Eagle Conservation Plan for the Courtenay Wind Farm Project

Prepared for

Northern States Power Company – Minnesota dba Xcel Energy

Prepared by

2001 Killebrew Drive, Suite 141
Bloomington, MN 55425

October 2016

This page intentionally left blank

TABLE OF CONTENTS

1.0 INTRODUCTION AND PURPOSE 1
2.0 REGULATORY FRAMEWORK 7
2.1 Migratory Bird Treaty Act 7
2.2 Bald and Golden Eagle Protection Act 8
2.3 National Environmental Policy Act 9
3.0 PROJECT DESCRIPTION 10
4.1 Preliminary Site Evaluation (WEG Tier 1) 16
4.2 Site-specific Characterization and Decisions (WEG Tier 2) 17
5.0 SITE-SPECIFIC SURVEYS 19
5.1 Eagle Use 20
5.1.1 Avian Point Count Surveys 20
5.1.2 Eagle Use Surveys 22
5.2 Eagle Nests 25
5.2.1 2013 Ground-based Raptor Nest Surveys 25
5.2.2 2014 Aerial Raptor Nest Surveys 25
5.2.3 2014 Ground-based Nest Observations 28
5.2.4 2015 Ground-based Nest Observations 29
5.3 Prey Assessment 29
5.4 Eagle Risk Evaluation Based on Survey Data 30
6.0 AVOIDANCE AND MINIMIZATION OF RISKS IN PROJECT DESIGN 31
7.0 PREDICTING EAGLE FATALITIES 33
7.1 Fatality Model 33
7.1.1 Fatality Inputs and Results 36
7.2 Risk Assessment 37
7.2.1 Disturbance 37
7.2.2 Eagle Risk Summary 38
8.0 AVOIDANCE AND MINIMIZATION OF RISKS, ACPS, AND COMPENSATORY MITIGATION 38
8.1 Construction BMPs 38
8.2 Operational BMPs 40
9.0 EXPERIMENTAL ADVANCED CONSERVATION PRACTICES 41

10.0 POST-CONSTRUCTION MONITORING 44
10.1 Fatality Monitoring 44
10.1.1 Permit Compliance Monitoring 44
10.2 Additional Surveys 55
10.2.1 Nest Monitoring 55
11.0 REPORTING 57
12.0 PERMITS 57
13.0 LITERATURE CITED 58

Table 1. Chronology of Resource Agency Contact for the Courtenay Wind Farm Project 4
Table 2. Basis of Calculations of Temporary and Permanent Project Impacts (Tables 4 and 5) ... 10
Table 3. Habitat Types within the Project Boundary 12
Table 4. Permanent Impacts by Habitat Type 15
Table 5: Temporary Impacts by Habitat Type 15
Table 6. Survey Efforts to Date at the Courtenay Wind Farm Project 19
Table 7. Eagle Use Survey Results, 2012-2015 23
Table 8. Raptor Nest Survey Data for the Courtenay Wind Farm, North Dakota, 2014 28
Table 9. Variables Used in the Bayesian Collision Risk Model 34
Table 10. Data Inputs for the USFWS Bayesian Eagle Fatality Model 36
Table 11. Predicted Annual Bald Eagle Fatalities at the Project 37
Table 12. Summary of Experimental Advanced Conservation Practices Using a Step-wise Approach to be Implemented When an Eagle Take Occurs[1] 41
Table 13. Parameters in the Prospective Power Analysis of Fatality Monitoring Design 47

Figure 1. Project Vicinity 3
Figure 2. Project Facilities 11
Figure 3. Land Cover 14
Figure 4. Avian Point Count Locations 21
Figure 5. Flight Paths Related to Project Facilities 24
Figure 6. Aerial Survey Project Boundary and Identified Nests 27
Figure 7. Avoidance and Minimization of Risk during Project Siting 32
Figure 8. Output from Evidence of Absence 49
Figure 9. Example of Output derived from Evidence of Absence 54

Appendix A: Site Selection Questions

1.0 INTRODUCTION AND PURPOSE

Northern States Power Company – Minnesota doing business as Xcel Energy is proposing to construct and operate the up to 200.5 megawatt (MW) Courtenay Wind Farm Project (the Project) approximately 15 miles north of Jamestown in Stutsman County, North Dakota. The Project boundary contains approximately 24,200 acres and approximately 19,000 acres of privately owned land is leased for the Project. The Project will interconnect to the Otter Tail Power (Otter Tail) 115/345 kilovolt (kV) substation, located approximately 7 miles north of Jamestown via an approximately 17-mile long overhead transmission line (Figure 1) and will transmit power into the Midcontinent Independent System Operator (MISO) grid.

Northern States Power Company Minnesota dba Xcel Energy (NSPM) purchased Courtenay Wind Farm, LLC in July 2015. Prior to July 2015, Courtenay Wind Farm, LLC, coordinated development of this ECP with USFWS. After July 2015, all coordination between USFWS and Courtenay Wind Farm was conducted by NSPM. For simplicity within this document CWF will be used to refer to all coordination and communication activities with USFWS, both prior to and after NSPM's acquisition of the facility.

CWF contracted Tetra Tech, Inc. (Tetra Tech) to create this Eagle Conservation Plan (ECP) to summarize the environmental conditions in the Project area and eagle studies to date; develop an assessment of impacts to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) from development of the Project; develop avoidance and minimization measures; and describe compensatory mitigation measures for unavoidable impacts. CWF has worked closely with the U.S. Fish and Wildlife Service (USFWS) in the development of the ECP, as reflected in the chronology of agency contacts (Table 1). Field studies at the Project were initiated in 2013 by Tetra Tech and are ongoing. Bald eagle nests were identified within the Project boundary during these surveys, and details regarding these nests and their identification are provided in Section 5. Agencies consulted during study planning and preparation of the ECP consisted of USFWS and the North Dakota Game and Fish Department (NDGFD).

This ECP serves as a supporting document for CWF's formal application for an incidental take permit under the Bald and Golden Eagle Protection Act (BGEPA). After submittal of the formal eagle take permit application, the USFWS will complete their own National Environmental Policy Act (NEPA) analysis to consider issuance of a permit using the most current version of the ECP.

This page intentionally left blank

Figure 1. Project Vicinity

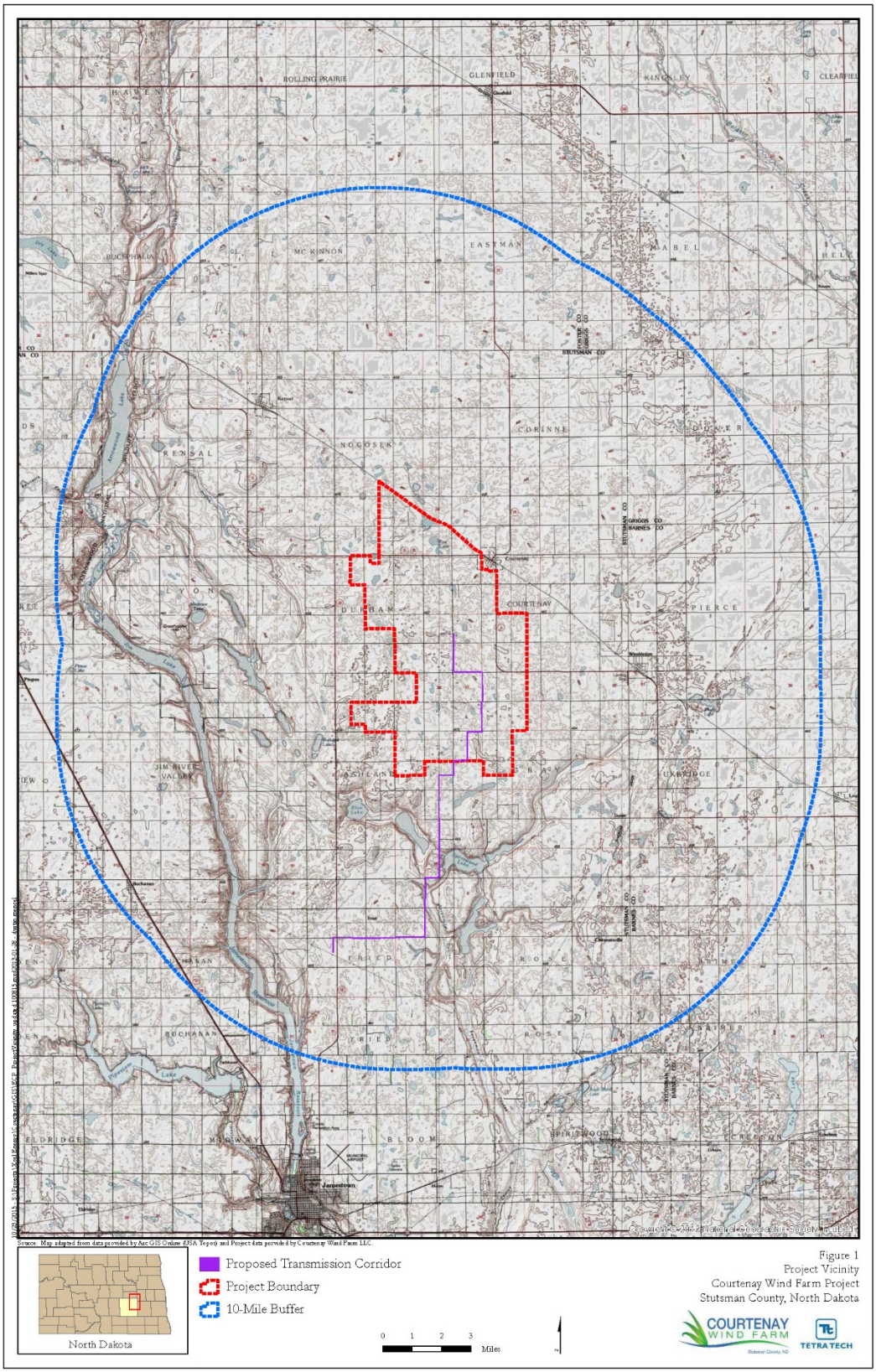


Table 1. Chronology of Resource Agency Contact for the Courtenay Wind Farm Project

Date	Purpose	Participants
10/28/2010	CWF contacted USFWS to introduce project and request environmental information from USFWS	CWF, USFWS
10/28/2010	CWF contacted NDGFD to introduce project and request environmental information from USFWS	CWF, NDGFD
11/16/2010	NDGFD reply to request for environmental information	NDGFD, CWF
3/18/2011	USFWS reply to request for environmental information; eagle nest survey recommended, as well as a ½ mile buffer for all eagle nests	USFWS, CWF
4/26/2011	Meeting at USFWS office in Bismarck, ND	CWF, USFWS
2/22/2013	Meeting at USFWS office in Bismarck, ND to discuss findings of Tier 1 and 2 analyses and fall avian point count surveys	CWF, USFWS, Tetra Tech
3/14/2013	Email from USFWS stating that there are no known eagle nests within 10 miles of the Project footprint	USFWS, CWF, Tetra Tech
7/3/2013	Conference call to discuss spring avian point count surveys and discovery of nest 2013-2, an active bald eagle nest within the Project footprint	CWF, USFWS, Tetra Tech, Fredrikson and Byron
7/5/2013	Email providing spring avian point count survey report and a summary of observations made at nest 2013-2	Fredrikson and Byron, CWF, USFWS, Tetra Tech
7/9/2013	Email from USFWS Bismarck Ecological Services Field Office staff indicating that the Project may fall under Category 1 of the ECP Guidance and recommending that the Project be redesigned to meet the Category 2 criteria	USFWS, CWF, Tetra Tech, Fredrikson and Byron
8/2/2013	Discussion of CWF's intention to move forward with eagle use surveys and other efforts in support of an eagle take permit application	CWF, USFWS, Tetra Tech, Fredrikson and Byron
8/12/2013	Email providing "Eagle Take Permit Application Analysis" memo prepared by Tetra Tech, which recommended that the Project be considered Category 2. Eagle use survey locations were also provided in this transmittal.	CWF, USFWS, Tetra Tech, Fredrikson and Byron
8/14/2013	Transmittal of spring bat acoustic monitoring report	CWF, USFWS, Tetra Tech, Fredrikson and Byron
8/22/2013	Transmittal of eagle use survey methodology and survey locations. USFWS feedback requested.	Tetra Tech, USFWS, CWF, Fredrikson and Byron
9/12/2013	Email to USFWS requesting feedback on eagle use survey locations	Tetra Tech, USFWS, CWF, Fredrikson and Byron
11/20/2013	Email from USFWS transmitting photos of nests 2013-1 and 2013-2 taken on April 23, 2013 by NDGFD	USFWS, CWF
11/26/2013	Memo from CWF to USFWS providing summary of coordination and environmental review of the Project	CWF, USFWS
12/13/2013	Letter from USFWS with details of nests within project footprint and details of October 29, 2013 recovery of one immature bald eagle carcass within the Project area. Letter indicated that the Project may meet the definition of a Category 1 project and recommended coordination with the USFWS Migratory Bird Permit Office.	USFWS, CWF, NDGFD
12/18/2013	Email to USFWS Region 6 Migratory Bird Permit Office summarizing Project status and ECP	CWF, USFWS

Date	Purpose	Participants
12/20/2013	Issuance of USFWS wetland easement permit for temporary impacts	USFWS, CWF
1/29/2014	Conference Call/Webinar discussing draft ECP	Tetra Tech, CWF, USFWS
2/3/2014	Meeting at USFWS Bismarck Ecological Services Field Office to discuss ECP	USFWS, CWF, Tetra Tech
2/4/2014	Draft ECP transmittal	CWF, USFWS, Tetra Tech
2/14/2014	Preliminary comments on draft ECP from USFWS Bismarck Ecological Services Field Office	USFWS, CWF, Tetra Tech
2/18/2014	Submission of draft ECP Addendum	Tetra Tech, USFWS, CWF
2/18/2014	Comments from USFWS on draft ECP	USFWS, CWF, Tetra Tech
2/20/2014	Meeting at USFWS Bismarck Ecological Services Field Office to discuss ECP and ITP	USFWS, CWF, Tetra Tech
2/28/2014	Submission of revised draft ECP, including figures, to USFWS	CWF, USFWS, Tetra Tech, Fredrikson and Byron
3/14/2014	USFWS response to revised draft ECP	USFWS, CWF, Tetra Tech
3/25/2014	Submission of changes in response to revised draft ECP	CWF, USFWS, Tetra Tech, Fredrikson and Byron
4/2/2014	Comments on changes in response to revised draft ECP	USFWS, CWF
4/2/2014	"Clean," revised copy of ECP incorporating comments from USFWS received on 4/2/2014	CWF, USFWS, Tetra Tech, Fredrikson and Byron
4/15/2014	Transmittal of memo summarizing results of March 2014 aerial stick nest survey	CWF, USFWS, Tetra Tech, Fredrikson and Byron
8/12/2014	Project update. Included March and May 2014 aerial nest survey reports; summary of eagle use survey results to date and updated fatality estimate; notification that nest 2013-1 had collapsed; notification of intent to end eagle use surveys at the end of August 2014.	CWF, USFWS, Tetra Tech
7/29/2015	Transmittal of informal USFWS comments on draft ECP to CWF	CWF, USFWS
9/30/2015	Meeting to review USFWS comments on ECP	CWF, USFWS, Tetra Tech, Geronimo Energy
10/12/2015	Email presenting CWFs proposed schedule for ECP review and ETP application	CWF, USFWS, Tetra Tech
10/16/2015	Transmittal of revised post-construction monitoring plan for USFWS review	CWF, USFWS, Tetra Tech
10/27/2015	Telephone call and email follow up regarding timing of construction, past history and current status of the preparation of EACP and post-construction monitoring plan, and NEPA process	CWF, USFWS
11/11/2015	Email from CWF requesting an estimated schedule for completion of USFWS comments on post-construction monitoring plan and EACPs	CWF, USFWS
11/12/2015	Telephone conference to discuss potential schedule for USFWS comments on EACPs and post-construction monitoring plan	CWF, USFWS
11/20/2015	Telephone call to USFS requesting update on response to EACP and post-construction monitoring plan	CWF, USFWS
12/15/2015	Email response to 12/11/2015 email from USFWS that meeting scheduled to develop order of project priorities	CWF, USFWS

Date	Purpose	Participants
12/18/2015	Email from USFWS providing revised timeline for USFWS review of EACPs and post-construction monitoring plan, anticipating completion in January	CWF, USFWS
1/19/2016	Meeting to discuss proposed EACPs	CWF, USFWS
1/22/2016	Transmittal of USFWS comments on post-construction monitoring plan	CWF, USFWS
2/2/2016	Email from USFWS regarding timing of USFWS comments on EACP table	CWF, USFWS
2/8/2016	Email with comments from USFWS on EACP table	CWF, USFWS
2/10/2016	Email correspondence regarding scheduling eagle fatality modeling by USFWS modelers	CWF, USFWS
2/23/2016	Transmittal of raw eagle use data and eagle flight path maps to USFWS	CWF, USFWS
2/24/2016	USFWS confirmation of receipt of files for modeling	CWF, USFWS
2/25/2016	Telephone conference to discuss EACPs, NEPA process, recently submitted eagle observation data and maps	CWF, USFWS

Notes:
CWF: Courtenay Wind Farm, LLC
ECP: Eagle Conservation Plan
Fredrikson and Byron: Fredrikson & Byron, P.A. (legal counsel for CWF)
NDGFD: North Dakota Game and Fish Department
Tetra Tech: Tetra Tech, Inc.
USFWS: US Fish and Wildlife Service

2.0 REGULATORY FRAMEWORK

Eagles are protected under a variety of state and federal laws and regulations. Relative to the Project, these include the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). These regulations are described in the following subsections.

2.1 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (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. It is a strict liability statute, meaning that proof of intent, knowledge, or negligence is not an element of an MBTA violation. The statute's language is clear that actions resulting in a "taking" or possession (permanent or temporary) of a protected species, in the absence of a U.S. Fish and Wildlife Service (USFWS) permit or regulatory authorization, are a violation of the MBTA.

