailed hawk	17	14	0.16	0.62%
Northern harrier	14	14	0.13	0.51%
American kestrel	7	7	0.06	0.26%
Turkey vulture	3	3	0.03	0.11%
Gamebirds	**25**	**3**	**0.23**	**0.92%**
Sharp-tailed grouse	23	1	0.21	0.84%
Ring-necked pheasant	2	2	0.02	0.07%
Other	**1**	**1**	**0.01**	**0.04%**
Belted kingfisher	1	1	0.01	0.04%
Grand Total	**2,732**	**250**	**25.30**	**100%**

4.1.1 Species of Concern

No federal or state endangered, threatened, or candidate species were observed during the 2019 fall avian surveys (Table 1).

4.1.2 Raptors

Raptors are a group of special interest when considering impacts from wind energy development due to their propensity to fly at heights similar to turbine RSAs. Four raptor species were observed within the Project footprint during the 2019 fall avian surveys: red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus hudsonius*), American kestrel (*Falco sparverius*), and turkey vulture (*Cathartes aura*). Overall mean use for raptors was 0.38 birds/20 minutes, and the raptor species with the highest mean use was red-tailed hawk (0.16 birds/20 minutes) (Table 1).

4.2 FLIGHT BEHAVIOR

Behavioral data was collected for all individuals observed and 96% exhibited some form of flight behavior. Thirty-six species (Including 4 unidentified categories) were observed in flight with, 21 species (plus 2 unidentified categories) were observed flying within the RSA. Fifteen species and 2 unidentified categories were observed only in low altitude flight below the RSA and no species were observed only in high altitude flight above the RSA (Table 3). The species most frequently observed flying within the RSA were Canada goose (*Branta canadensis;* 705) and brown-headed cowbird (*Molothrus ater*, 82; Table 3).

Table 2. Number of Individuals Recorded by Point Count Location During 2019 Fall Avian Surveys

Species	Point Count Location																		Total Number of Individuals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Canada goose	18								59	200	157	19	71		138	75	33	27	797
European starling		50			2	25				100	187	50							414
Brown-headed cowbird		1				2		7	1		187	37			85		50	10	380
Horned lark	1		61	50		14	3	4	5	10	52	3	8		16	15	2	53	297
Killdeer		1			1	2	13			1	3	101				1	11		134
Rock pigeon	4				2		6				3	3		19			24		61
Barn swallow	1	4	9	23	3	7	3					4				5			59
Western meadowlark	3	5	3				6	2	5	12		8	1	1	2	5	1	4	58
Red-winged blackbird							1	2		46			4		3				56
Cliff swallow						1							4			50			55
Tree swallow	4	1	15	20			5		2				3					1	51
Unidentified blackbird											21							25	46
Mallard									11						15				26
Ring-billed gull															20	6			26
Unidentified duck		2							6				15	1					24
Sharp-tailed grouse								23											23
Mourning dove	1		7				1	1	2		6		2					2	22
Unidentified swallow																20			20
Darek-eyed junco											18								18

Species	Point Count Location																		Total Number of Individuals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
Franklin's gull															18				18
Red-tailed hawk			2				2	1		2		4	3		1		2		17
Unidentified sparrow		2	8	2										2	3				17
Dickscissel									2	5			9						16
Northern harrier			1		1		2			1		2	1	1	3		1	1	14
American goldfinch								2			7		1	1	1		1		13
American crow	5					1									2		1		9
Field sparrow			1			1			4								1	1	8
American kestrel	2			1			1	3											7
Yellow-headed blackbird		7																	7
Wilson's snipe			6																6
Blue jay												1				1	3		5
Common yellowthroat						3													3
Great egret					2											1			3
Harris' sparrow																	3		3
Northern flicker								1				1				1			3
Song sparrow													1				2		3
Turkey vulture				1	1							1							3
House sparrow														2					2
Ring-necked pheasant				1														1	2

Species	Point Count Location																		Total Number of Individuals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
American robin							1												1
Belted kingfisher					1														1
Chipping sparrow	1																		1
Common grackle											1								1
Great blue heron					1														1
Grasshopper sparrow												1							1
Totals	**40**	**73**	**113**	**98**	**14**	**56**	**44**	**46**	**97**	**377**	**642**	**235**	**123**	**27**	**307**	**180**	**135**	**125**	**2,732**
Percent of Overall Total (%)	**1.5**	**2.7**	**4.1**	**3.6**	**0.5**	**2.0**	**1.6**	**1.7**	**3.6**	**13.8**	**23.5**	**8.6**	**4.5**	**1.0**	**11.2**	**6.6**	**4.9**	**4.6**	**100%**

Table 3. Avian Flight Height Characteristics in Relation to the RSA

Species Grouping	Number Observed in Flight	Percent Flying Below RSA	Percent Flying Above RSA	Percent Flying Within RSA
Waterfowl	**798**	**6.6%**	**0%**	**93.4%**
Mallard	26	3.8%	0%	96.2%
Canada goose	748	5.7%	0%	94.3%
Unidentified duck	24	37.5%	0%	62.5%
Waterbirds	**45**	**13.3%**	**0%**	**86.7%**
Franklin's gull	18	0%	0%	100%
Great egret	1	0%	0%	100%
Ring-billed gull	26	23.1%	0%	76.9%
Raptors	**41**	**61.0%**	**0%**	**39.0%**
Red-tailed hawk	17	23.5%	0%	76.5%
Turkey vulture	3	33.3%	0%	66.7%
Northern harrier	14	92.9%	0%	7.1%
American kestrel	7	100%	0%	0%
Pigeons/Doves	**82**	**64.6%**	**0%**	**35.4%**
Rock pigeon	61	55.7%	0%	44.3%
Mourning dove	21	90.5%	0%	9.5%
Songbirds	**1,500**	**81.5%**	**0%**	**18.5%**
American robin	1	0%	0%	100%
Unidentified swallow	20	0%	0%	100%
Cliff swallow	55	1.8%	0%	98.2%
Dickscissel	16	31.3%	0%	68.8%
Northern flicker	3	66.7%	0%	33.3%
Brown-headed cowbird	355	76.9%	0%	23.1%
Horned lark	296	82.1%	0%	17.9%
European starling	414	87.4%	0%	12.6%
American crow	8	87.5%	0%	12.5%
American goldfinch	13	92.3%	0%	7.7%

Species Grouping	Number Observed in Flight	Percent Flying Below RSA	Percent Flying Above RSA	Percent Flying Within RSA
Red-winged blackbird	55	98.2%	0%	1.8%
Barn swallow	59	100%	0%	0%
Blue jay	1	100%	0%	0%
Common grackle	1	100%	0%	0%
Dark-eyed junco	18	100%	0%	0%
Field sparrow	8	100%	0%	0%
Harris' sparrow	3	100%	0%	0%
House sparrow	2	100%	0%	0%
Song sparrow	2	100%	0%	0%
Tree swallow	51	100%	0%	0%
Unidentified blackbird	46	100%	0%	0%
Unidentified sparrow	14	100%	0%	0%
Western meadowlark	52	100%	0%	0%
Yellow-headed blackbird	7	100%	0%	0%
Shorebirds	**131**	**99.2%**	**0%**	**0.8%**
Killdeer	125	99.2%	0%	0.8%
Wilson's snipe	6	100%	0%	0%
Gamebirds	**23**	**100%**	**0%**	**0%**
Sharp-tailed grouse	23	100%	0%	0%
Other	**1**	**100%**	**0%**	**0%**
Belted kingfisher	1	100%	0%	0%
Totals	**2,621**	**57.8%**	**0%**	**42.2%**

Note: Percentage presented in table is of the number of birds in flight, not of the total number of birds recorded.

5.0 DISCUSSION AND CONCLUSIONS

The mix of grassland and wetland habitat observed within the Project footprint provides habitat for resident and migrating birds. Species observed in the Project footprint with the highest mean use are consistent with those species that prefer grassland and wetland habitats.

Songbirds exhibited the highest mean use among the species groups observed, although only 18.5% of the songbirds observed flying were within the RSA (Table 3). Studies have found higher fatality numbers at wind projects for songbirds than any other taxa, although less than one-tenth of one percent of the continent-wide population of each songbird species is estimated to be killed annually by collisions with wind turbines (AWWI 2019, Erickson et al. 2014). The three most commonly observed songbird species (European starling, brown-headed cowbird, and horned lark), detected during this study have stable populations, likely due to their adaptability to changing habitats and human disturbance (Rosenberg et al. 2016; Sauer et al. 2017). Given their wide-spread occurrence, high numbers, and stable populations, population-level impacts to any of the songbirds observed during this study are unlikely as a result of turbine-related mortality that may occur at the Project. Waterfowl were also seen during the 2019 fall avian surveys and 93.4% of the individuals flew within the RSA (Table 3). Although turbine-related fatalities may occur to waterfowl, their wide-spread distribution, high numbers, and stable populations, make population level impacts unlikely (Sauer et al. 2017).

Special consideration is often given to raptor species at wind farms because diurnal raptors are generally at higher risk for collision with turbines than are many other avian species (AWWI 2019). High raptor use has been associated with high raptor mortality at new generation wind farms (Erickson 2007), and conversely, raptor mortality appears to be low when raptor use is low, defined by Erickson (2007) as less than 1.0 birds/20 min. Based on the low mean use recorded (0.38 birds/20 min), the Project would be considered a low risk site for fall raptor mortality (Table 1).