The MBTA states, "Unless and except as permitted by regulations … it shall be unlawful at any time, by any means, or in any manner to pursue, hunt, take, capture, kill … possess, offer for sale, sell … purchase … ship, export, import … transport or cause to be transported … any migratory bird, any part, nest, or eggs of any such bird …. [The Act] prohibits the taking, killing, possession, transportation, import and export of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior." 16 U.S.C. 703. The word "take" is defined by regulation as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect." 50 CFR 10.12.

The MBTA provides criminal penalties for persons who commit any of the acts prohibited by the statute in section 703 on any of the species protected by the statute. See 16 U.S.C. 707. The USFWS maintains a list of all species protected by the MBTA at 50 CFR 10.13. This list includes over one thousand species of migratory birds, including eagles and other raptors, waterfowl, shorebirds, seabirds, wading birds, and passerines. The MBTA does not protect introduced species such as the house (English) sparrow, European starling, rock dove (pigeon), Eurasian collared dove, and non-migratory upland game birds. The USFWS maintains a list of introduced species not protected by the Act. See 70 Fed. Reg. 12,710 (Mar. 15, 2005).

For eagles, the BGEPA take authorization (see Section 2. 2 below) serves as authorization under MBTA, per 50 CFR 22.11(b) (USFWS 2013). CWF has been coordinating with USFWS to develop this ECP to represent best management practices (BMPs) and good-faith efforts to minimize impacts to eagles and comply with the MBTA. CWF is currently developing a separate Bird and Bat Conservation Strategy (BBCS) to detail the avoidance, minimization, mitigation, monitoring, and adaptive management at its facility for all migratory birds including bald and golden eagles. This ECP provides specific eagle avoidance, minimization, mitigation, monitoring, and adaptive management.

2.2 Bald and Golden Eagle Protection Act

Under authority of the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668–668d, bald eagles and golden eagles are afforded additional legal protection. 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. 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 USFWS further defined the term "disturb" as agitating or bothering an eagle to a degree that causes, or is likely to cause, injury, or either a decrease in productivity or nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior (50 CFR 22.3). BGEPA authorizes the USFWS to permit the take of eagles for certain purposes and under certain circumstances, including scientific or exhibition purposes, religious purposes of Indian tribes, and the protection of wildlife, agricultural, or other interests, so long as that take is compatible with the preservation of eagles (16 U.S.C. 668a).

In 2009, the USFWS promulgated a final rule on two new permit regulations that, for the first time, specifically authorize the non-purposeful (i.e. incidental) take of eagles and eagle nests to protect interests in particular localities under BGEPA (50 CFR 22.26 & 22.27). The permits authorize limited, non-purposeful (incidental) take of bald and golden eagles; authorizing individuals, companies, government agencies (including tribal governments), and other organizations to disturb or otherwise take eagles in the course of conducting lawful activities such as operating utilities and airports.

In 2013, USFWS issued a final rule to extend the maximum term for programmatic take permits under BGEPA to 30 years, subject to a recurring five-year review process throughout the permit life. See 78 Fed. Reg. 73,704 (December 9, 2013). The change is designed to facilitate responsible development of renewable energy and other projects that operate for multiple decades, and to provide certainty for project proponents, all while continuing to conserve eagles. The new rule went into effect January 8, 2014. On August 11, 2015, a U.S. District Court judge in Shearwater et al. v Ashe set aside the rule allowing for the extension of the permit term to 30 years and remanded the rule for further consideration by the USFWS.

USFWS's permit program allows for two kinds of non-purposeful take permits for protected eagles: the standard permit and the programmatic permit. The standard permit authorizes the limited take of eagles resulting from a one-time and otherwise lawful activity where the take cannot be practically avoided (e.g., construction of a housing development).12 See 50 C.F.R. § 22.26(a)(1). The standard permit is subject to numerous conditions, including a limitation on the amount of authorized take that is based on a total authorized nationwide take of eagles, and other permit applicants' requests that may take precedence (e.g., Native American religious use requests).

The programmatic permit authorizes non-purposeful eagle take associated with operations at a facility (*e.g.*, operation of a wind energy facility)[13] where take of eagles is unavoidable even though ACPs are being implemented. *See 50 C.F.R. § 22.26(a)(2).* Programmatic take means take that is recurring, is not caused solely by indirect effects, and that occurs over the long term or in a location, or locations that cannot be specifically identified. A key feature of the programmatic take permit is the implementation of ACPs at the facility. An "advanced conservation practice" is defined as: "scientifically supportable measures that are approved by USFWS and represent the best available techniques to reduce eagle disturbance and ongoing mortalities to a level where remaining take is unavoidable." *See 50 C.F.R. § 22.3.* In general, ACPs would be determined by the permit applicant and USFWS on a case-by-case basis. However, as discussed in the ECP Guidance, at this time there are no proven ACPs for wind energy projects; therefore, all ACPs for wind energy are considered experimental (USFWS 2013).

To facilitate issuance of permits under these new regulations, the USFWS developed the Eagle Conservation Plan (ECP) Guidance (USFWS, 2013). The ECP Guidance is compatible with the Land-Based Wind Energy Guidelines (Guidelines) also developed by USFWS (USFWS 2012). The Guidelines guide developers through the process of project development and operation. If eagles are identified as a potential risk at a project site, developers are strongly encouraged to refer to the ECP Guidance. The ECP Guidance describes specific actions that are recommended to comply with the regulatory requirements in BGEPA for an eagle take permit, as described in 50 CFR 22.26 and 22.27. The ECP Guidance provides a national framework for assessing and mitigating risk specific to eagles through development of EGP and issuance of programmatic incidental takes of eagles at wind turbine facilities.

2.3 National Environmental Policy Act

The National Environmental Policy Act (NEPA) applies to issuance of eagle take permits because issuing such a permit is a federal action (USFWS 2013). Where no federal nexus exists other than an eagle permit the USFWS must complete a NEPA analysis before it can issue an eagle take permit. Eagle take permits may be issued only in compliance with the conservation standards of BGEPA. This means that the take must be "compatible with the goal of stable or increasing breeding populations." To ensure that any authorized take of eagles does not exceed this standard, the USFWS has set regional take thresholds for each species, using methodology contained in the NEPA Final Environmental Assessment (FEA) developed for the new eagle permit rules. The USFWS analyzed regional populations of eagles and set take thresholds for each species (upper limits on the number of eagle mortalities that can be allowed under permit each year in these regional management areas) (USFWS 2013). Project developers may provide assistance that can expedite the NEPA process in accordance with 40 CFR §1506.5.

3.0 PROJECT DESCRIPTION

CWF is proposing to construct and operate the Project approximately 15 miles north of Jamestown in Stutsman County, North Dakota (Figure 1). The Project's capacity will be up to 200.5 megawatts (MW) of wind energy. The Project boundary contains approximately 24,200 acres, and CWF currently leases approximately 19,000 privately owned acres for the Project. CWF selected the specific Project boundary based on significant landowner support, transmission and interconnection suitability, optimal wind resources, and minimal impact on environmental resources (see Section 4.0). CWF obtained a Certificate of Site Compatibility (CSC) from the North Dakota Public Service Commission (PSC) on November 13, 2013.

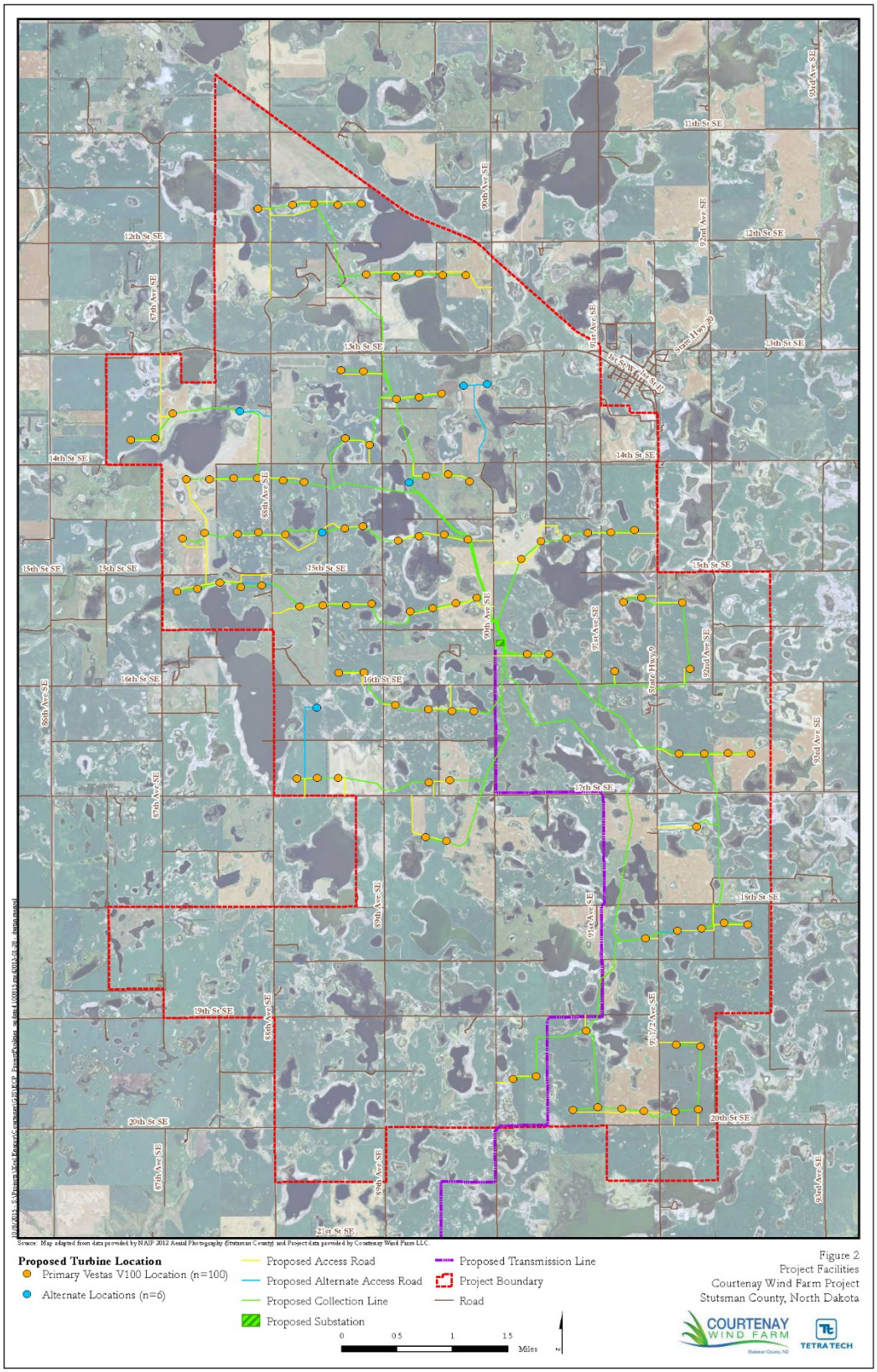
Project facilities will include: (1) up to 100 Vestas V100 wind turbines; (2) new gravel access roads and improvements to existing roads; (3) underground electrical collection lines; (4) an operations and maintenance (O&M) building; (5) a collector substation; (6) up to three permanent meteorological towers; and (7) a temporary batch plant area and staging/laydown area for construction of the Project (location to be determined) (Figure 2, Table 2). The Project will interconnect to the Otter Tail Power (Otter Tail) 115/345 kilovolt (kV) substation, located approximately 7 miles north of Jamestown via an approximately 17-mile long overhead transmission line (Figure 1) and will transmit power into the Midcontinent Independent System Operator (MISO) grid. All of the Project facilities will be located on privately owned land.

Table 2. Basis of Calculations of Temporary and Permanent Project Impacts

Impact Name	Impact Size	Comment
Temporary		
Roads/Crane Path[1]	100′	50′ either side of centerline
Collection	50′	25′ either side of centerline
Turbines[2]	200′ radius	
Laydown/O&M/Batch Plant/Substation	Parcel boundary	
Transmission Line	100′	50′ either side of centerline This data is preliminary
Permanent		
Roads[1]	16′ wide	8′ either side of centerline
Turbines[2]	14′ radius	
O&M/Substation	Edge of gravel	
T-line Structures	2′ diameter	

Includes alternate turbines.
[1]Does not include existing road improvements or temporary intersection improvements
[2]Includes alternate turbines

Figure 2. Project Facilities



The Project is located within the Level IV End Moraine Complex and Drift Plains Ecoregions. The Drift Plains Ecoregion is relatively flat with higher concentrations of temporary and seasonal wetlands. In contrast, the End Moraine Complex is characterized by parallel moraine ridges, and other glacial features such as eskers, kames, and thrust ridges. The glaciation of both ecoregions created varied soil conditions, consisting of glacial till and clay deposits, and a large prairie pothole complex, which is found in and around the Project Area (a 10-mile buffer of the Project boundary). Prairie potholes provide habitat for water birds and waterfowl, particularly during the spring and fall migrations. Historically, the Project Area predominantly consisted of tall-grass prairie, which left rich, deep topsoil deposits and abundant organic material. Because of the productive soil and relatively level topography, the Project Area is almost entirely cultivated and tilled (Table 3; Figure 3; USGS 2013).

Table 3. Habitat Types within the Project Boundary

NLCD Category	Total Acres (Percent of Project Area)
Cultivated Crops	16,034.40 (66.2)
Pasture/Hay	2,723.30 (11.3)
Emergent Herbaceous Wetlands	2,126.70 (8.8)
Open Water	1,719.70 (7.1)
Developed, Open Space	1,034.80 (4.3)
Grassland/Herbaceous	475.2 (2.0)
Developed, Low Intensity	40.2 (0.2)
Deciduous Forest	35.9 (0.1)
Woody Wetlands	14.7 (0.1)
Evergreen Forest	1 (0)
Total	**24,205.9 (100)**

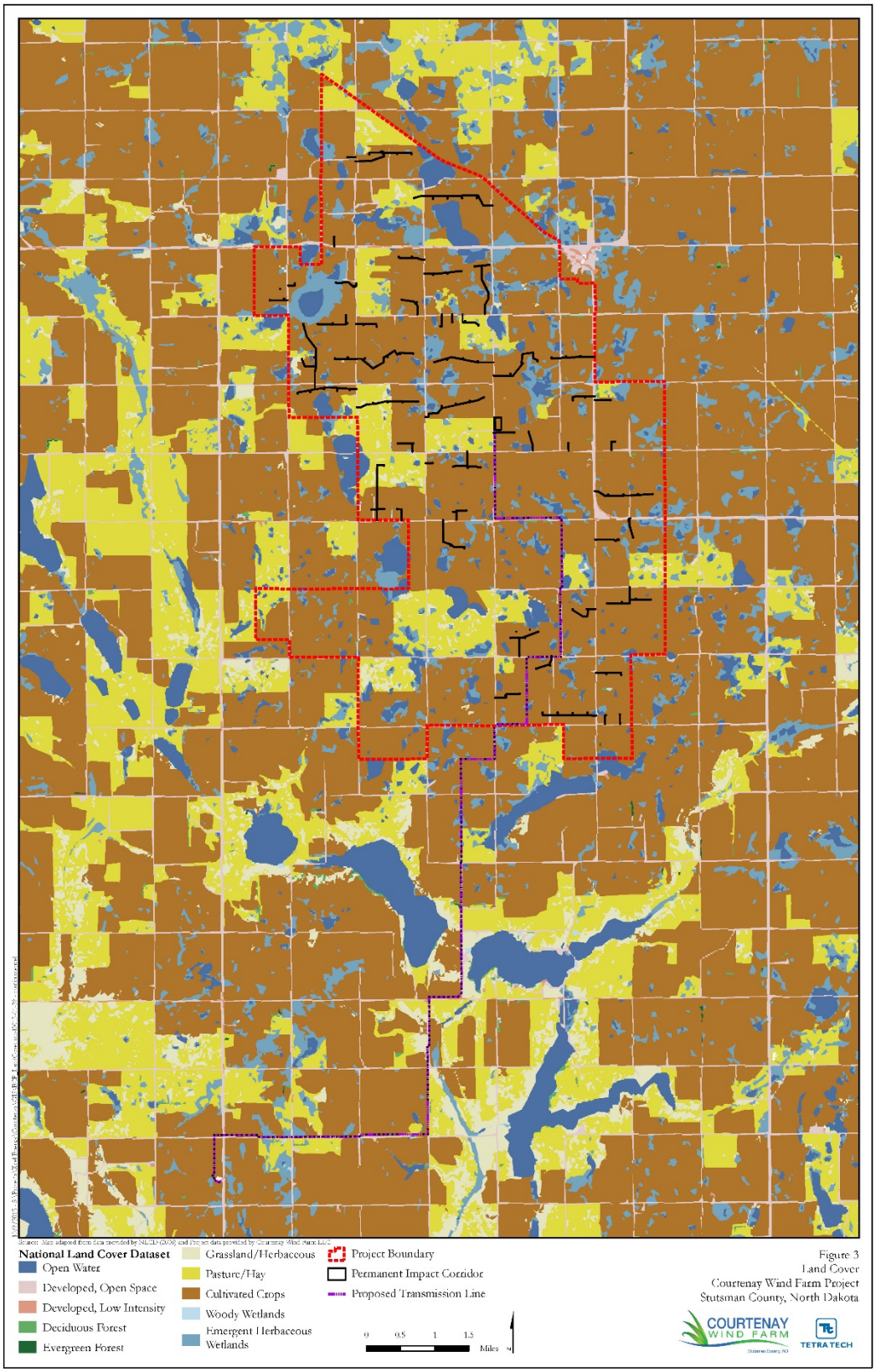
The Project Area currently consists primarily of cultivated cropland with principal crops being soybeans, corn, wheat, alfalfa and other small grains. Areas of pasture are primarily dominated by smooth brome (*Bromus inermis*) and Canada bluegrass (*Poa compressa*). Yellow and white sweet clover (*Melilotus officinalis* and *Melilotus albus*), Canada goldenrod (*Solidago canadensis*), and snowberry (*Symphoricarpos albus*) were also observed in most pasture areas. Areas of hay are primarily dominated by smooth brome (*Bromus inermis*), alfalfa (*Medicago sativa*) and Canada bluegrass (*Poa compressa*). Scattered farmsteads (accounting for the "developed, open space" and "developed, low intensity categories in Table 3) are present along the roadways within the Project boundary, and forested windbreaks (accounting for the "deciduous forest" and "evergreen forest" categories in Table 3) are present around most farmsteads. No other significant wooded areas are present within the Project boundary.