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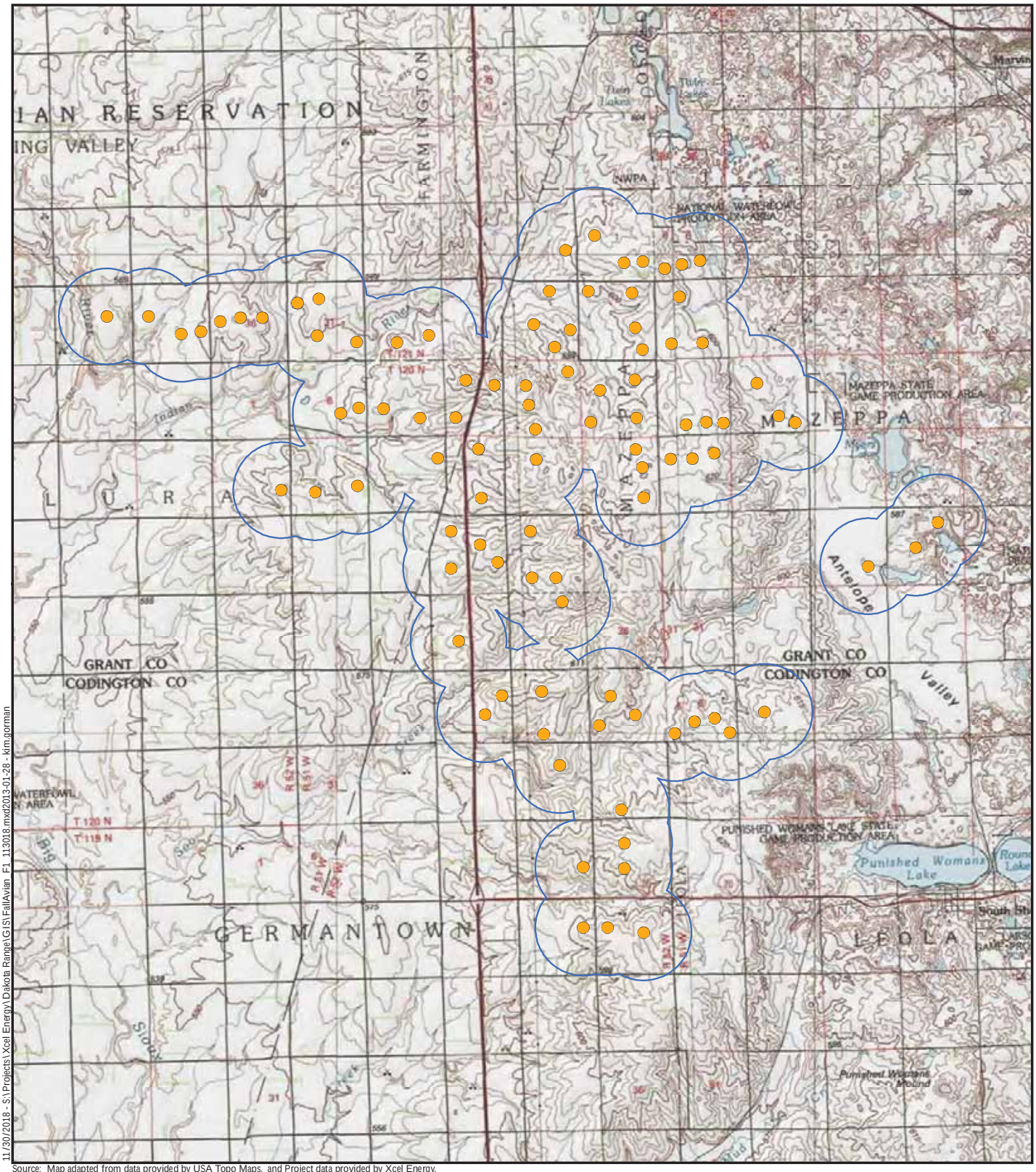
APPENDIX A. FIGURES



11/30/2018 - S:\Projects\Xcel Energy\Dakota Range\GIS\FallAvian_F1_113018.mxd2013-01-28 - kim.gorman

Source: Map adapted from data provided by USA Topo Maps, and Project data provided by Xcel Energy.

Proposed Turbine Location 3/7/2018

Project Footprint (1km Turbine Buffer)

0 1 2 3 Miles

N

Figure 1: Site Vicinity
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

Xcel Energy

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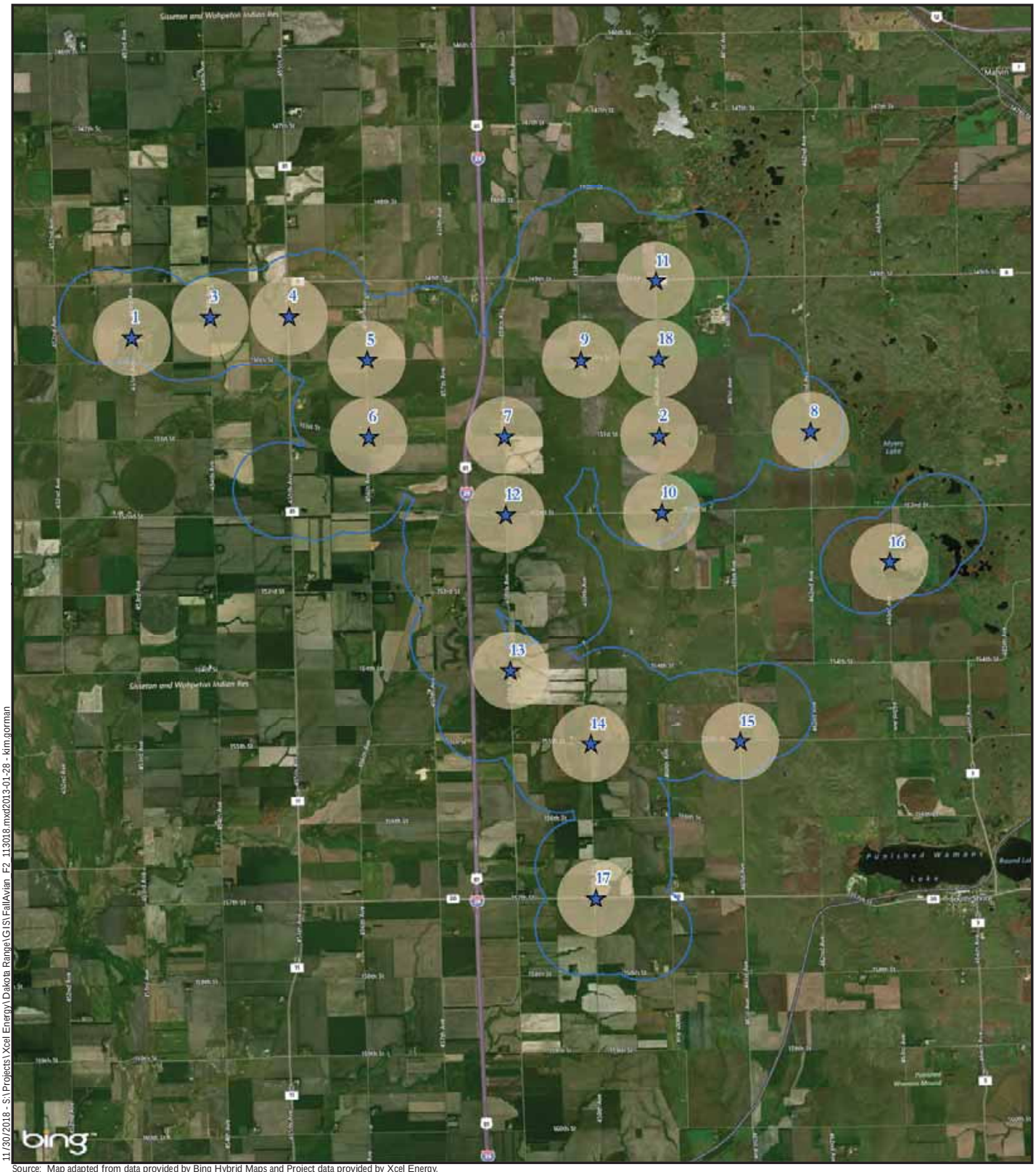

11/30/2018 - S:\Projects\Xcel Energy\Dakota Range\GIS\FallAvian_F2_113018.mxd2013-01-28 - kim.gorman

Source: Map adapted from data provided by Bing Hybrid Maps and Project data provided by Xcel Energy.

Avian Point Count Location (n=18)
800-Meter Survey Buffer
Project Footprint (1km Turbine Buffer)

0 1 2 3 Miles

N

Figure 2: Avian Point Count Locations
Dakota Range Wind Farm
Grant and Codington Counties, South Dakota

Xcel Energy
TETRA TECH

APPENDIX B. AVIAN POINT COUNT SURVEY PROTOCOL

TETRA TECH

Avian Point Count Survey Protocol

1.0 Methods

The methodology employed here is a wind industry standard avian point count survey designed to determine the overall avian use of the area. To this end, 20-minute (min) point counts within an 800-meter (m) radius over the course of 1-2 days (depending on number of points) are utilized.

1.1. Prior to Conducting Surveys

Land Owner Contact

In many cases, projects will have a lease agent which will provide you with information. If you are asked to contact landowners directly, ask the following:

- Are there any locked gates? If so, what is the combination?
- Are there any places that I should not go?
- Are there hunters on the property?
- Are there any time restrictions as to when I can be on the property?
- Is there anything else that I should know (e.g., road conditions, fences, cattle, lambing season)?

Equipment List

- Binoculars
- Watch that displays in 24-hour time
- GPS unit
- Compass
- Field map with turbine strings if available
- Field notebook
- Digital camera
- Pens/Pencils
- Flagging tape
- Clip board (preferably with weather protection)
- Bird book
- Range finder that registers both horizontal and vertical (for example, OPTi-LOGIC 1000 LH Rangefinder Hypsometer)
- Anemometer (Kph)
- Thermometer
- Data sheets (point count, incidental, point count schedule, distance/height calibration worksheet)
- List of 4-letter species codes/List of unknown bird codes

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2001 Killebrew Drive, Sutie 141, Bloomington, MN 55425
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1.2. Conducting Surveys

Key Points

- Your safety is the highest priority. If there is a situation that feels unsafe (e.g., lightning storm, confrontational person, washed-out road), do not survey that point and remove yourself to a safe location.
- Documenting bird use of the area is the goal of the point count survey. Thus, the priority is to identify "Species", "Number of individuals" and "Activity." Individual birds' characteristics are secondary.
- Surveys are meant to capture avian use throughout the day and, therefore, are conducted during all weather (except when visibility is reduced (see section 1.2.2) or the situation is unsafe) and during all daylight hours. *Keep track of when during the day points are surveyed using the Time Tracker Data Table.*
- For any weekly survey all points must be surveyed within 7 days and there shall be no less than 4 days from the date of the last survey to the beginning of next survey week.
- Legible handwriting is key; please make every effort to write legibly, preferably using a dark pencil or waterproof pen.
- If you observe any federal or state-listed Threatened & Endangered species, take detailed notes of observations on the appropriate data sheet.