Grassland/herbaceous upland areas are primarily dominated by smooth brome (*Bromus inermis*) and Canada bluegrass (*Poa compressa*). Yellow and white sweet clover (*Melilotus officinalis* and *Melilotus albus*), Canada goldenrod (*Solidago canadensis*), Canada thistle (*Cirsium arvense*) and common milkweed (*Asclepias syriaca*) were also observed in most grassland/herbaceous upland areas. Herbaceous wetland areas are dominated by cattail (*Typha sp.*) in standing water areas, with reed canary grass (*Phalaris arundinacea*) and common reed (*Phragmites australis*) present on the wetland fringes in less saturated areas.

According to NLCD data, wetlands and open water make up a combined 16 percent of the area within the Project boundary (Table 3). Wetlands within the Project boundary are typical of the prairie pothole region, which is characterized by numerous small, depressional wetlands. Tetra Tech conducted a wetlands and waters survey for the Project in 2013 which identified wetlands within the survey corridor (the locations of Project facilities). A majority (85 percent) of wetlands identified within the survey corridor were classified as Type 1 and Type 3 wetlands (45.6 percent and 39.4 percent of the total wetlands identified, respectively). Type 1 wetlands are seasonally flooded basins or flats. These wetlands may be inundated or saturated for variable periods, but are usually well drained during much of the growing season. Type 3 wetlands are inland shallow fresh marshes, which typically have soils that remain saturated during the growing season and are commonly inundated with six inches or more of water. The remaining 15 percent of wetlands were classified as Type 2 (inland fresh meadows; 2.3 percent), Type 4 (inland deep fresh marshes; 6.4 percent), and Type 5 (inland open fresh water; 6.2 percent).

Wetlands observed within the survey corridor were typically vegetated with a variety of wetland plants typical of the central North Dakota ecotone. Many of the Type 1 and Type 2 wetlands were observed to be cultivated and were either barren or vegetated with crops (wheat, soybeans or corn). Vegetation observed in non-cultivated Type 1 and Type 2 wetlands included grasses (bluejoint [*Calamagrostis canadensis*], large barnyard grass [*Echinochloa crus-galli*], fox-tail barley [*Hordeum jubatum*], reed canary grass [Phalaris arundinacea], and freshwater cord grass *[Spartina pectinata*]), sedges (Carex sp.), foxtails (Setaria sp.), horsetails (Equisetum sp.), and various forbs. Type 3 and Type 4 wetlands were often dominated by cattails (*Typha angustifolia*). Other species observed in Type 3 and Type 4 wetlands included: American water-plantain (*Alisma subcordatum*), sedges (Carex sp.), spike-rushes (Eleocharis sp.), smartweeds (Persicaria sp.), curly dock (*Rumex crispus*), and soft-stem club-rush (*Schoenoplectus tabernaemontani*). Deep-water portions of Type 4 and Type 5 wetlands were not observed during the survey for indications of non-emergent (submerged or floating) vegetation.

Figure 3. Land Cover



To calculate the permanent impacts to habitat, National Land Cover Dataset (NLCD) data were used determine the habitat impacts by category (Figure 3, Fry et al. 2011). Based on a permanent impact assumption for impacts of the Project, 89 percent of permanent impacts occur in cultivated crops (Table 4). Temporary Impacts will occur mainly in agricultural or otherwise developed land (95%) (Table 5). Limited impacts are predicted to habitat that could be used by eagles such as open water (0.01 ac. of permanent impact and 6.07 ac. for temporary impact), forest (0.06 ac. of permanent impact and 0.41 ac. of temporary impact), and grassland (0.11 of permanent impact and 14.43 acres of temporary impact). A discussion of potential impacts to eagles is provided in Section 7.

Table 4. Permanent Impacts by Habitat Type

NLCD Category	Permanent Impact (Acres)	Percent of Permanent Impacts
Cultivated Crops	49.24	89.03
Pasture/Hay	2.86	5.17
Developed, Open Space	2.47	4.47
Emergent Herbaceous Wetlands	0.56	1.01
Grassland/Herbaceous	0.11	0.20
Deciduous Forest	0.06	0.11
Open Water	0.01	0.01
Developed, Low Intensity	0.00	0.00
Total	**55.31**	**100**

Table 5: Temporary Impacts by Habitat Type

NLCD Category	Temporary Impact (Acres)	Percent of Temporary Impacts
Cultivated Crops	919.37	82.41
Developed, Open Space	77.15	6.92
Hay/Pasture	65.66	5.89
Emergent Herbaceous Wetlands	29.62	2.66
Grassland/Herbaceous	14.43	1.29
Open Water	6.07	0.54
Developed, Low Intensity	2.30	0.21
Deciduous Forest	0.41	0.04
Woody Wetlands	0.35	0.03
Developed Medium Intensity	0.25	0.02
Total	**1,115.62**	**100**

4.0 SITE ASSESSMENT (ECPG STAGE 1)

4.1 Preliminary Site Evaluation (WEG Tier 1)

CWF began its evaluation of potential North Dakota wind farm locations in 2008 by identifying areas where there would be good wind resources, access to transmission, supportive landowner groups and other factors that were conducive to successful wind farm development. This evaluation was made prior to the publication of the WEG and ECPG; however, the work described here is consistent with Tier 1 of the WEG (Preliminary Site Evaluation) and Stage 1 of the ECPG (Site Assessment) - to evaluate sites for their impacts on eagles and other migratory birds.

Beginning in 2010, CWF was examining three potential North Dakota wind farm sites that had available interconnection and commercially viable development opportunities. One particular concern in locating a site was avoidance of the whooping crane migration corridor, as it was believed that sites within the corridor would be more likely to impact whooping cranes. Two of the projects undergoing evaluation were potential development originations by Geronimo and one project was under development and for sale by another party.

As part of the assessment of the Project Area, and consistent with WEG Tier 1, CWF sent a letter to USFWS Ecological Services in October 2010 requesting environmental information on its three proposed sites in Stutsman County, North Dakota (Table 1). USFWS provided feedback in March 2011 and recommended comparing several alternative sites before selecting a final site, in order to avoid and minimize impacts to wildlife. The USFWS indicated that projects in portions of Stutsman County may impact migratory birds. They also discussed the presence of USFWS easements and recommended further coordination on these matters.

After reviewing USFWS correspondence with the third party developer of one of the sites, CWF scheduled an in-person meeting with staff from the USFWS Bismarck Field Office on April 26, 2011. The April 2011 meeting provided a detailed discussion of the Project's environmental characteristics and potential impacts as well as specific discussions regarding wildlife and easements. CWF participated in teleconferences with the third party developer and the USFWS in 2012 to evaluate the acquisition option.

Based on the evaluations described above, CWF determined that the site associated with the current Project provided the least impactful location of those evaluated for sensitive avian and bat species, and proceeded with additional evaluation.

4.2 Site-specific Characterization and Decisions (WEG Tier 2)

CWF continued evaluating the Project as recommended in ECPG Stage 1 and moved into WEG Tier 2 review by conducting desktop reviews of information regarding risks to migratory birds, including eagles, at each of the three sites under evaluation. As part of this review, CWF consulted publicly available data from the USGS, Breeding Bird Surveys, eBird, and other available data sources. A summary of CWF's conclusions are provided in Appendix A. As shown in Appendix A, none of the three North Dakota sites evaluated by Geronimo were identified as posing a significant risk to eagles. However, whooping crane and piping plover were identified as species of concern that warranted further investigation. The current Project Area was identified as having the lowest risk of impact to whooping crane and piping plover.

As a part of the Tier 2 assessment, a qualified Tetra Tech biologist conducted a reconnaissance-level site visit on November 1-2, 2012 to evaluate current vegetation/habitat coverage and land management/use. The land cover within the Project boundary was 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 agricultural lands used for grain crops, wetlands, developed land (farmsteads), and small tracts of grasslands. One large stick nest of an unidentified raptor was observed from a roadway during the site visit (see Section 5.2 for raptor nest surveys). CWF met with USFWS on February 22, 2013 to discuss the results of its (WEG Tier 1 & 2) site assessment. Representatives from CWF, USFWS, and Tetra Tech were all present at USFWS's Bismarck Office. As a follow up to the February 2013 meeting, USFWS provided a letter dated March 2013 indicating that USFWS did not have any record of a bald eagle nest within 10 miles of the CWF proposed Project boundary (Table 1).

Based on publicly available information, CWF's desktop review concluded that the Project Area could be used by eagles due to the presence of suitable habitat, and that no known eagle wintering concentrations, migratory corridors, or areas of concentrated prey occur in the Project Area. As of March, 2013 the USFWS indicated there were no known eagle nests in the area. No areas within the CWF boundary were noted to be precluded from development by law, and the large proportion of agricultural land within the Project and surrounding landscape led CWF to conclude that the fragmentation of sensitive species habitat was unlikely. Although the presence of high-value wildlife habitat in the form of wetlands was noted, the Project appeared to present the least impact to sensitive avian and bat species of the three sites evaluated, based on the lack of designated wildlife areas within the boundary (Appendix A). Thus, based on the ECP Guidance at the time of the Desktop Review, CWF determined the Project to be Category 3 – minimal risk to eagles, and the decision was made to move forward with further evaluation of the Project. The eagle nests and eagle activity discussed in this ECP were observed after completion of the desktop review (See Section 5.2).

CWF began field surveys consistent with ECPG Stage 2 (WEG Tier 3) in spring 2013. These field studies were conducted to document eagle and other avian species use, habitat conditions and

to better understand the potential risk to eagles that might be posed by the Project. In April 2013, NGDF documented one occupied eagle nest and one unoccupied eagle nest within the Project Boundary, and this information was communicated to CWF by USFWS in November 2013. Details on these nests and surveys conducted for ECPG Stage 2 are documented in this ECP in Section 5.0 – Eagle Use.

5.0 SITE-SPECIFIC SURVEYS

Following site selection, a variety of field studies were conducted (Table 6). CWF developed the survey protocol for the site specific surveys based on written correspondence from USFWS in March 2011 and in-person meetings in April 2011 with the USFWS.

Both bald eagles and golden eagles are found in North Dakota. Stutsman County is considered outside the breeding and wintering ranges of golden eagles (Kochert et al 2002) although an occasional migrant is possible. Bald eagles nest sparsely in central North Dakota and migrants could occasionally pass through (Buehler 2000). Tetra Tech conducted all avian and eagle surveys cognizant of the possibility that either species could be found. Surveys for eagles included nest surveys, eagle surveys, and avian point count surveys. No golden eagles were found during surveys and bald eagle observations are detailed in subsections below. Methodologies and results are presented in sections 5.1.1, 5.1.2 and 5.2 in chronological order of their occurrence. Full details about methods, specific areas covered, and the locations and numbers of eagles detected during the surveys can be found within the original reports for the respective studies. Table 6 provides a summary of those results relevant to eagles.

Table 6. Survey Efforts to Date at the Courtenay Wind Farm Project

Study	Taxa	Survey Dates	Results Summary[1]
Fall Avian Point Count Surveys (Tetra Tech 2013a)	All Birds	September 2012 - November 2012	Two bald eagles observed (see Section 5.1.1) accounting for two eagle use minutes.
Spring Avian Point Count Surveys (Tetra Tech 2013b)	All Birds	March 2013 - June 2013	Four bald eagles observed (see Section 5.1.1) accounting for two eagle use minutes.
Ground-based Raptor Nest Survey (Tetra Tech 2013b)	Raptors	March 2013	One unoccupied stick nest (2013-1) identified within the Project boundary (see Section 5.2.1)
Aerial Raptor Nest Surveys (Tetra Tech 2014a and 2014b)	Raptors	March 2014 and May 2014	One occupied active (2014-4), one occupied inactive (2013-1), and one unoccupied inactive nest (2013-2) were identified within the Project boundary. One occupied active bald eagle nest (Nest 2014-1), one unoccupied likely hawk nest (Nest 2014-2), and one unoccupied inactive potential bald eagle nest (Nest 2014-2) were identified outside the Project boundary within the 10-mile buffer (see Section 5.2.2).
Ground-based Nest Observations	Eagles	July 2014 March, August 2015	2014 – Nests 2013-1 and 2013-2 unoccupied 2015 – March; Nest 2014-4 occupied 2015 – August; Nest 2014-4 occupied, Nests 2013-1 and 2013-2 unoccupied

Study	Taxa	Survey Dates	Results Summary[1]
Eagle Use Surveys (Section 5.1.2)	Bald Eagles	August 2013 – September 2014; July 2015 - August 2015	Twenty six eagle use minutes recorded out of 27,720 minutes surveyed during eagle use surveys (see Section 5.1.2).

[1]Results presented are those relevant to eagles

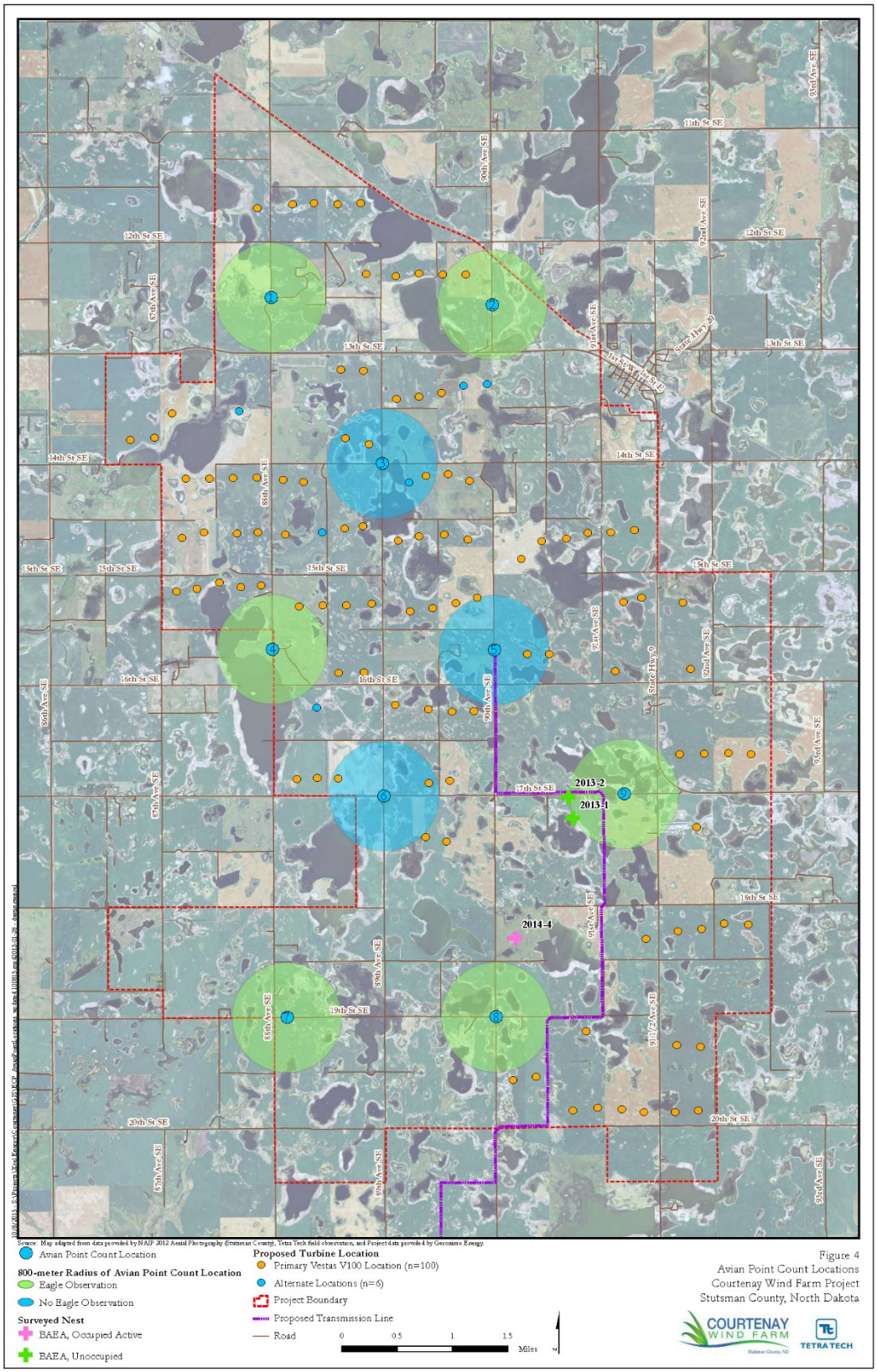
5.1 Eagle Use

5.1.1 Avian Point Count Surveys

Fixed-point count avian surveys to quantify bird use by all avian species were conducted at nine points distributed within the Project boundary (Figure 4). Point count locations were established based on the Project boundary and not specific to the turbine layout. As the turbine layout has been revised, turbines in the vicinity of point count location 7 have been removed. Surveys were conducted every week between September 27, 2012, and November 16, 2012 (fall surveys), and between March 25, 2013, and June 12, 2013 (spring surveys). Each point count location consisted of an 800-meter radius circular plot, and individual surveys were conducted for 20 minutes at each count location. A total of 4,720 survey minutes were completed within the Project boundary during fall and spring fixed-point avian surveys.