1.2.1. Point Count Datasheets

All fields

- All blanks on the datasheet should be filled in. If you are unable to determine a value (e.g., sex or age) then draw a dash in the box so that it is clear that the information was not available and not that the observer forgot to write it down. You must check the data sheet for errors and omitted information from top to bottom following the survey before moving on to the next point location.

Point data (top of the datasheet):

Date:

- Date survey was conducted.

Observer:

- Initials of the surveyor of record.
- NOTE: If there are two people at a point, one person is the official observer and the other person should act only as the recorder.

Start time and End time:

- Time survey begins and ends. If at any time during the survey period you are interrupted for less than 1 minute you may suspend the survey and continue when the interruption has ended. Record the time that the interruption occurred and the time it ended. However, if an interruption lasts more than 1 minute you will need to stop the survey and restart the 20- (or 30-) min survey clock. The data you collected prior to the interruption are no longer valid.

Visibility:

- Distance in meters you are able to see.
- If you are able to see the entire 800-m circle during your survey, mark "Clear"
- If you did not mark "Clear":
    - As overall visibility may change within a survey period, we ask you to record both the minimum (Min) and maximum (Max) visibility you had during the survey period.
        - Example: If you can see 1000m to the north, but only 200m to the south , write "Min: 200m and Max: 1000m".
        - Example: If you can see 400m in the beginning of the survey and 700m by the end write "Min:400m and Max: 700m".
- If at any time you are unable to see less than 50% of the 800-m radius circle and/or the cloud ceiling drops below 100m, you either need to postpone or stop the survey. When you are able to see at least 50% of the circle and the cloud ceiling is higher than 100m you may resume the survey. However, if the break was greater than 1min you will need to start the survey over again. The data you collected prior to the reduction in visibility are no longer valid.

Wind Direction:

- Record the direction the wind is originating from (not the direction it is traveling).

Wind Speed (km/h):

- Record the range of wind speeds that occur during the survey period. Fill in both a minimum and maximum wind speed. All wind speed data must be recorded in kilometers per hour (km/h).

Precipitation:

- Circle the appropriate precipitation. If "other" please define in the Notes section.
    - Do not conduct survey if the precipitation limits your visibility to less than 50% of the 800-m circle.

Temp (˚F):

- Temperature during survey period. Please record all temperatures in degrees Fahrenheit.

Cloud Cover (%):

- Record the percentage of clouds covering the 800-m circle.
    - Do not conduct survey if the cloud cover is 100% and the cloud ceiling is lower than 150 m.

Observation data(bottom section of datasheet): Species codes:

- A state-specific species list with the codes we use will be provided to you at the beginning of the field season. We use the 4-letter codes from Pyle's *Identification guide to North American Birds*". Most of these codes are the same as BBL codes; however, there are some differences. Please check your codes the first time out to ensure that you use the correct code.
- If you are unable to identify the species, a separate list for unknown birds is provided.
- If you are unsure of the species code, write the full name of the bird you saw in the Notes section and fill in the appropriate code when you are able to check the code list sent you.
- If a mixed species flock is observed, please note the observation by recording each species on a separate line and estimating the number of individuals for each species. You should write in the notes column that the species was part of a mixed species flock (see example datasheet).
- For unidentified species please write out any additional information that might refine the possibilities in the notes column. For example, if you record UNSW, in the Notes column, you might write "tree swallow or violet-green swallow."

Time:

- Time is the time you first saw the bird.
- Time is recorded using a 24-hour clock (to avoid am/pm time confusion).

Sex:

- Field should be filled in as male (M), female (F), or both (B).
- If you know the number of males and females, write in the Notes.
- If unknown, draw a line through the box.

Age:

- Field should be filled in as adult (A) or juvenile (J) or both (B).

- If you know the number of adults and/or juveniles, write in the notes column.
- If unknown, draw a line through the box.

Number of individuals:

- Always fill in this field, even in "auditory-only" detections.
- Estimate this number when uncertain.
- Estimates are most accurate at time of observation and do not need any numerical symbols (e.g., ~ or ±) to accompany them.

Activity:

- Circle the first activity observed.
- Put a check mark over the second activity.
  - Walking: bird was on the ground (height is 0).
  - Perching: bird was perched above ground (e.g., tree, fence).
  - Flying: bird was in the air.
  - Other: only select if the activity could not be categorized as an activity listed (e.g., swimming). Please explain any "OT" selection in the Notes..
    - e.g., "mobbing" is a flying activity so select "FL" and write in Notes "mobbing").
- Additional, relevant behavioral information should be included in Notes.

Height data:

- Use a range finder to measure reference heights within the point count circle.
  - When driving by tall structures not on point counts (e.g., telephone poles, met towers, barns) use the range finder to test your ability to estimate heights.
- Two heights are recorded: lowest and highest.
- Heights should be filled in for all birds observed.
- If a bird's height does not change while observed (e.g., a perched bird), simply write the same height in each column.
- Heights should be recorded in meters (m).
- If you cannot see a bird and, therefore, cannot estimate its height, draw lines through the blanks.