Based on the avian surveys referenced above, use of the Project by bald eagles was low compared to other raptor species at the Project and can be considered low overall (Strickland et al. 2011, Tetra Tech 2013a, Tetra Tech 2013b), with a reported mean use of less than 0.05 eagles/20-minute survey during the spring and fall surveys. A total of six bald eagle observations were recorded within the Project boundary during the two seasons of avian point count surveys. Two bald eagle observations occurred during November 2012, and four bald eagle observations occurred during April 2013. Two of the bald eagles observed were perched during the survey and were not observed in flight. Three of the observations were in flight at heights less than 50 meters from the ground, and the one remaining observation was in flight at 200 to 300 meters from the ground. Each of the six observations occurred at different point count locations, and no spatial patterns in bald eagle use of the Project boundary were evident. One bald eagle observation occurred at point count location 7; however, turbines have been removed from the vicinity of point count 7 to reduce risk to eagles.

Figure 4. Avian Point Count Locations



5.1.2 Eagle Use Surveys

Tetra Tech is conducting eagle use surveys in order to estimate the seasonal, spatial, and temporal use of a 1-kilometer [km] buffer around the proposed turbines by bald eagles, and to provide data input sufficient for an eagle risk assessment consistent with the ECP Guidance (USFWS 2013). Eagle use surveys were originally conducted at 16 locations. However, as the turbine layout has been revised, turbines in the vicinity of eagle survey location 13 and 15 have been removed. Eagle use surveys conducted at the remaining 14 locations are distributed throughout the 1km buffer of the turbines, providing spatial coverage of approximately 31 percent of the Project footprint which is greater than the 30 percent recommended in the ECP Guidance (USFWS 2013; Figure 5). 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.

Eagle use surveys were developed to follow the protocol described in the ECP Guidance (USFWS 2013). Tetra Tech has documented flight paths of individual eagles, recorded minutes of flight categorized by flight height (i.e., minutes at or below 200 meters above ground [the conservative approximation of the maximum height of blade tip of the tallest turbine] and within 800 meters of the count location), and recorded the age class of eagles observed, when possible. Observation minutes were rounded up to the nearest minute (e.g., one-minute ten seconds rounded up to 2 minutes) prior to analysis, for a conservative record of eagle flight at or below 200 meters above ground.

The survey effort between August 15, 2013 and September 26, 2014 was two survey hours per month per survey location (i.e. two one-hour sample visits), and Tetra Tech completed 380 hours of surveys during this time period. Eight bald eagle observations were recorded during the 2013 and 2014 eagle use surveys with a total of 26 minutes of eagle flight at or below 200 meters and within 800 meters of the point location (Figure 5). These eight observations qualify for quantitative risk assessment pursuant to the ECP Guidance (USFWS 2013). Table 7 in Section 7.1.1 provides a summary of eagle use survey results by season. Based on the limited number of eagle observations, no spatial or temporal pattern of activity was evident.

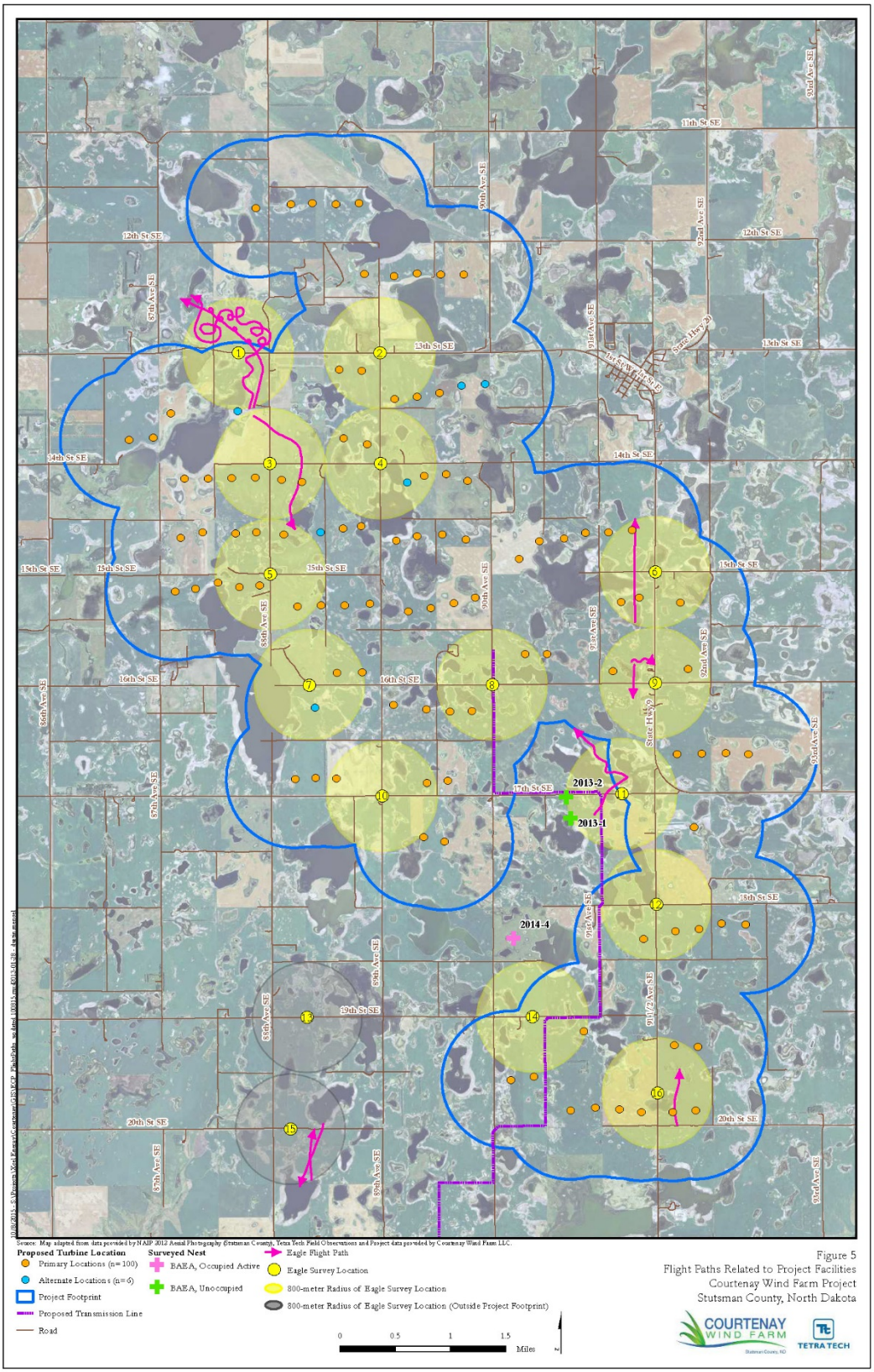
Eagle use surveys were reinitiated from July 29, 2015 through August 20, 2015. Each survey location was visited five times during this period, for a total of 70 additional survey hours. No eagles were observed during the 2015 eagle use surveys.

Table 7. Eagle Use Survey Results, 2012-2015

Season and Year [a]	Month	Total survey (min)	Count duration (min)	Total counts	Eagle minutes below 200m
Fall 2012	Sep	160	20	8	0
	Oct	640	20	32	1
	Nov	480	20	24	1
Spring 2013	Mar	160	20	8	0
	Apr	640	20	32	2
	May	640	20	32	0
	Jun	320	20	16	0
Summer 2013	Aug	1,680	60	28	0
Fall 2013	Sep	1,680	60	28	0
	Oct	1,680	60	28	0
	Nov	1,680	60	28	4
Winter 2013 - 2014	Dec	1,680	60	28	2
	Jan	1,680	60	28	0
	Feb	1,680	60	28	0
	Mar	1,680	60	28	10
Spring 2014	Apr	1,680	60	28	0
	May	1,680	60	28	0
Summer 2014	Jun	1,680	60	28	4
	Jul	1,680	60	28	1
	Aug	1,680	60	28	4
Fall 2014	Sep	1,680	60	28	1
Summer 2015	Jul	840	60	14	0
	Aug	3,360	60	56	0
Total		**30,760**	**NA**	**512.7[b]**	**30**

[a] Fall 2012 and Spring 2013 are Avian Surveys
[b] Total converted to 60-minute counts

Figure 5. Flight Paths Related to Project Facilities



5.2 Eagle Nests

5.2.1 2013 Ground-based Raptor Nest Surveys

On March 26, 2013, Tetra Tech's biologist conducted a ground-based raptor nest survey to identify raptor nests within the Project boundary and a 2-mile buffer. The survey consisted of field reconnaissance of the Project boundary and a 2-mile buffer from the nearest public right-of-way using binoculars and a spotting scope. The field reconnaissance was conducted before leaf out of deciduous trees to allow better visibility of nests. Tetra Tech's biologist recorded locations of potential raptor nests observed and took photographs of nests. The biologist also recorded species, activity status, nest height, nest condition, nest substrate, and other relevant data for each nest.

During the March 2013 raptor nest survey, Tetra Tech observed, from the public roadway, one unoccupied stick nest (2013-1) within the Project boundary (Figure 5). The nest appeared to be in good condition and was consistent with the size and placement of a bald eagle nest; however, no raptors or other birds were observed using the nest during the raptor nest survey or during fall/spring avian point count surveys. Nest 2013-1 has been identified by the North Dakota Game and Fish Department (NDGFP) as an eagle nest, and was identified as active in 2013.

During wetlands surveys on June 20, 2013, Tetra Tech wetland biologists observed an additional stick nest (2013-2) within the Project boundary from the public roadway. The nest was located approximately 12 meters above ground in a roadside wooded windbreak and its diameter was estimated at 1 to 1.5 meters. The nest was consistent with the size and placement of a bald eagle nest, and two adult bald eagles were observed in flight within the vicinity of the nest. The eagles appeared to be exhibiting defensive behavior (i.e., circling and vocalizing). North Dakota Game and Fish also identified 2013-2 as an active eagle nest in 2013. Based on the proximity of Nest 2013-1 to nest 2013-2 it is possible these two nests are alternate nests within the same bald eagle territory.

On June 28, 2013 a Tetra Tech biologist observed nest 2013-2 with a spotting scope for 4 hours from locations approximately 400 meters southwest of the nest. Two adult bald eagles were observed near the nest during the survey period; however, the eagles were not observed carrying prey items or other materials back to the nest, and no young were observed within the nest. In October 2013, an eagle carcass was recovered by a USFWS Special Service Agent near nest 2013-2 and determined to be a young of the year, likely from that nest, based on feather characteristics. The cause of mortality is unknown.

5.2.2 2014 Aerial Raptor Nest Surveys

Tetra Tech, Inc. completed a raptor nest survey of the Project Area (the area within the Project boundary and a 10-mile buffer of the Project boundary) on March 25 and 26, 2014 to inventory nests. On May 23, 2014, Tetra Tech conducted a follow-up aerial survey to further evaluate the

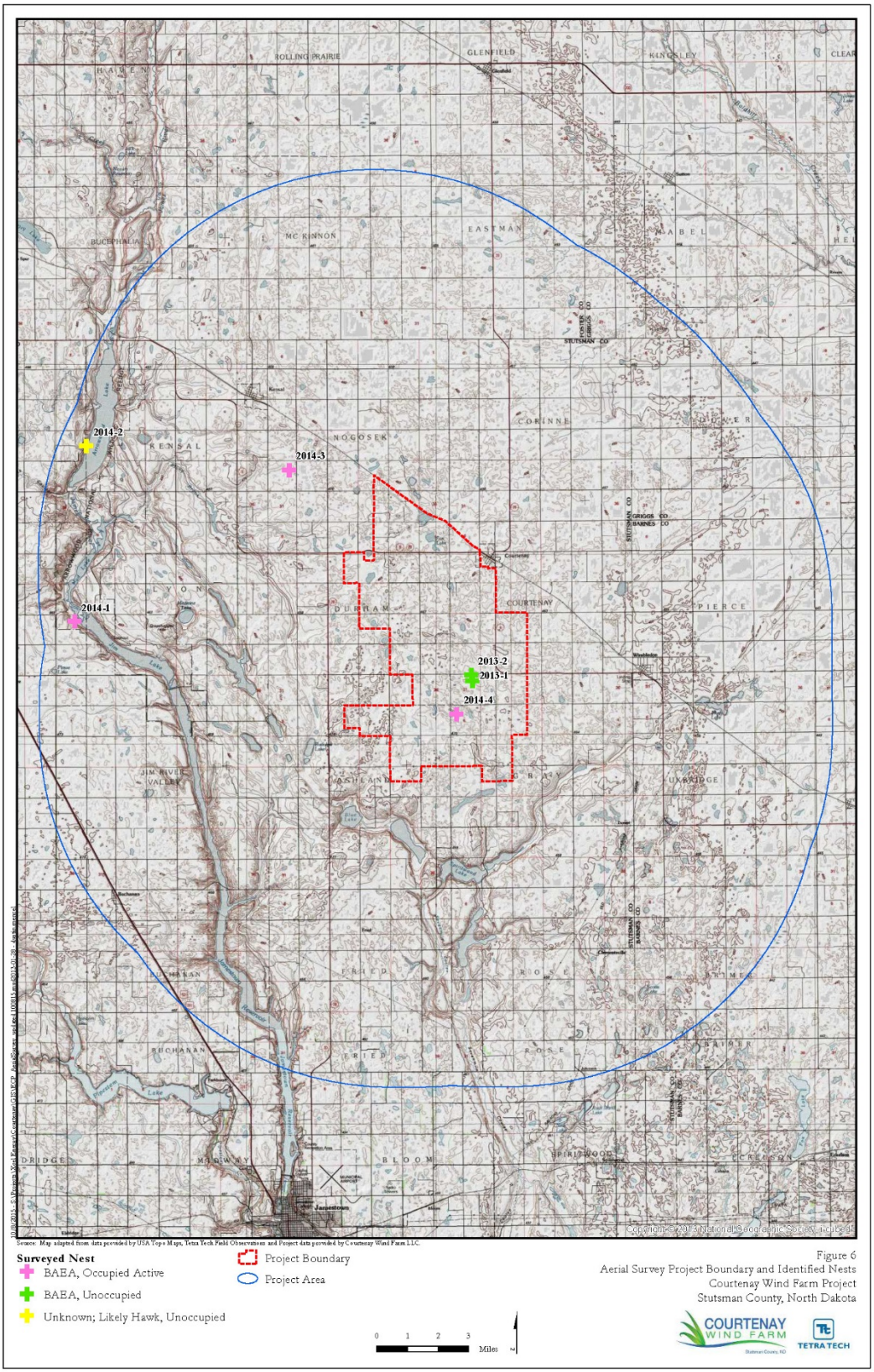
occupancy, productivity, condition, and other attributes of the nests identified as bald eagle nests or potential bald eagle nests during the initial phase of raptor nest survey within the Project Area.

The primary objective for the raptor nest surveys was to document nesting bald eagles within a 10-mile radius of the Project Area in accordance with ECP Guidance (USFWS 2013). The secondary objective included documenting other raptor nests observed within the Project boundary. The survey was conducted from a Bell 206BIII Jetranger helicopter (Double M Helicopters) that was flown approximately 60 feet above ground level at an approximate speed of 50 miles per hour. The survey plan for the first phase included searches of north-south transects spaced 1.0 mile (1.6 km) apart within the Project Area for a total of approximately 635 transect-miles (Figure 6). Deviations from the transects were needed in order to survey suitable nesting habitat and low visibility areas. The James River corridor within the Project Area was flown completely in order to allow continuous survey of suitable habitat. Two known bald eagle nests (Nest 2013-1, 2013-2) were visited as part of the survey. The second phase of the survey focused on checking nests identified in the first phase, and also included a search of suitable habitat in the eastern portion of the Project Area.

If a nest was found the following data were collected: nest identification number, raptor species, adult presence (a bird sitting or standing on the nest or near the nest), presence of eggs or young (number of eggs or young observed), nest substrate (where the nest located [e.g., elm tree, cut bank, transmission pole, etc.]), nest height (in meters (m), distance from nest to ground). Nest activity was recorded as “Occupied Active” (nest contains eggs, young, or an adult sitting on the nest indicating incubation or brooding), “Occupied Inactive” (nest does not contain eggs or young but shows evidence of use this year such as fresh lining, droppings, feathers on or underneath, or adults near the nest but not sitting on the nest), “Unoccupied” (nest shows no evidence of use and adults are not present at the nest). Nest condition was assigned into one of five categories (excellent, good, fair, poor, or remnant) based on observations made of the nest bowl and walls.

The first phase of the aerial survey was conducted on March 25 and 26, 2014. The survey team located one Occupied Active (Nest 2014-4; not previously identified), one Occupied Inactive (previously identified as nest 2013-1), and one Unoccupied (previously identified as Nest 2013-2) bald eagle nests within the Project boundary (Table 5, Figure 6). One Occupied Active bald eagle nest (Nest 2014-1), one Unoccupied likely hawk nest (Nest 2014-2), and one Unoccupied potential bald eagle nest (Nest 2014-3) were identified outside the Project boundary within the 10-mile buffer (Figure 6). Nest 2014-3 was classified as a potential bald eagle nest based on the size of the nest, proximity to wetlands, and the large flat nest bowl. However, no eagles were observed in proximity to this nest.

Figure 6. Aerial Survey Project Boundary and Identified Nests



Nest 2014-2 was identified as a likely hawk nest based on smaller size and round, deep nest bowl compared to the wide flat nest bowl of the known eagle nests.

The second phase of the aerial survey was conducted on May 23, 2014. Nests 2013-1, 2013-2, 2014-3, and 2014-4 were visited (Table 8). Nests 2013-1 and 2013-2 were occupied by Canada geese, and five eggs were visible in 2013-2 when an adult Canada goose flushed off the nest. The contents of 2013-1 could not be determined due to the presence of the adult Canada goose on the nest for the duration of the visit. Nests 2014-3 and 2014-4 were each observed to contain one eagle chick. Based on the size of the chicks and their grey downy covering, both chicks were determined to be approximately three weeks old. One adult bald eagle was present at 2014-3, and two adult bald eagles were present at 2014-4. Both 2014-3 and 2014-4 were observed to contain prey items.

Table 8. Raptor Nest Survey Data for the Courtenay Wind Farm, North Dakota 2014

Nest	Species[1]	Within Project Boundary?	Adult Present?	Number Eggs or Young	Activity[2]	Condition	Comments
2014-1*	BAEA	No	Yes	0	OA	Excellent	Adult on nest, mate near nest
2014-2*	UNKN	No	No	0	UN	Excellent	Likely hawk nest based on size and shape of nest bowl
2014-3	BAEA	No	Yes	1	OA	Excellent	One chick in nest, one adult perched on edge of nest
2014-4	BAEA	Yes	Yes	1	OA	Excellent	One chick in nest, one adult perched on edge of nest, one adult perched within 50 meters
2013-1	BAEA	Yes	No	0	UN	Excellent	Adult Canada goose on nest
2013-2	BAEA	Yes	No	0	UN	Fair	Adult Canada goose on nest with five eggs

[1]BAEA = Bald eagle; UNKN = Unknown species

[2]OA = Occupied Active; OI = Occupied Inactive; UN = Unoccupied

* Nest 2014-1 and 2014-2 were not visited during the second phase of the aerial survey, and the characteristics reported in Table 2 reflect observations made during the first phase of the aerial survey

5.2.3 2014 Ground-based Nest Observations

On July 7, 2014, a Tetra Tech biologist conducting eagle use surveys at the Project observed that Nest 2013-1 was not visible from eagle point count location 9 (Figure 5). The biologist confirmed

land access with CWE and visited the location of Nest 2013-1 on July 8, 2014. The biologist observed that the tree branches that had previously supported Nest 2013-1 appeared to have broken off, and Nest 2013-1 was no longer present. The biologist was unable to locate any remnants of Nest 2013-1 on the ground or in the nearby wetland. On August 12, 2014, CWE provided the USFWS North Dakota Field Office with an update (including photographs) regarding the status of 2013-1 (Table 1).

In early February 2015, a CWF employee reported that Nest 2013-2 appeared to be in poor condition, with only remnants of the nest remaining. A Tetra Tech biologist visited the location of Nest 2013-2 on March 19, 2015 and confirmed that only a portion of the base of Nest 2013-2 appeared to be present. No obvious remains of the former nest materials were observed on the ground surrounding the nest.

The Tetra Tech biologist also made observations of Nest 2014-4 on March 19, 2015. The biologist observed the nest with a spotting scope for approximately one hour from a location approximately 400 meters southwest of the nest. During this time, one adult bald eagle was observed near the nest; however, the eagle was not observed carrying prey items or other materials back to the nest, and the biologist was unable to view the contents, if any, of the nest.

5.2.4 2015 Ground-based Nest Observations

On August 13, 2015 a Tetra Tech biologist observed Nest 2014-4 with a spotting scope for 4 hours from locations approximately 400 meters southwest of the nest. Two adult bald eagles were observed perched near the nest for the duration of the survey period; however, the eagles were not observed carrying prey items or other materials back to the nest, and no young were observed within the nest.

The biologist also visited the locations of Nests 2013-1 and 2013-2 on August 13, 2015. Nest 2013-1 was not present, and no new nests were observed in the vicinity of former Nest 2013-1. Nest 2013-2 was observed to be in poor condition, with only a portion of the base of the nest present (similar to observations made in March 2015). No eagle activity was observed at this nest location, and no new nests were observed in the vicinity of 2013-2.

The Project Area ½-mean inter-nest distance based on occupied bald eagle nests observed during 2014-2015 nest surveys is 4.5 miles (7.2 km).

5.3 Prey Assessment

To better assess eagle use of the area and develop management strategies to prevent eagle take, it can be useful to understand the factors that bring eagles to an area. Bald eagles in particular are drawn to concentrated prey resources which may occur naturally or be the result of human activities. The diet of bald eagles in this region likely includes fish, upland game birds, small to medium sized mammals, and carrion (Buehler 2000). Bodies of water that may potentially

support fish populations are distributed throughout the Project Area and surrounding landscape. No lakes or ponds in the project area are currently stocked by the North Dakota Dept. of Game and Fish. Two lakes are stocked within a mile of the project and twenty lakes are stocked in Stutsman County.

During aerial stick nest surveys of the Project Area (see Section 5.2.3), an effort was made to identify areas of potential concentrated prey resources including poultry or sheep operations, prairie dog towns, prairie chicken leks, or ungulate wintering/parturition areas. Consistent with NLCD data and the habitat discussion presented in Section 3.0., the land cover within the Project boundary was observed to be dominated by agricultural land used for row crop production along with scattered wetlands, developed land (farmsteads), forested windbreaks around farmsteads, and small tracts of grasslands. None of these land uses would lend themselves to any concentrated prey resources. The land cover within the Project Area outside the Project boundary was generally observed to be similar to that within the Project boundary. However, areas of grazing land were observed along the James River, to the west of the Project boundary and several farmsteads with cattle yards were observed in this general area. These operations appeared to be associated with livestock ranches, and did not appear to be concentrated animal feeding operations and thus are likely not concentrated prey resources. During the March 2014 aerial surveys, several large herds of white-tailed deer were observed within the Project Area; however, these herds appeared to be grazing across the landscape and did not appear to be concentrated in any specific areas.

Based on the habitat assessment and surveys of the area, it seems that while there is prey available for bald eagles such as fish, small mammals and occasional carrion, there are no concentrated prey resources that would draw eagles into the Project Area.

5.4 Eagle Risk Evaluation Based on Survey Data

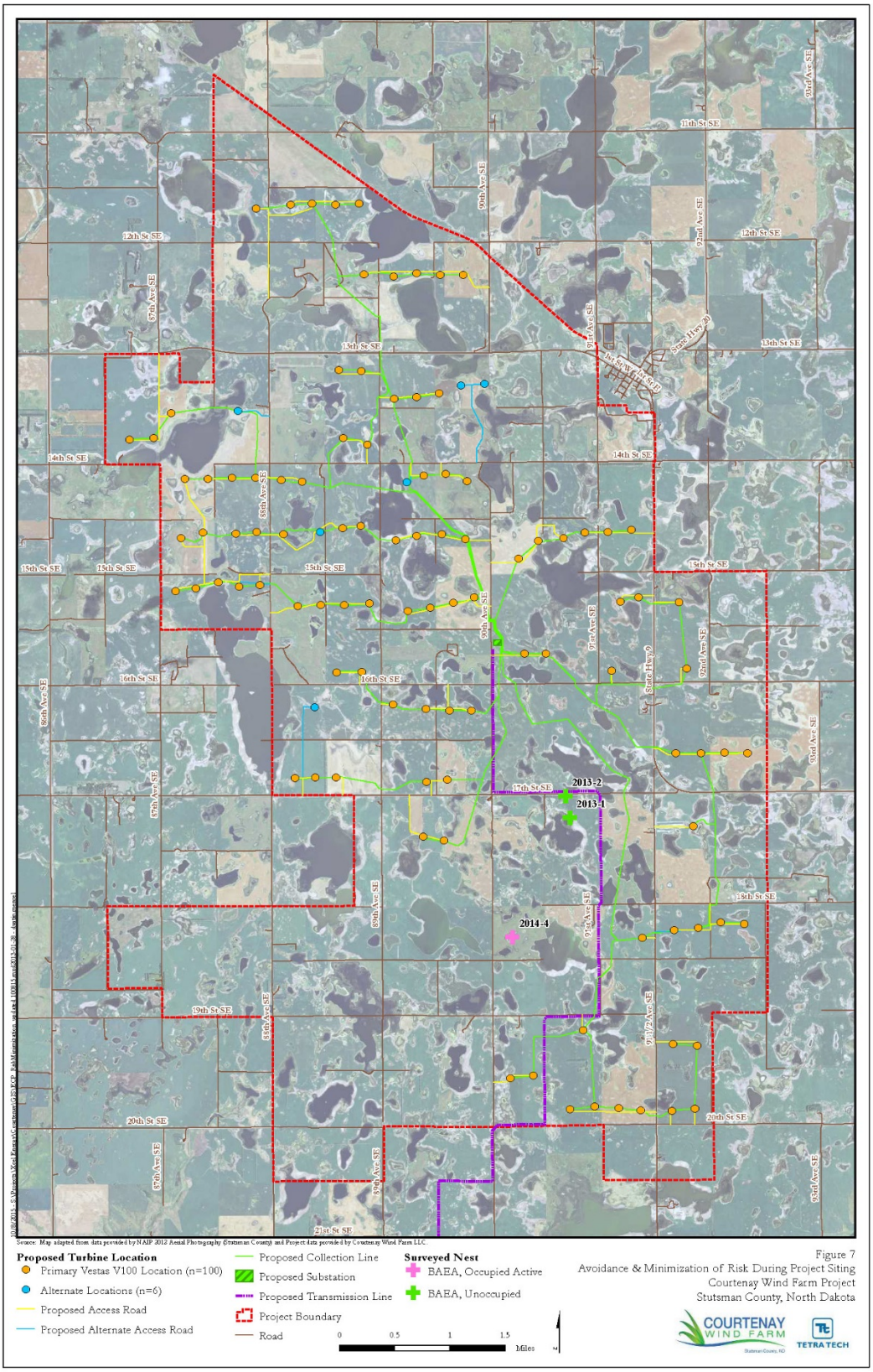
During avian point count and eagle use surveys conducted between November 2012 and August 2015, a total of eight bald eagle observations were recorded within 1 km of the proposed turbine locations. No areas of concentrated eagle use within the Project boundary are evident, and prey resources are likely distributed relatively evenly across the local landscape. No surveys were conducted that were specifically designed to assess the presence of roosting habitat within the Project Area; however, few trees are present within the Project Area (see Sections 3.0 and 5.3). One active bald eagle nest is present within a 1 km buffer of turbine locations included as part of CWF's CSC application; thus, based on the ECP Guidance the Project could fall into Category 1 – High risk to eagles, potential to avoid or mitigate impacts low because of the location of the eagle nests to the turbines. The ECP Guidance states that the risk category of a project could change as measures to reduce risk are applied. Thus, the risk category is reevaluated after consideration of Avoidance and Minimization measures included Sections 6.0, 8.1, 8.2 and is reduced to Category 2 (see Section 7.2.2).

6.0 AVOIDANCE AND MINIMIZATION OF RISKS IN PROJECT DESIGN

CWF took measures to avoid and minimize impacts to eagles during the planning and design phase of project development; these measures included (Figure 7):

- No turbines will be located within one mile of Nests 2013-1, 2013-2, 2014-4 to reduce the risk of disturbance or collision to resident eagles.
- Prior to facility siting, a high-level desktop review was conducted for fatal flaws at several potential sites (see Section 4.1).Prior to issuance of the CSC, CWF removed nine wind turbines from the southwest portion of the Project boundary, reducing the total number of turbines. By reducing the total number of wind turbines, CWF has minimized the potential collision risk to eagles as an eagle was observed at point count 7 and two eagle observations were recorded at eagle survey location 15 in the vicinity of these turbines. The current Project layout includes 100 primary turbine locations and six alternate turbine locations.
- Wetlands and waters surveys of the proposed Project facilities were conducted in 2013, and revisions to the Project layout were made to minimize impacts to wetlands and waters. By avoiding wetlands and waters, CWF has reduced the risk to eagles potentially using these habitats to forage.
- 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 eagle collision or electrocution with this equipment.
- The design of the transmission line will follow regional utility practices as well as the National Electrical Safety Code, the Rural Utility Service Code, and the Avian Power line Interaction Committee Suggested Practices (APLIC 2006; APLIC 2012). Bird diverters will be installed on the entire 17-mile length of the Project transmission line to minimize the collision risk to eagles and other avian species.

Figure 7. Avoidance and Minimization of Risk during Project Siting



7.0 PREDICTING EAGLE FATALITIES

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 with eagle fatalities compared to projects with no eagle fatalities (Allison 2012, Strickland et al. 2011). To date, evidence of bald eagle fatalities is not abundant at wind energy facilities, with a total of six known fatalities throughout North America as of fall 2012 (Pagel et al. 2013). One additional bald eagle fatality was recorded at a wind farm in North Dakota in 2015 (Prairie Public News 2015). However, there is a weak predictive relationship between eagle use prior to construction and the number of fatalities post-construction. Data regarding distribution of wind turbine collision fatalities among turbines are limited, and have been collected primarily for golden eagles. Some authors have suggested that eagles nesting near turbines are at lower risk of collision because they are familiar with the landscape compared to sub-adults or floaters (i.e., non-breeding individuals), and fatalities at the Altamont Wind Facility in California were highest for these age categories of golden eagles (Hunt 2002).

Identifying general areas within a wind project where eagle use is highest could provide insight into areas where collision risk is highest. Identifying the specific turbines that pose a collision risk is challenging, and recommendations have focused on determining if there is higher collision risk at turbines that overlap with topography, favored by eagles, such as saddles, or near the edge of cliffs where uplift is higher than the surrounding landscape (Strickland et al. 2011, USFWS 2013). In the absence of a comprehensive understanding of the influence of risk factors such as topography on the risk of collision, eagle use of an area provides a basic indicator of collision risk, and has led to the use of quantitative collision risk models to predict eagle fatalities based on pre-construction use data.

7.1 Fatality Model

To estimate the potential number of annual bald eagle fatalities at the Project, CWF used the USFWS eagle fatality prediction model provided in the ECP Guidance (USFWS 2013) and in New et al. 2015. The risk of collision was modeled as the mean number of fatalities per year resulting from a Bayesian analysis of the input data, which assumes that risk is proportional to use (USFWS 2013). Bayesian models use existing information to estimate the statistical distribution (referred to as prior probabilities in Bayesian analysis) of variables of interest in a hypothesis test, and then use new data to update the distribution. The USFWS Bayesian model predicts collision risk at a wind farm based on the exposure of eagles to turbines as measured by point-count surveys, and the collision probability. Variables incorporated into the model are summarized in Table 9.

Table 9. Variables Used in the Bayesian Collision Risk Model

Symbol	Name	Description (Units)
t	Eagle minutes	Minutes of eagle flight detected over the Project during point counts (units = minutes)
N	Number of point counts	The number of point count periods surveyed (units = point count visits)
λ	Mean exposure minutes	The mean number of exposure minutes per hour per km^3 in the sampled area (units = eagle minutes/hours/km^2)
h	Height of hazardous area	Total height of a turbine from ground level to maximum turbine blade tip height (units = meters)
r	Rotor radius	Radius of a turbine blade (units = meters)
T	Total daylight hours	Total hours of daylight at the Project (units = hours)
ε	Expansion factor	Scaling factor used to scale mean exposure minutes to the hazardous volume and total daylight hours (τ). (units = hours x km^3)
C	Average collision probability	The probability, given one minute of flight through the hazardous area, of a collision with a turbine (unitless number)
F	Eagle fatalities	Estimated eagle fatalities per year (units = eagles/year)

km^3 – cubic kilometer

In this model, the total annual eagle fatalities (F) as the result of collisions with wind turbines are predicted as the product of the rate of eagle exposure (λ) to turbine hazards, the probability that eagle exposure will result in a collision with a turbine (C), and an expansion factor (ε) that scales the resulting fatality rate to all daylight hours over the entire project (Equation 1).

$$F = \varepsilon \lambda C \qquad \text{Equation 1}$$

Within the Bayesian estimation framework, prior distributions for exposure rate and collision probability are derived by the USFWS from previous studies. The expansion factor is a constant based on the proportion of daylight hours and hazardous area around turbines that is sampled by the point counts. The analysis calculates the exposure posterior distribution from its prior distribution and observed point count data. The expanded product of the posterior exposure distribution and collision probability prior yields the predicted number of annual fatalities.

Exposure rate. The exposure rate λ is the expected number of exposure events (eagle minutes) per daylight hour per square km. In the ECP Guidance (USFWS 2013), the USFWS defined the prior distribution for exposure rate for eagles based on information from a range of projects under review, as well as others described with sufficient detail in Whitfield's Collision Avoidance of Golden Eagles at Wind Farms under the 'Band' Collision Risk Model (Whitfield 2009). CWF's analysis of data used this prior distribution as updated for a three-dimensional model by New et al. (2015) with mean = 8.69 and SD = 13.64 eagle minutes/hour/km^3. This prior probability may not be appropriate for bald eagles because the two eagle species are not closely related and have very different foraging ecologies. Although both species are referred to

as eagles, they in fact belong to separate genera within the family *Accipitriformes*. More relevant are their separate habitat and prey preferences. Golden eagles prefer small to medium sized mammals found in semi-open habitats (Kochert et al 2002). Bald eagles focus mainly on fish, carrion, waterfowl and occasionally small mammals using forested and semi-forested habitats associated with rivers, lakes, and sea shores (Buehler 2000).The posterior probability distribution for exposure is produced by the model using the prior distribution and the minutes of eagle exposure measured during point counts (t). The new posterior λ parameters are the sum of the mean of the prior distribution and the eagle minutes observed (t), with the standard deviation of the posterior distribution determined by the number of point counts (N).

Collision probability. Collision probability (C) is the probability of an eagle colliding with a turbine given an eagle's exposure to turbine collisions (1 minute of flight in the hazardous area). For the purposes of the model, all collisions are considered fatal. The USFWS provided a prior distribution for this variable based on the Whitfield 2009 study of avoidance rates of golden eagles from four independent sites. CWF used this prior distribution because there is no comparable empirical distribution for bald eagles in the published literature; however, use of this prior distribution in the analysis may not be appropriate for bald eagles because the two eagle species are not closely related and have very different foraging ecologies (see above). A weighted mean and range of avoidance from those sites yielded a mean and standard deviation for collision probability of 0.0058 and 0.0038 respectively (USFWS 2013).