Flight direction:

- This applies only to birds that do not land within the 800-m circle.
  - Example: If you see a flock of sandhill cranes flying through or above the count circle.
  - Example: You see a TUVU circle soaring and moving with thermals.
- If a bird is making localized flight movements (e.g., tree to tree) or if a bird is not flying, simply put a line through this space on the data sheet.
  - Example: If a robin changed perches by flying from one tree to another.
  - Example: A flock of blackbirds gets flushed by a passing car and settles nearby.

- Flight direction is the direction to which the bird is flying.
  - If the bird is flying from the north to the south, then the flight direction would be south.
  - The overall directionality of a circle soaring bird should be filled out (as opposed to recording "variable").

Horizontal distance:

- This is a key piece of information!
- Distance is recorded as first distance and closest distance.
- If first and closest distance are the same, use ditto marks (") in the blank.
- Record all distances in meters (m).
- Use a rangefinder and topographic map to identify the distances of distinctive features in the landscape to help with distance estimation.

Habitat types:

- Circle the primary habitat type in which birds were seen.
- Check second habitat type in which birds where seen.
- Other: only select if the habitat could not be categorized as a habitat listed (e.g., agriculture). Please explain any "OT" selection in the Notes.
- NOTE: Habitat types and codes should be identified prior to first survey. Use Habitat Codes Table for code selection. Point count description sheets should be filled out and sent in to Tetra Tech office with first survey.

Aud?/Vis? Columns:

- Check the auditory box if the bird(s) were heard.
- Check the visual box if the bird(s) was seen.
- Check both if the bird(s) was seen and heard.

Notes:

- Use the Notes column for any additional details you consider important.
- This may include, but is not limited to:
  - Behavior of the bird (e.g., male displaying to female).
  - Location of the bird (e.g., kestrel sitting on wire).
  - Taxonomic grouping of bird if species is unknown (e.g., *Buteo*).
  - If species is unknown, any characters you observed or hunches about what it was (e.g., light head, dark body, song a descending trill; or likely a HOLA or LALO).
  - Full species name, if uncertain about 4-letter code (e.g., ring-necked pheasant, unknown *Buteo*).

Additional Notes:

- Use this section at the bottom of the page for any notes that relate to the survey in general (e.g., "Snowing on and off").
- Additionally, use this section if you run out of room in the notes column for a specific observation. If you use it for this reason, write the observation number in the Obs #/Time column.

1.2.2. Pausing and/or Halting a Point Count

There may be times while conducting your point count surveys that you will need to pause or halt a point count survey(s). Some example circumstances are:

- Weather/Visibility
  - If you are unable to see at least 50% of the point count circle and/or the cloud ceiling has dropped below 100m.
  - If you are unable to reach a point due to road conditions.
- Interruptions
  - If someone approaches you to speak to you while you are conducting a survey and the interruption last more than 1 min.
  - Some activity (e.g., equipment moving through the area, field within the circle is being actively plowed) interferes with your ability to conduct the survey.
  - You get a flat tire and are unable to delay getting help until after you have finished your surveys.

Depending on the particular circumstances there are several options as to how to proceed:

- If the situation is temporary (e.g., fog rapidly moving through the area), then either wait for the situation to clear or proceed surveying other unaffected points and return to the affected point(s). Note: If you already started to survey a point and the interruption lasts more than 1 minute, you must restart the 20- (or 30-) min survey clock. The data you collected prior to the interruption are no longer valid.
- If this situation is likely to persist for the weekly survey (the number of days it typically takes you to completely survey all points) simply send a blank datasheet(s) for this point(s) with the other data you collected with an explanation written in the Notes as to why you skipped the point(s).

1.2.3. Examples of Common Problems During Surveys and What to do Someone stops and talks to you during a survey

- If survey is stopped for greater than 1 minute, the survey must start over. The data collected prior to the interruption are no longer valid.
- Talk to the person. Be polite, respectful and discrete. Remember that wind farms can be controversial and the all information you have, including survey data, is confidential.
- Tell the person, "I am in the middle of a bird survey right now and I have five minutes left. I can talk to you when I am finished if you would like to wait?"
- Record in your notes the name the person you spoke with.
- Refer the person to the development company's (client) contact.
- As maps contain confidential information, keep them out of view.

You are unsure if you have counted a bird

- Try to keep track of each bird.
- If you lose track, assume they are new individuals.
- Each unique bird should only have one line of data; therefore, if the activity/behaviors or habitat use changes during the survey, check or add in the appropriate information on the original line of data. Do not create a new line for this existing bird.
- QUICK TIP: To help keep track of birds, in the Notes box write the direction the bird was observed in.
    - Example: You have 1 singing male 200 m away to the north and 2 singing males 30 m away to the south. In 15 minutes when you hear a singing male 100 m away to the northeast, you can assume it is a new male.

You are unsure how many individuals are present

- The "number of individuals" field always MUST be filled in.
- Exact numbers are better, but if exact numbers are not possible, make a reasonable estimate.
- Using orders of magnitude (e.g., 1, 10, 50, 100) is an appropriate tool for estimating. Remember, without a number, we cannot count a record.
- "At least 1" is acceptable.
- QUICK TIP: To estimate large flocks of birds, count a group of birds (e.g., 50 individuals) and get an idea of what a group of 50 looks like. Then begin counting in groups of 50.
- QUICK TIP: To estimate singing males when there is an abundance of singing occurring, imagine dividing the circle into a pie. Concentrate on listening to one slice of that pie or one quadrant. Estimate the number of males in that quadrant only and put those male as one line item on the data sheet (noting the direction you were listening in the Comments box, so you don't lose track). Then continue in the next quadrant until you have covered the entire circle.