Expansion factor. The expansion factor (ε) scales the resulting per-unit fatality rate (fatalities per hour × km^2) to the daylight hours, τ, in 1 year (or other time period if calculating and combining fatalities for seasons or stratified areas) and total hazardous volume (km^3) within the project footprint (equation 2):

$$\varepsilon = \tau n h \pi r^2 \qquad \text{Equation 2}$$

where n is the number of turbines, h is the height of the hazardous area associated with the turbine, and r is the rotor-swept radius of the turbine. The units for ε are hour·km^3 per year (or season in a stratified model).

To determine the distribution for the predicted annual fatalities, the exposure and collision risk distributions need to be multiplied by each other and expanded. The resulting distribution cannot be calculated in closed form; therefore the model generates it through 100,000 simulations.

Following the ECP Guidance (USFWS 2013), CWF used the model to predict annual fatality rate as the mean and upper 80 percent credible interval limit of the posterior distribution of F. The upper 80 percent credible interval limit represents the fatality rate below which 80 percent of the projected fatality rates fell during the 100,000 simulations (i.e., the 80th percentile). A straightforward interpretation of the 80 percent upper credible interval limit is that there is an 80 percent probability that the actual mortality rate will be at or below this limit. As such, it

provides an extremely conservative estimate of the fatality rate that may occur at the facility, and USFWS uses it to manage eagle take permits to attempt to ensure that the fatality rate will not exceed permit levels.

7.1.1 Fatality Inputs and Results

CWF used data collected from the avian point counts and eagle use surveys through August 20, 2015 as inputs into the fatality model (Table 10). Based on the design changes to the turbine layout (Section 6.0), survey effort and data collected at avian point count 7 and eagle survey locations 13 and 15 are not included in the fatality analysis because these locations do not occur within 1 km of wind turbines. The ECP Guidance states that count locations should be located within a 1 km buffer of turbines; thus, the above referenced count locations are outside of the buffer and data are not included in fatality analysis. Thirty bald eagle minutes (4 minutes from avian point count surveys and 26 minutes from eagle use surveys) were recorded over 512.67 hours of survey over all seasons. The resulting estimated potential eagle fatalities per year (upper 80 percent credible limit [CI]) are 0. 60 (0.89) bald eagle fatalities per year (Table 11). Annual fatality rates corresponding to these estimates would result in 3 (5) bald eagle fatalities over a 5-year permit term or 18 (26) eagle fatalities over 30 years.

Table 10. Data Inputs for the USFWS Bayesian Eagle Fatality Model

Season and Year	Number of turbines	Turbine radius (m)	Total 60-minute counts	Eagle minutes below 200m
Fall 2012	100	50	21.3	2
Spring 2013	100	50	29.3	2
Summer 2013	100	50	28.0	0
Fall 2013	100	50	84.0	4
Winter 2013-2014	100	50	112.0	12
Spring 2014	100	50	56.0	0
Summer 2014	100	50	84.0	9
Fall 2014	100	50	28.0	1
Summer 2015	100	50	70	0
Total	**NA**	**NA**	**512.7**	**30**

Table 11. Predicted Annual Bald Eagle Fatalities at the Project

Season	Bald eagle minutes below 200m	Estimated fatalities per year	Upper 80% credible interval
Spring	2	0.080	0.121
Summer	9	0.164	0.243
Fall	7	0.125	0.185
Winter	12	0.209	0.309
Annual	**30**	**0.600**	**0.886**

7.2 Risk Assessment

7.2.1 Disturbance

Disturbance in the context of BGEPA means to agitate or bother an eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding or sheltering behavior (USFWS 2013). Bald eagle disturbance or displacement is possible during construction or operation of the Project, primarily at nests within the Project Area ½-mean inter-nest distance (4.5 miles) of Project facilities. The potential for displacement or disturbance for eagles is somewhat offset by the baseline disturbance in the Project, which includes daily agricultural activity and traffic along the roads in the Project vicinity. CWF understands that current levels of disturbance in the Project Area do not exempt the Project from liability for disturbance take due to the Project. Project construction may disturb bald eagles under circumstances such as if they are nesting within line-of-sight of the Project or the areas under active construction are preferred foraging areas. Although bald eagles are tolerant of some types of human activity (Guinn 2013), a buffer of 1 mile has been established around nests 2013-1 and 2013-2 in which turbines will not be constructed (Section 4.1) to minimize disturbance to the extent practicable during operation of the Project,. To minimize the potential for eagle disturbance during the construction period to the extent practicable, a non-disturbance construction buffer of 0.5 miles will be established around nests 2014-4 for ground-disturbing activities, and a 1-mile, no-turbine buffer will be established around 2013-1, 2013-2, and2014-4 (Section 8.1).

Few studies have been conducted regarding raptor nest density and activity before and after the construction of wind farms. Most of these studies have produced descriptive rather than experimental data. Several studies conducted by consultants at wind energy facilities in the western United States have produced somewhat equivocal results, but generally suggest that wind energy facilities do not displace nesting raptors or reduce nest densities over the long term (Howell and Noone 1992; Erickson et al. 2003, 2004; Johnson et al. 2000a, 2003; Young et al.

2006, Young et al. 2010; and Gritski et al. 2008). For example, post-construction studies at the Leaning Juniper Wind Farm in Oregon suggest that raptor nests greater than 0.5 mile from turbines were not disturbed by the wind energy facility (Gritski et al. 2008). Other studies have found no clear relationship between nest occupancy and distance from turbines (Johnson et al. 2003; Young et al. 2006), and some studies have suggested that species differ in their response to construction activities (Johnson et al. 2000b; Erickson et al. 2003, 2004). It is not currently known if the responses to wind farms described above are predictive of bald eagle responses to disturbance associated with construction or operation of a wind farm. A before-after/control impact study of avian use was conducted at the Buffalo Ridge wind-energy facility in Minnesota. That study found evidence that northern harriers tended to avoid turbines in the first year following construction. Two years following construction, however, no large-scale displacement was detected, i.e., displacement had ceased (Johnson et al. 2000b).

7.2.2 Eagle Risk Summary

Based on the wide spatial distribution of potential foraging areas, eagles are unlikely to concentrate in a specific location, as shown in the flight paths mapped (Figure 5). Incorporation of a no turbine buffer and a construction avoidance buffer of nests 2013-1, 2013-2 and 2014-4should minimize disturbance during the construction and periods (Figure 6). Few bald eagle fatalities have been detected at wind energy projects in the United States, and between 0.542 and 0.893 (upper 80% CI) fatalities at the Project are predicted per year, depending on how bald eagles respond to wind turbines. Thus, considering the siting measures (Section 6.0) to design the Project to accommodate nesting bald eagles and the predicted fatality rate, based on the ECP Guidance the Project falls into Category 2 – High or moderate risk to eagles, opportunity to mitigate impacts.

8.0 AVOIDANCE AND MINIMIZATION OF RISKS, ACPS, AND COMPENSATORY MITIGATION

8.1 Construction BMPs

This section identifies impact avoidance and minimization measures (BMPs) specific to eagles that CWF will incorporate during construction of the Project. Parallel measures considered during siting and operations are described in Sections 6.0 and 8.2, respectively. General avoidance and minimization measures that will benefit wildlife in general are described in the BBCS. CWF evaluated the BMPs listed in the WEGs and decided to implement the following BMPs based on their potential benefit to eagles:

- A non-disturbance buffer of 0.5 miles for ground disturbing activities will be established around nest 2014-4 from January – August to avoid disturbance of nesting eagles. Nests will be monitored for activity.

- Native species will be used when seeding or planting non-cropped fields during restoration. USFWS and the Natural Resource Conservation Service (NRCS) will be consulted regarding native species to use for restoration as this will provide a general benefit for eagle habitat. Restored areas will be monitored to determine reestablishment, and reseeding or replanting will occur in areas where non-establishment occurs.
- Existing trees and shrubs will be protected where practicable. If impacts are unavoidable, CWF will replant trees and shrubs in accordance with the North Dakota Public Service Commission's tree and shrub mitigation specifications in the siting permit.
- Accumulation of outdoor storage or waste will be addressed immediately so as not to attract birds or rodents, which could serve as prey for eagles.
- Site personnel will be required to receive training on the wildlife incident reporting system in the event that an injured eagle or eagle carcass is discovered during construction.
- The Construction Monitoring Plan will focus on instilling an awareness of construction activities that may affect bird species of concern including eagles, so as to identify opportunities to minimize those effects where warranted.
- All construction-related traffic within the site will be limited to a maximum speed limit of 25 mph unless a lower speed limit is posted to reduce the risk of vehicle/eagle collisions.
- Road kill or other carcasses (including large wildlife carcasses and livestock carcasses) around the Project site will be cleared within 24 hours of discovery or notification by a landowner to avoid attracting bald eagles as bald eagles scavenge road-killed animals. Site personnel will be trained so that only carcasses of non-federally protected animals are moved.
- Bird diverters will be installed along the entire 17 mile above-ground transmission line to reduce the risk of collision by bald eagles. The Bird Flight Diverter layout is anticipated to be addressed in the BBCS, once finalized. CWF has a great deal of experience with diverter design, and typically works on a targeted application in the most beneficial areas, or the areas that clearly would reduce the potential for bird strikes.
- The electrical collection line connecting the turbines to the Project substation will be buried underground to reduce the risk of electrocution of bald eagles.
- Minimize, to the maximum extent practicable, roads, power lines, fences, and other infrastructure associated with the Project.

- When practical use tubular towers of best available technology to reduce ability of birds to perch and reduce risk of collision.
- Instruct employees, contractors, and site visitors to avoid harassing or disturbing wildlife, particularly during reproductive seasons.

8.2 Operational BMPs

This section identifies impact avoidance and minimization measures (BMPs) specific to eagles that CWF will incorporate during operation of the Project. Parallel measures considered during siting and construction are described in Sections 6.0 and 8.1, respectively. General avoidance and minimization measures that will benefit wildlife in general are described in the BBCS.

- APLIC (2006, APLIC 2012) recommendations for overhead utilities maintenance will be followed to reduce risk of eagle electrocution and collision with electrical components.
- To reduce collision risk of bald eagles, guyed temporary meteorological towers will be removed and replaced with a non-guyed permanent lattice tower for meteorological monitoring. In the event that temporary towers are installed as part of an operational assessment of the Project, guy wires will be marked with marker balls to improve visibility to birds and reduce collision risk for bald eagles.
- Rock and brush piles that could create prey habitat located adjacent to wind turbines will be removed to reduce prey sources for eagles in risk areas. Creation of these features will be prevented, to the extent practicable.
- Road kill or other carcasses (including larger wildlife carcasses and livestock carcasses) around the Project site will be cleared by CWF within 24 hours of discovery or notification by a landowner to avoid attracting bald eagles as bald eagles scavenge road-killed animals. Site personnel will be trained so that only carcasses of non-federally protected animals are moved.
- Bald eagles are known to scavenge carcasses at livestock operations. Thus, written training materials will be provided to landowners that have livestock operations within the Project. Materials will describe carcass disposal methods that minimize scavenging opportunities for bald eagles and other raptors. CWF will work with owners of livestock operation in the Project Area to ensure that carcasses are removed with 24 hours of discovery. The goal of this measure is to reduce such scavenging opportunities in the area through increased landowner awareness of the issue.
- If a bald eagle nest is built within one mile of the Project when the Project is operational, it may indicate that the operation of the Project does not negatively affect bald eagle breeding behavior. If maintenance requires use of heavy equipment during the breeding

period, eagle behavior will be monitored as described in Section 8.1, and CWF will coordinate with USFWS prior to the activity to determine whether or not a permit for one-time nest disturbance is needed. This measure would only apply to nests built after the Project is operational as there is a 1-mile no turbine buffer around the nests 2013-1 and 2013-2 as described in Section 4.

9.0 EXPERIMENTAL ADVANCED CONSERVATION PRACTICES

CWF has developed an adaptive management strategy for the implementation of Experimental Advanced Conservation Practices (EACPs) that CWF will implement if a bald eagle take is observed in post construction monitoring. ACPs are defined as scientifically supportable measures that are approved by the USFWS and represent the best available techniques to reduce eagle disturbance and ongoing fatalities. Adaptive management will be guided by the steps outlined in Table 12, and CWF will engage with USFWS any time a trigger or threshold event occurs to collaboratively manage the process. Table 12 elaborates the management actions that are to be taken when specific take thresholds are reached; it is not intended to limit or preclude other equivalent EACPs that are identified in consultation with the USFWS or that may be developed as a result of new information, techniques or science.

Table 12. Summary of Experimental Advanced Conservation Practices Using a Step-wise Approach to be Implemented When an Eagle Take Occurs[1]

Experimental Advanced Conservation Practices		Cost Caps	Non-cumulative Threshold or "Trigger"[2]
Step I	Coordinate with USFWS to determine cause of mortality if not an obvious turbine collision. If an obvious turbine strike, determine if there are any factors that might influence risk. Assess eagle fatalities to determine if cause or contributing risk factors can be determined (e.g., nest proximity, weather, presence of prey/carrion) based on information gathered by operational personnel and if management response is warranted and feasible. Coordinate with USFWS about findings from assessment. Of primary concern is whether common elements between eagle fatalities exist that indicate a more concentrated assessment of the cause of mortality should be performed.	No cost cap is identified due to the assumption that no additional contractor support is needed. If additional contractor support is needed, then USFWS and CWF will discuss a cost cap.	Any eagle taken during effective period of the permit.

Experimental Advanced Conservation Practices		Cost Caps	Non-cumulative Threshold or "Trigger"[2]
Step II	Coordinate with USFWS to determine cause of mortality if not an obvious turbine collision. For project-caused fatalities perform additional observational/behavioral studies to further evaluate risk and inform potential conservation measures. For example flight path monitoring that defines seasonal and diurnal flight patterns which may inform future risk reduction plans for the project. Use monitoring results to determine if a risk mitigation plan is appropriate. Coordinate with USFWS about findings from evaluation.	There is no cost cap for this step unless additional contractor support is needed to conduct additional observational/behavioral studies and analysis for this step. Costs will be limited to a maximum of $75,000 a year.	If any two eagles taken within any 12- month period or two eagles taken within the first two years of the effective period of the permit.
Step III	Coordinate with USFWS to determine cause of mortality if not an obvious turbine collision. For project-caused fatalities, CWF will work in conjunction with USFWS to implement a program in which personnel with appropriate skills to monitor for raptors will be present on site during daylight hours during high-risk periods identified in prior studies, and have the authorization to modify turbine operations when an eagle approaches the rotor swept area (RSA). CWF will continue monitoring and develop a curtailment plan in which turbines will be curtailed in high risk areas during high risk periods based upon information collected in Step I, the data collected during the observational/behavioral studies performed in Step II, and/or during the interim program here in Step III. The curtailment plan will identify eagle risk areas/times/turbines to be targeted for implementation of informed curtailment as part of regular operations. Curtailment will be designed to reduce risk at times or in areas where environmental factors contribute to the collision risk of eagles.	Costs associated with biological monitoring to implement modification of turbine operations will be limited to a maximum of $100,000 per year of monitoring. Turbine curtailment will be limited to a maximum cost of $100,000 per year as long as permitted eagle take is not exceeded.	If any three eagles taken within any 24- month period (actual annual rate >1 eagle per year).

Experimental Advanced Conservation Practices		Cost Caps	Non-cumulative Threshold or "Trigger"[2]
Step IV	Work with USFWS to determine cause of mortality if not an obvious turbine collision. For project-caused fatalities, CWF will coordinate with USFWS to determine best options to reduce eagle fatalities, and implement measures in a joint collaborative process involving USFWS. Measures could include: (1) implementing informed curtailment plan to reduce risk in high risk areas or during high risk periods; (2) deploying approved advanced technology designed to detect and deter large raptors; and/or, (3) implementing technology that is designed to curtail turbine blade rotation as eagle(s)/large raptors approach individual turbine's RSA.	Turbine curtailment will limited to a maximum cost of $200,000 per year. Costs associated with installation of alternative technologies to prevent further eagle fatalities will be limited to a maximum of $200,000 as long as permitted eagle take is not exceeded.[1]	If more than three eagles taken within any 24 month period (actual annual rate > 1.5 eagles per year)

[1] Nothing in this table authorizes the permittee to exceed the level of take authorized in the programmatic take permit. The purpose of the table is to describe how permittee will respond to data that potentially indicates additional measures may be needed to ensure compliance with permit conditions.

[2] Thresholds are not intended to be applied cumulatively, i.e., if 3 eagles are found in a single event, CWF may employ Step III measures without having to first employ Steps I and II. Evaluations will be compared to the threshold levels on the table, which are intended to signal rates of take that may lead CWF to exceed its anticipated permit level of 5 eagles per 5-year permit term if additional EACPs are not employed. EACPs at each step in the table are intended to be commensurate with the level of impact indicated by the threshold.

This adaptive management framework provides an increasing level of effort to understand and address eagle fatalities should unanticipated eagle fatalities result in up to three eagle fatalities in one 24-month period. If three eagle fatalities occur in a 24-month period, indicating an annual rate of take ≥ 1.0 eagles per year, monitoring will be intensified and biologists will be given the authority to modify turbine operations. Additionally, the ongoing monitoring triggered at Step II of the adaptive management plan will be used to develop a curtailment plan targeting high risk turbines and situations. If more than three fatalities occur in a 24-month period, CWF and the USFWS will use information collected to determine the next step to reduce eagle fatalities, which could include the implementation of a curtailment plan or the use of detect and curtail or detect and deter technology. Because technology and modeling methods continue to evolve, CWF commits to working with the Service immediately upon detection of any eagle fatality to develop feasible and practicable EACPs, rather than prescribing such measures at this time, to allow CWF to make use of the best available scientific information known at that time, subject to appropriate cost caps.