You are unsure of the species

- Record the species to the most specific taxonomic level possible (e.g., unidentified warbler is more specific than unidentified passerine, unidentified *Buteo* is more specific than unidentified hawk).
- Examples of possible choices, from broadest to most specific:
  - Unknown hawk
  - Unknown *Buteo*
  - Red-tailed hawk
- Check the species list to look for the appropriate unknown code.
- If an appropriate code is not listed, leave the code blank and put your species determination in the Notes field.

How do you record a perching bird?

- Perched birds should be recorded at the height they are perched.
  - Example: a bird is perched on a fence post at 1.5 m height. It flies to 4 m and lands on the ground.
    - First behavior = perching (circled)
    - Second behavior = flying (checked)
    - Third behavior = walking (checked)
    - Low height = 0 m (landed on the ground)
    - High height = 4 m
  - Example: a bird is perched on a fence post at 1.5 m height. It flies to 4 m and returns to the same fence post.
    - First behavior = perching (circled)
    - Second behavior = flying (checked)
    - Low height = 1.5 m
    - High height = 4 m

How do you record flight heights over variable topography?

- Record the height above the ground over which the bird is directly located.
- No negative height values should be recorded.

The weather changes during the survey

- If the change is dramatic then note the time and continue the survey unless the situation is dangerous or visibility is obscured in greater than 50% of the survey circle.
- If the situation is dangerous, 50% of the 800-m circle is obscured, or there is 100% cloud cover with a cloud ceiling of less than 100 m, cancel survey and return later.

Common problems with data we receive from field biologists

- Number of individuals is missing.
- Species codes are incorrect.
- Species are missing.
- Low height is higher than the maximum height observed.
- Activity or habitat is “Other”, but is not explained in the Notes.
- Activity or habitat has been left blank.

1.2.4. Incidental Observation Datasheets

Not all birds need to be recorded! Only record observations of state or federal threatened and endangered species, novel species not seen during point counts, raptors or other large birds, grouse species, common birds behaving in a way that puts them at higher risk of being affected by a turbine or large flocks (25+ individuals). Do not record unidentified birds!

- Record birds viewed outside of survey time, outside of 800-m radius of survey circle and those seen while traveling between points.

  - These observations should be made in transit. Do not stop to go birding.
- If you see a threatened or endangered species, provide detailed notes on the data sheet.
- You may also include observations of non-bird species that are of particular interest (e.g., the observation of a carcass near a point as it may draw in birds). We do not have 4-letter codes for non-bird species so if a non-bird observation is important, write the species in the Notes column and record all pertinent info.
- Familiarize yourself with general habitats outside the project area, and think about how they may be affecting the bird activity within the site (e.g., large reservoir within a mile of the site likely drawing in the water fowl flocks you are seeing). Include any information such as this you deem helpful in understanding the big picture of the site on incidental forms.

1.2.5. Time Tracker Data Table

To ensure that all points are being visited at different times of the day and that all daylight hours are being covered, record the hour in which each point was visited in the Time Tracker data table. Include this table with your last data set for the survey season.

- Record the survey date above the appropriate survey number.
- Sunrise and sunset times can be found on-line (http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html). Obtain before going into the field.
- At the time the point is surveyed, write the HOUR in the given cell. If the survey covers two hours, then write the hour that is in the majority.
  - Example: If you start the survey at 6:10am, write 6.
  - Example: If you start the survey at 2:30pm, write 14.
  - Example: If you start the survey at 2:55pm, write 15.
- All points should be visited in the first hour after sunrise at least once during the season.
- Surveys can begin approximately 15 minutes before sunrise, depending on weather and lighting conditions.
- IMPORTANT: If you are driving to the field in the morning and it is already light, you are starting surveys too late!
- IMPORTANT: If unforeseen events prevent a survey from being conducted at the normal scheduled time, two consecutive surveys must be at least 4 days apart.
  - Example: Snow prevented you to go to the field on week 1. Therefore you needed to do survey 1 on week 2. Then survey 2 must not occur until 4 days have elapsed. Survey 2 can be conducted on the 5th day.

1.2.6 Quality Assurance/Quality Control (QA/QC)

In order to produce the highest quality data Tetra Tech asks surveyors to carefully adhere to the following QA/QC standards.

- Data should **NEVER** be transcribed from one datasheet to another or from a notebook to a datasheet. We recognize the nature of fieldwork and expect sheets with cross outs, dirt. etc. If for some unavoidable reason you transcribed data, you **MUST** send both the datasheet you transcribed the data to and the original sheet the data were originally collected on (even if it is a napkin)!
- DO NOT ERASE DATA ON DATASHEETS-If you make an error simply put a line through it.
- Check your data sheets at the end of each point before moving on to the next point in order to catch any missing information while you still remember what happened.
- If data are unavailable, then please place a dash the appropriate space on the datasheet so that it is clear that this piece of data was not forgotten during the data collection.
- Each week prior to surveys, calibrate yourself for height measurements using your range finder to determine accuracy. Because we use height data to determine bird activity within the rotor swept area, it is imperative that height information is accurate. Whenever possible, determine the height of known objects within the point count circle for reference and familiarize yourself with these heights each time that point is surveyed. Additionally, practice on objects outside of the point count circle to verify your accuracy.