Based on several statements in the ECP Guidance it does not appear to CWF that compensatory mitigation targeted to offset permitted mortality will be required for the Project. The ECP

Guidance states that if eagle populations are not healthy enough to sustain additional mortality, applicants must reduce the unavoidable mortality to meet the no-net-loss standard (USFWS 2013). As the population in North Dakota is increasing (Johnson 2010), and based on CWF's initial review, CWF believes the predicted take will not exceed that which can be sustained by the local area population, compensatory mitigation is not likely to be required for bald eagles at the Project. However, as part of CWF's good faith interest in advancing the conservation of eagles as well as other wildlife, CWF will voluntarily contribute $25,000 to efforts in North Dakota to preserve eagles and eagle habitat in addition to the commitments made in Table 12.

10.0 POST-CONSTRUCTION MONITORING

This section provides a brief overview of all avian monitoring for the Project and explains in detail monitoring that will be conducted to document compliance with a programmatic eagle take permit. A complete description of all avian monitoring is described in the BBCS for the project.

10.1 Fatality Monitoring

The objective of bald eagle fatality monitoring is to accurately estimate the number of bald eagle fatalities, if any, associated with Project operations. Because no monitoring protocol can assure a complete census of fatality events, CWF has designed its methodology using a probabilistic approach to identify a protocol that produces a high level of statistical confidence in the results of monitoring. The following sections describe fatality monitoring for bald eagles to be used at the Project to measure long-term permit compliance. Eagle-take-permit compliance monitoring will be conducted at 100 percent of the Project turbines for the first two years of operations, after which CWF will evaluate and modify the program in coordination with USFWS.

Long-term permit compliance monitoring for the Project was designed using a prospective power analysis as described in Section 10.1.1.1.

Baseline monitoring for all birds and bats will occur during the first two years at a subset of turbines, and is described in the Project Bird and Bat Conservation Strategy (Tetra Tech 2014). As described in Section 10.1.1.7, permit compliance monitoring will be adaptively managed throughout the life of the Project to maintain accuracy and precision of the resulting fatality estimates.

10.1.1 Permit Compliance Monitoring

As the primary means of eagle fatality monitoring, CWF will implement long-term, permit compliance monitoring at 100 percent of turbines, which will start immediately after commercial operation and continue for the life of the Project. The initial study design, described below will be implemented for the first two years of operations, after which it, and any assumptions necessary to perform power analysis will be examined by CWF in coordination

with USFWS and adaptively managed. Each eagle fatality will be documented on a data sheet and reported to the designated Xcel Energy Environmental Services contact, who will report any eagle fatalities to the USFWS Office of Law Enforcement and Region 6 Migratory Bird Permit Office within 24 hours of identification or the next business day if a fatality is discovered on a federal holiday or weekend. The data will be logged in a tracking spreadsheet maintained by Environmental Services and accessible to the facility. Permit compliance monitoring will be the sole source of fatality monitoring in years without baseline fatality monitoring, and will provide a complete count of eagle fatalities subject to the probabilistic caveats described below.

10.1.1.1 Basis of Permit Compliance Monitoring Design

CWF used the fatality estimation program, Evidence of Absence (Dalthorp et al. 2014) to perform a prospective (predictive) power analysis in the Design Tradeoffs module. The Evidence of Absence software allows a user to design a fatality monitoring protocol to achieve a pre-determined level of statistical power once several search parameters are known. If search parameters such as carcass persistence and searcher efficiency are not known for a project, typical values from the publicly available literature can be used to design a program; subsequent analyses can use updated parameter estimates derived from the project. The software uses a Bayesian statistical approach, and statistical power in this approach is quantified as the credibility of an estimate. In this analysis, CWF used Evidence of Absence to quantify the credibility (probability) that total eagle fatalities occurring in a monitoring year did not exceed 1, which is the projected annual take under the proposed permit, based on current fatality projections for the Project.

Sampling coverage refers to the proportion of the actual carcass distribution that is sampled, and it is a function of the proportion of the turbines sampled and the proportion of the carcass impact zone around the turbines that is searched. CWF used the ballistics model of Hull and Muir (2010) to identify the size of a plot that would encompass at least 99 percent of the large-bird impact zone around the search turbines (130m MBTH), which are slightly smaller than Hull and Muir's "large" turbines (150 m MBTH), resulting in a square plot extending 117 m from the turbine on each side (total plot size: 234 m x 234 m). This search plot size will be evaluated by CWF in coordination with USFWS after the end of the initial two years of monitoring and may be adjusted downward if warranted.

Searcher efficiency and carcass persistence are not yet known for the Project, so CWF conservatively estimated these parameters from available information, which suggests that carcasses of large raptors persist at least 30 days (e.g., NWC and WEST 2007; Gritski et al. 2010), with mean persistence as high as 128 days reported for some projects (Rabie et al. 2014) and that searcher efficiency for eagles is approximately 0.90 (Smallwood 2013 and references therein; Rabie et al. 2014, New et al. 2015). CWF also estimated several other parameters that have a minor influence on sampling design, and all parameter entries in the power analysis are summarized in Table 13.

Table 13. Parameters in the Prospective Power Analysis of Fatality Monitoring Design

Parameters required to design a survey	Required model input value chosen for simulations
Carcass Persistence – the time a carcass is available for detection, a random variable	Weibull probability model with mean = 30 days (95% confidence interval: 5,65)
Sampling Coverage – proportion of the carcass distribution sampled, a random variable	Varied from 0.2 to 1.0
Searcher Efficiency – probability of finding a carcass given that it is available for detection in the searched area	Fixed at 0.90
Carcass arrival rate, a random variable	Uniform probability model, indicating no expectation of seasonal variation
Factor by which searcher efficiency changes between searches, which accounts for decreasing detectability of carcasses not found on the first search	Fixed at 0.75, indicating that searcher efficiency on a second search = 0.75 x 0.90 = 0.68
Search Interval – the interval in days between successive searches, a random variable	Varied from 1-30 days

The prospective power analysis indicated that searching 80 percent of the carcass distribution around turbines at intervals of 28 days will provide 90-percent certainty that no more than one bald eagle fatality occurred during a monitoring year if zero carcasses are found (Figure 8). CWF has determined that nearly 18 percent of the areas within 117m of the turbines will be unsearchable due to permanent or intermittent coverage by standing water based on an analysis of all surveyed wetlands in the Project Area. Therefore, to ensure sampling 80 percent of the carcass distribution, it may be necessary to search at 100 percent of turbines. Conclusions regarding search parameters depend on the assumptions that eagle carcasses persist for an average of 30 days and that searcher efficiency for bald eagles averages 90 percent. These parameters will be estimated for the Project during the first two years of fatality monitoring and the monitoring design will be adaptively managed by making any adjustments necessary to maintain the target credibility level of 90 percent.

10.1.1.2 Technical Approach

Fatality searches will be conducted at 100 percent of turbines at the Project once every 28 days during operations. In fatality monitoring, the number of fatalities found during searches represents a minimum number of fatalities at a project because of the possibility that not all fatalities are found by searchers. Therefore, to understand how likely searchers are to detect a carcass and how long carcasses persist, carcass persistence trials and searcher efficiency trials (see Sections 9.1.2.3 and 9.1.2.4) will be conducted and the results used to adjust survey techniques and analyses for these sources of bias.

During the initial set-up for carcass surveys, a “sweep survey” will be conducted by properly

permitted persons 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 carcass 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).

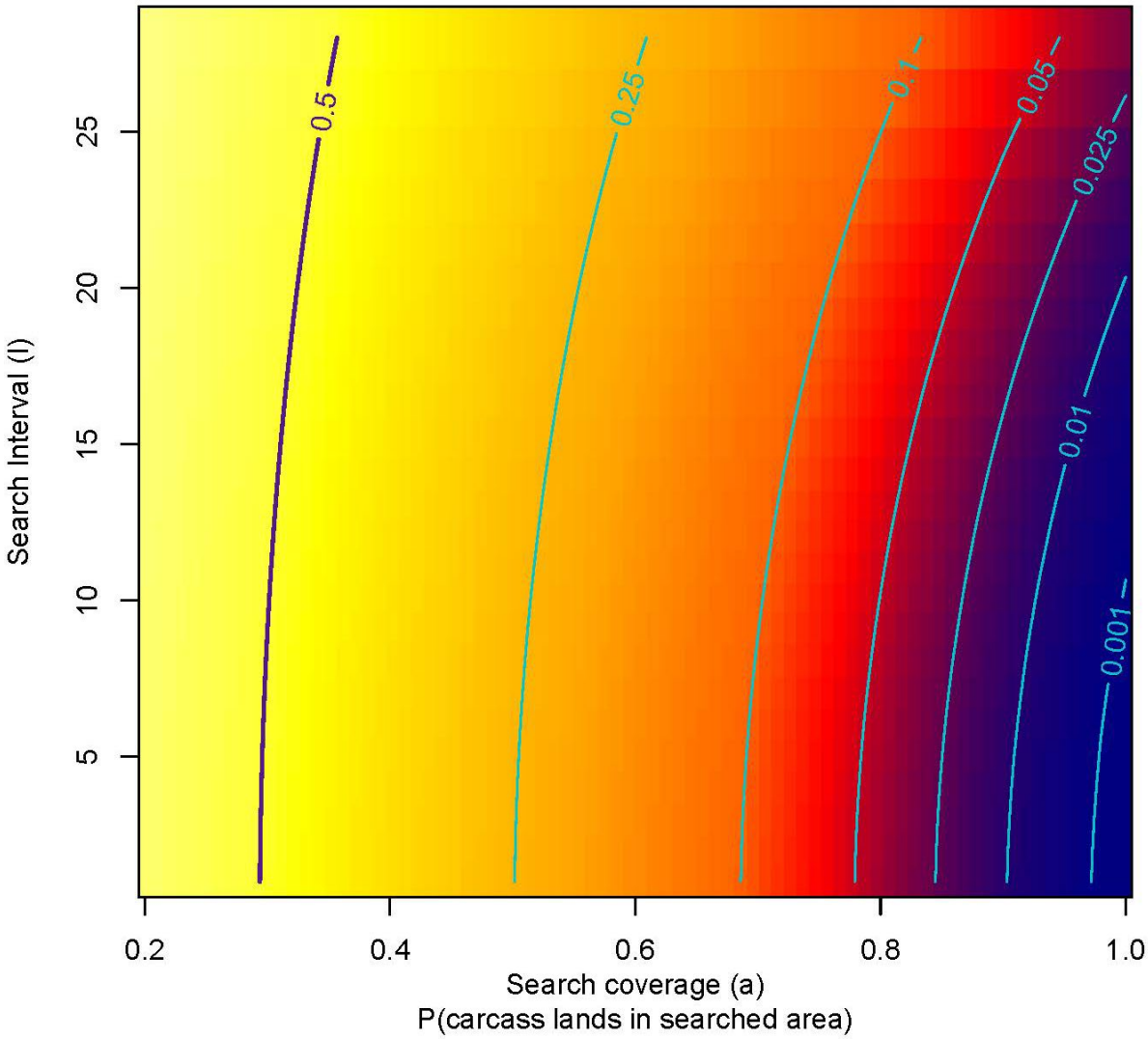
Large raptors generally have longer carcass persistence times than small birds and can often be in place for longer than 30 days (e.g., NWC and WEST 2007; Gritski et al. 2010) with mean persistence as high as 128 days reported in some studies (Rabie et al. 2014). Based on these results, the search interval will be initially set at 28 days because of the large size of eagles.

The 28-day search interval will be used for the first two years of surveys. After the second year of monitoring, CWF will evaluate search interval in coordination with USFWS and may adjust the interval to optimize detection probability for eagles.

A square search plot centered on the turbine with sides equal to 240 m will be searched for carcasses during each visit. The proposed search plot will extend 120 m (92 percent of MBTH; rounded up from 117 m) from the turbine on all sides, and will encompass over 99 percent of the carcass distribution for large birds as predicted for large turbines (up to 150m MBTH) by the ballistics model of Hull and Muir (2010). Based on the anticipated high visibility of a bald eagle carcass, linear transects will be established within search plots approximately 20 m (66 ft) apart and the searcher will walk along each transect searching both sides out to 10 m (33 ft) for eagle fatalities.

Searchers will assume that bald eagle carcasses found are a result of turbine collisions unless the cause of death can be clearly attributed to a non-turbine cause. If necropsy results are available from USFWS for an eagle carcass, they will be used to assign cause of death. Eagle carcasses found will be carefully examined by individuals with the appropriate permits to handle eagles for signs of injury consistent with turbine collision. Although an unknown number of fatalities of bald eagles may result from natural predation, disease, or anthropogenic events (e.g., shooting), carcass condition rarely facilitates determining the cause of death in the field.

Figure 8. Output from Evidence of Absence indicating the probability that no more than 1 eagle fatality occurred at the Project given that 0 fatalities were detected in searches as a function of sampling coverage (x-axis) and search interval (y-axis). Inputs assumed a mean carcass persistence time of 30 days and a searcher efficiency of 90%. A credibility of 90 percent is achieved by all combinations along the line labeled 0.1.



Bald eagle carcasses found during carcass searches will be left in place, and covered with a large, weighted container, and the USFWS Office of Law Enforcement and USFWS Region 6 Migratory Bird Permit Office will be contacted within 24 hours of discovery, or the next business day following discovery, of the carcasses. The protocol for dealing with eagle carcasses will be included in the operational monitoring protocol and operations personnel will be trained in its execution. A kit containing the materials necessary for the protocol will be provided in the operations and maintenance building.

Fatality searchers will collect all of the data recommended in Appendix H of the Guidance, including the following, for each search:

- Date
- Start time
- End time
- Interval since last search
- Observer
- Turbine area searched (e.g., string or turbine numbers)
- Weather data (e.g. cloudiness, precipitation, temperature, wind, snow cover)
- Search path

If an eagle fatality is found during a search, the following information will be recorded on a fatality data sheet:

- Date
- Species
- Age/sex category when possible
- Band number and notation if wearing an band or auxiliary marker
- Observer name
- Turbine number or other identifying character
- Distance of the carcass from the turbine
- Azimuth of the carcass from the turbine.
- Geographic coordinates of the carcass and turbine

- Habitat/cover type surrounding the carcass
- Condition of the carcass (entire, partial, scavenged)
- Description of the carcass
- A rough estimate of the time since death (e.g., <1 day, > a week), and how estimated
- Digital photographs of the carcass and key identifying characteristics with a scale object
- Information on carcass disposition

10.1.1.3 Carcass Persistence Trials

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 each of 4 defined 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 the species. For large birds, such as eagles, carcasses may include domestic waterfowl, pheasant, or similar species legally obtained from game farms.

Assuming adequate carcass availability, one carcass persistence trial will be conducted in representative areas outside turbine plots during each of the spring, summer, fall, and winter seasons with at least 15 carcasses representing large birds (eagles) placed per season during baseline monitoring. Additionally, carcass persistence trials during subsequent permit compliance monitoring may have reduced level of effort if the data suggest consistency among years. To avoid attracting eagles to areas of high collision risk, carcass persistence trials will be conducted in areas away from the turbines with substrates that are representative of those found beneath turbines.

Random locations will be generated and loaded into a Global Positioning System as waypoints 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 Project personnel. Personnel will monitor the trial carcasses on days 1, 2, 3, 4, 7, 10, 14, 21, 28, 35, and 42. 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 42-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 presented in Huso 2011 or similar analysis method. To date, Huso (2011) presents the most bias-free equation for determining the average probability of persistence, which takes into account the length of the search interval and the carcass persistence time:

$$\hat{r} = \frac{\hat{\bar{t}}(I - e^{-I/\hat{\bar{t}}})}{I}$$

Where e is the root of natural logarithms, t is the estimated mean persistence time, and I is the length of the interval. A bootstrapped estimate and 90 percent CI will be calculated based on 5,000 iterations for carcass persistence time. Results of the carcass persistence calculation will be used to inform ongoing power analysis of the permit compliance monitoring and the results of this analysis will be used to modify the design of monitoring as needed (e.g., modified search frequency or spatial coverage) to maintain 90 percent confidence that no more than one bald eagle fatality occurred during a given monitoring year in which no eagle carcasses were found.

10.1.1.4 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 proportion of eagle fatalities that searchers are able to 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; all searchers participating in the monitoring program will be tested. However, searcher efficiency trials during years of long-term monitoring may have reduced level of effort if the data suggest consistency among years. Carcass species used in the trials and marking and placement techniques will be the same as those in the carcass persistence trials, except that CWF will investigate the feasibility of using large decoys covered by turkey feathers in addition to bird carcasses; if this approach proves feasible, CWF may use these decoys to estimate searcher efficiency.

Searcher efficiency trials will begin when standardized carcass searches start. Personnel conducting the searches will not know when trials are conducted or the location of the efficiency-trial carcasses (i.e., blind trials). Trials will be conducted multiple times throughout each season and will incorporate testing of each person searching for carcasses. Assuming adequate carcass availability, at least 15 large-bird carcasses will be placed per season for searcher efficiency trials. Searcher efficiency trials will be conducted at randomly selected monitoring turbines with ground cover that is typical of major visibility classes around the

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 season. A bootstrapped estimate confidence interval will be calculated based on 5,000 iterations for searcher efficiency. New seasonal estimates will be developed via searcher efficiency testing in any year during which new searchers are used. Searcher efficiency results will be used in ongoing power analysis of the monitoring design and adjustments will be made to the design (e.g., changes in transect spacing) to maintain 90 percent confidence that no more than one eagle fatality occurred during a given monitoring year in which no eagle carcasses were found.