Note: Do not be surprised if you get an email from the person entering the data from your project asking for data clarifications.

APPENDIX C. SAMPLE AVIAN SURVEY DATA SHEET

Dakota Range Wind Project
Grant and Codington Counties, SD

Avian Fixed Point Observation Data Sheet

Date (mmddyy) _____ **Observer (init.)** _____ **Start Time** _____ **End Time** _____ **Obs Pt.**

Visibility: Clear or Min _____ Max _____ (m) **Page** ____ of ____

Wind Direction from (circle one): Calm N NE E SE S SW W NW Variable **Speed**: Low ____ High ____ (km/h)

Precipitation (circle one): none light rain rain snow sleet hail fog other **Temp:** _____ (ºF) **Cloud Cover**: _____%

Obs #	Species Code	Time	Sex	Age	# of ind.	Activity (circle 1st, X others)	Height (m) Low	Height (m) High	Flight Dir (to)	Horizontal Distance (m) 1st	Horizontal Distance (m) closest	Habitat Type (circle 1st, X others)			Aud?	Vis?	Notes
1						WA PE FL OT											
2						WA PE FL OT											
3						WA PE FL OT											
4						WA PE FL OT											
5						WA PE FL OT											
6						WA PE FL OT											
7						WA PE FL OT											
8						WA PE FL OT											
9						WA PE FL OT											
10						WA PE FL OT											
11						WA PE FL OT											
12						WA PE FL OT											

Activity Codes: WA-walking on ground, PE-perched above ground, FL-flying, OT-other (please specify)
Habitat Codes:

OBS. # (Time)	ADDITIONAL NOTES

APPENDIX D. SITE PHOTOGRAPHS

Dakota Range Wind Farm

Photograph 1: A view from point count location 1 to the north.

Photograph 2: A view from point count location 1 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 3: A view from point count location 1 to the south.

Photograph 4: A view from point count location 1 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 5: A view from point count location 2 to the north.

Photograph 6: A view from point count location 2 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 7: A view from point count location 2 to the south.

Photograph 8: A view from point count location 2 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 9: A view from point count location 3 to the north.

Photograph 10: A view from point count location 3 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 11: A view from point count location 3 to the south.

Photograph 12: A view from point count location 3 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 13: A view from point count location 4 to the north.

Photograph 14: A view from point count location 4 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 15: A view from point count location 4 to the south.

Photograph 16: A view from point count location 4 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 17: A view from point count location 5 to the north.

Photograph 18: A view from point count location 5 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 19: A view from point count location 5 to the south.

Photograph 20: A view from point count location 5 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 21: A view from point count location 6 to the north.

Photograph 22: A view from point count location 6 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 23: A view from point count location 6 to the south.

Photograph 24: A view from point count location 6 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 25: A view from point count location 7 to the north.

Photograph 26: A view from point count location 7 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 27: A view from point count location 7 to the south.

Photograph 28: A view from point count location 7 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 29: A view from point count location 8 to the north.

Photograph 30: A view from point count location 8 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 31: A view from point count location 8 to the south.

Photograph 32: A view from point count location 8 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 33: A view from point count location 9 to the north.

Photograph 34: A view from point count location 9 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 35: A view from point count location 9 to the south.

Photograph 36: A view from point count location 9 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 37: A view from point count location 10 to the north.

Photograph 38: A view from point count location 10 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 39: A view from point count location 10 to the south.

Photograph 40: A view from point count location 10 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 41: A view from point count location 11 to the north.

Photograph 42: A view from point count location 11 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 43: A view from point count location 11 to the south.

Photograph 44: A view from point count location 11 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 45: A view from point count location 12 to the north.

Photograph 46: A view from point count location 12 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 47: A view from point count location 12 to the south.

Photograph 48: A view from point count location 12 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 49: A view from point count location 13 to the north.

Photograph 50: A view from point count location 13 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 51: A view from point count location 13 to the south.

Photograph 52: A view from point count location 13 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 53: A view from point count location 14 to the north.

Photograph 54: A view from point count location 14 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 55: A view from point count location 14 to the south.

Photograph 56: A view from point count location 14 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 57: A view from point count location 15 to the north.

Photograph 58: A view from point count location 15 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 59: A view from point count location 15 to the south.

Photograph 60: A view from point count location 15 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 61: A view from point count location 16 to the north.

Photograph 62: A view from point count location 16 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 63: A view from point count location 16 to the south.

Photograph 64: A view from point count location 16 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 65: A view from point count location 17 to the north.

Photograph 66: A view from point count location 17 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 67: A view from point count location 17 to the south.

Photograph 68: A view from point count location 17 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 69: A view from point count location 18 to the north.

Photograph 70: A view from point count location 18 to the east.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018

Dakota Range Wind Farm

Photograph 71: A view from point count location 18 to the south.

Photograph 72: A view from point count location 18 to the west.

Photographer: Greg Thomson

Date Photos Taken: March 19, 2018