10.1.1.5 Fatality Estimation

Fatality rate estimation normally uses a statistical estimator like the Huso estimator (Huso 2011) to calculate the Project-wide fatality rate (eagles/turbine/year and eagles/MW/year). Due to the low anticipated fatality rate at the Project (≤ 1 eagle per year) CWF does not anticipate it will have sufficient sample size of fatalities (≥ 5) in any search year to use a standard estimator. Instead, CWF proposes to use the Evidence of Absence estimator (Dalthorp et al. 2014) to produce an estimate of the most probable number of bald eagles killed during each year of monitoring (i.e., the highest probability number of fatalities in the posterior probability distribution). After the completion of the first two years of fatality monitoring, CWF will evaluate the approach to analysis of monitoring data in coordination with USFWS and modify if warranted. Output from the estimator will also be used to identify the probability that no more than 1 eagle fatality occurred during the monitoring year given the parameters of the search protocol. Key inputs to the fatality estimation include the following:

- Search interval;
- Observed number of carcasses found during standardized searches during the monitoring year for which the cause of death can be attributed to facility operation;
- Mean carcass persistence in days with confidence interval; and
- Searcher efficiency, expressed as the probability of trial carcasses found by searchers during searcher efficiency trials.

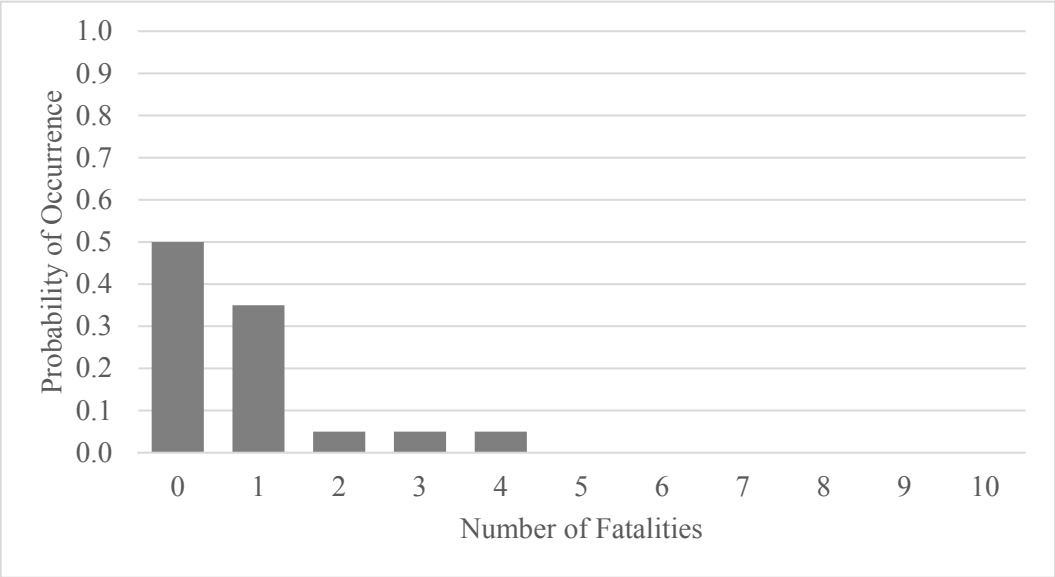
Output from Evidence of Absence will resemble the example shown in Figure 9. In the example, the most likely number of fatalities based on the search was 0, which corresponds to a probability value of 0.50. However, there is some probability based on the survey design that the actual number of fatalities was different from 0. The cumulative probability for fatality ≤ 2 is

0.90, indicated 90 percent credibility in the statement that fatalities did not exceed 2 during the monitoring period.

10.1.1.6 Searcher Training

The dedicated searcher (s) will be trained to follow the search procedure, fill out the reporting form, and take appropriate photographs for identification. Training will include searcher efficiency testing on appropriately sized test carcasses. Training will be performed by qualified consultants or qualified in-house environmental staff. Identification and aging of carcasses will be performed by external consultants or species experts. Training specifics will be described within the environmental monitoring program protocol. Further, a detailed monitoring protocol, including instructions for reporting an injured eagle or eagle carcass will be provided to all personnel and will be readily available in the operations and maintenance building. Any new fatality searchers joining the program will undergo training and periodic searcher efficiency testing to ensure that the rigor of the searches remains sufficient for the permit compliance monitoring.

Figure 9. Example of Output derived from Evidence of Absence showing posterior probability distribution of fatalities given that 0 were found (X=0) on a hypothetical search. The most probable value corresponds to the peak of the curve (0 fatalities), but that value has a probability of only 0.50. There is a probability of 0.35 that 1 fatality occurred and a probability of 0.90 that ≤ 2 fatalities occurred (cumulative probability below 3 fatalities).



10.1.1.7 Adaptive Management of Permit Compliance Monitoring

As noted above, carcass persistence and searcher efficiency will be measured and used to adjust the monitoring protocol to maintain a 90-percent credibility level. CWF also proposes to adaptively manage the timing of permit compliance monitoring based on the presence of eagles at the Project. After 2 full years of post-construction monitoring CWF will meet and collaborate with USFWS on a future post-construction monitoring protocol and work to get an appropriate long-term protocol implemented for the Project. Potential changes considered may include, but are not limited to focusing monitoring on periods of documented eagle presence, reallocation of search effort, modification of search interval, or modifying search protocols.

Pre-construction eagle-use surveys indicate that bald eagles have been present in the Project Area during fall, winter and spring in the past. Concurrent with the first two years of fatality monitoring, CWF will monitor eagle use year-round as described in Sections 9.2.

For the purposes of this monitoring plan, CWF will define monitoring seasons as the following: Spring (March 16-June 15), Summer (June 16-September 15), Fall (September 16-December 15), and Winter (December 16-March 15).

10.2 Additional Surveys

10.2.1 Nest Monitoring

Eagle nest surveys will be conducted by aircraft within the Project Footprint plus a 5-mile buffer during the first two years of operations to document the activity of known eagle nests and to locate any eagle nests not documented in 2013, 2014, and 2015. During the first two years of operations, nest searches within the Project Area plus 5-mile buffer will be conducted for eagle nests once per month in January - August of each year to detect occupancy, productivity, and nest success at any known eagle nests and detect newly constructed nests. CWF will implement aerial surveys in January and April to detect early nesting attempts and occupancy of nests by breeding pairs, combined with once-per-month, four-hour observations at each nest from the ground during March and May- August to monitoring occupancy, productivity, and nest success. Information gathered during nest monitoring will be used to inform adaptive management of the permit compliance monitoring as described in section 9.1.2.7.

The choice of a 5-mile nest monitoring buffer is based on several aspects of Project siting and bald eagle biology: 1) the Project is sited such that 4 bald eagle nest structures occur within 5 miles of the Footprint, and one nest is considerably farther away (approximately 9 miles); 2) the most distant bald eagle nest from the Project is located along the most distinctive eagle attractant in the vicinity (Jim Lake) and this suggests eagles associated with that nest are unlikely to be attracted to the Project Footprint; and 3) bald eagles tend to be closely associated with major waterbodies where these are available, because such waterbodies harbor their primary prey (fish; Buehler 2000) and the Guidance recommends using the Project Area ½-

mean inter-nest distance to identify eagle nests that may potentially be disturbed by the Project, except in cases where this distance might provide a misleading estimate of eagle movement distances, such as in the case where attractant features are closer to nests than the Project Footprint. The Project Area ½ -mean inter-nest distance is 4.5 miles, and a 5-mile buffer around the Project Area would therefore encompass this distance.

Nest surveys will be conducted consistent with the ECP Guidance (USFWS 2013) so that a conclusion regarding occupancy, productivity, and nest success can be reached. The ground-based nest surveys will be conducted from roadways within the search area, and will focus on stands of trees in suitable nesting habitat for bald eagles. Occupancy determinations from ground-based surveys will be based on observations of up to 4 hours each per visit to each nest structure; if occupancy is confirmed prior to 4 hours, an observation will end, but occupancy will not be ruled out until two 4-our observations indicate the nest is unoccupied. Any bald eagle nests determined to be occupied during these searches will be monitored once per month from the ground in a four-hour observation during the months of June, July, and August to measure nest success and estimate productivity. CWF believes ground-based searches and observations will be an efficient means of collecting the necessary information because of the sparseness of suitable nesting trees in the area to be searched. If CWF discovers that this approach does not facilitate full data collection, it will coordinate with USFWS to design a new survey approach to fill any data gaps.

11.0 REPORTING

CWF will track all fatalities in accordance with the Special Purpose – Utility (SPUT) permit it intends to obtain to transport, and temporarily possess carcasses of migratory birds. This permit will require CWF to notify USFWS of any fatalities of migratory birds. CWF will track and report all fatalities using the USFWS Avian Injury/Mortality Reporting System (AIMRS) database (form 3-202-17). The permit will also require CWF to prepare an annual report summarizing activities and findings to the Region 6 Migratory Birds Permit Office. CWF will also prepare a written memorandum that contains a summary of fatalities and a discussion of correlates of risk for any eagle fatalities that may occur, as well as a description of any EACPs implemented to reduce risk. Annual reports will be provided to USFWS for review. Any-eagle fatalities will be reported to the USFWS within 24 hours of discovery to the USFWS, OLE Resident Agent in charge and the Region 6, Migratory Bird Permit Office.

12.0 PERMITS

Prior to commencing operations, CWF will obtain an appropriate USFWS SPUT permit for the Project to allow temporary possession of carcasses of MBTA-protected birds, so that any carcasses may be handled and preserved for subsequent collection by USFWS. As described in Section 10.0, CWF will use the USFWS AIMRS database to report all fatalities throughout the term of the permit. CWF has obtained a special use permit from the Arrowwood National Wildlife Refuge for temporary wetland easement impacts associated with turbine, crane roads, access roads, and power collection line installation.

13.0 LITERATURE CITED

Allison, T.D. 2012. Eagles and Wind Energy: Identifying Research Priorities. A white paper of the American Wind Wildlife Institute, Washington, DC.

APLIC (Avian Power Line Interaction Committee). 2006. Suggested practices for raptor protection on power Lines; the State of the Art in 2006. Edison Electric Institute, APLIC and the California Energy Commission Washington, D.C and Sacramento, CA.

APLIC. 2012. Reducing avian collisions with power lines: the state of the art in 2012. Edison Electric Institute and APLIC. Washington, D.C.

Buehler, D. A. 2000. Bald Eagle (*Haliaeetus leucocephalus*). In A. Poole and F. Gill (ed.). The Birds of North America. Vol. 506. The Birds of North America, Inc., Philadelphia, PA, USA.

Dalthorp, D., M. Huso, D. Dail, and J. Kenyon. 2014, Evidence of absence software user guide: U.S. Geological Survey Data Series 881, doi:10.3133/ds881.

Erickson, W. P., K. Kronner, and B. Gritski. 2003. Nine Canyon Wind Power Project avian and bat monitoring report. September 2002 – August 2003. Prepared for the Nine Canyon Technical Advisory Committee and Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon.

Erickson, W. P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report, July 2001—December 2003. Technical report peer-reviewed by and submitted to FPL Energy, the Oregon Energy Facility Siting Council, and the Stateline Technical Advisory Committee.

Fry, J., Xian, G., Jin, S., Dewitz, J., Homer, C., Yang, L., Barnes, C., Herold, N., and Wickham, J., 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States, PE&RS, Vol. 77(9):858-864

Gritski, B., K. Kronner, and S. Downes. 2008. Leaning Juniper Wind Power Project, 2006 − 2008. Wildlife Monitoring Final Report. Prepared for PacifiCorp Energy, Portland, Oregon. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. December 30, 2008.

Gritski, B., S. Downes, and K. Kronner. 2010. Klondike III (Phase 1) Wind Power Project Wildlife Monitoring Study October 2007–October 2009. Prepared for Iberdrola Renewables, Klondike Wind Power III, LLC, Portland, OR. Prepared by Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. April 21, 2010.

Guinn. 2013. Generational habituation and current bald eagle populations. Human – Wildlife Interactions 7(1):69-76.

Howell, J. A. and J. Noone. 1992. Examination of avian use and mortality at a U.S. windpower wind energy development site, Montezuma Hills, Solano County, California. Final report to Solano County Department of Environmental Management, Fairfield, California.

Hull, C.L. and S. Muir. 2010. Search areas for monitoring bird and bat carcasses at wind farms using a Monte-Carlo model. Australasian Journal of Environmental Management 17: 77-87.

Hunt, W.G., 2002. Golden eagles in a perilous landscape: predicting the effects of mitigation for wind turbine blade-strike mortality. Consultant report to California Energy Commission under contract P500-02-043F, Public Interest Energy Research. California Energy Commission, Sacramento, USA. Available from:www.energy.ca.gov/reports/2002-11-04_500-02-043F.PDF

Huso, M. M. P. 2011. An estimator of wildlife fatality from observed carcasses. Environmetrics 22:318-329.

Johnson, G. D., D. P. Young, W. P. Erickson, C. E. Derby, M. D. Strickland, and R. E. Good. 2000a. Wildlife Monitoring Studies, SeaWest Windpower Plant, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, San Diego, California, and the Bureau of Land Management, Rawlins, Wyoming, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000b. Avian monitoring studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.

Johnson, G. D., W. P. Erickson, and J. White. 2003. Avian and bat mortality at the Klondike Oregon Phase I Wind Plant, Sherman County, Oregon. Technical Report prepared for Northwestern Wind Power. Prepared by WEST, Cheyenne, WY.

Johnson, S. 2010. Nesting in numbers: active bald eagle nests up in North Dakota. ND Outdoors 14-17. February.

Kochert, M. N., K. Steenhof, C. L. Mcintyre and E. H. Craig. 2002. Golden Eagle (Aquila chrysaetos), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/684doi:10.2173/bna.684

New, L., E. Bjerre, B. Millsap, M. Otto, and M. Runge. 2015. A collision model to predict avian fatalities at wind facilities: an example using golden eagles (Aquila chrysaetos). PLOS One 10.1371.

NWC (Northwest Wildlife Consultants, Inc.) and WEST (Western EcoSystems Technology, Inc.). 2007. Avian and Bat Monitoring Report for the Klondike II Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17, 2007.

Pagel, J. D., K. J. Kritz, B. A. Milsap, R. K. Murphy, E. L. Kershner, and S. Covington. 2013. Bald eagle and golden eagle mortalities at wind energy facilities in the contiguous United States. J. Raptor Res. 47(3):311-315.

Prairie Public News. 2015. Bald eagle death could mean a new look at wind turbine siting rules. Available online at: http://news.prairiepublic.org/post/bald-eagle-death-could-mean-new-look-wind-turbine-siting-rules. Accessed March 2016.

Rabie, P., K. Adachi, W. Erickson, K. Taylor, K. Bay, T Mattson, E. Hallingstad and J. Roppe. 2014. Efficient and effective eagle monitoring protocols. Paper presented at National Wind Coordinating Collaborative Research Meeting X, Broomfield Colorado.

Smallwood, K.S. 2013. Comparing bird and bat fatality-rate estimates from North American wind-energy projects. Wildlife Society Bulletin 37: 19–33, doi: 10.1002/wsb.260.

Strickland, M. D., E. B. Arnett, W. P. Erickson, D. H. Johnson, G. D. Johnson, M. L. Morrison, J. A. Shaffer, and W. Warren-Hicks. 2011. Comprehensive Guide to Studying Wind Energy/Wildlife Interactions. Prepared for the National Wind Coordinating Collaborative, Washington, D.C., USA.

Tetra Tech. 2013a. 2012 Fall avian and crane surveys. Courtenay Wind Farm, Stutsman County, North Dakota. February.

Tetra Tech. 2013b. 2013 Spring avian surveys. Courtenay Wind Farm, Stutsman County, North Dakota. June.

Tetra Tech. 2014a. 2014 Raptor Nest Survey. Courtenay Wind Farm, Stutsman County, North Dakota. March.

Tetra Tech. 2014b. 2014 Raptor Nest Survey. Courtenay Wind Farm, Stutsman County, North Dakota. May.

USFWS. 2012. Land-based Wind Energy Guidelines. Available online at www.fws.gov/windenergy/docs/weg_final.pdf

USFWS. 2013. Eagle Conservation Plan Guidance. Module 1 – Land-based wind energy. Version 2. Available online at www.fws.gov/windenergy/eagle_guidance.html

USGS. 2013. Ecoregions of North Dakota and South Dakota. Available online at http://www.npwrc.usgs.gov/resource/habitat/ndsdeco/nodak.htm.

Whitfield, D. P. 2009. Collision avoidance of golden eagles at wind farms under the 'Band' collision risk model. Report from Natural Research to Scottish Natural Heritage, Banchory, UK.

Young, D. P. Jr., J. Jeffrey, W. P. Erickson, K. Bay, and V. K. Poulton. 2006. Eurus Combine Hills Turbine Ranch. Phase 1 post construction wildlife monitoring first annual report. Technical report prepared for Eurus Energy America Corporation, San Diego, California, and the Combine Hills Technical Advisory Committee, Umatilla County, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon.

Young, D. P., Jr., C. LeBeau, W. Erickson, S. Nomani, J. R. Boehrs, and B. Oakleaf. 2010. Status of breeding populations of ferruginous hawks, golden eagles and bald eagles in Albany and Carbon County, Wyoming. Prepared for the Wyoming Game and Fish Department (WGFD).

APPENDIX A: SITE SELECTION QUESTIONS FOR COMPARISON OF 3 POTENTIAL WIND PROJECT LOCATIONS IN NORTH DAKOTA

This page intentionally left blank

Project	ECP Stage 1/ WEG Tier 1 and 2 Questions and Findings			
	Are there species of concern present on the potential site, or is habitat (including designated critical habitat) present for these species?	Does the landscape contain areas where development is precluded by law or areas designated as sensitive according to scientifically credible information?[1]	Are there known critical areas of wildlife congregation, including, but not limited to: maternity roosts, hibernacula, staging areas, winter ranges, nesting sites, migration stopovers or corridors, leks, or other areas of seasonal importance?	Are there large areas of intact habitat with the potential for fragmentation, with respect to species of habitat fragmentation concern needing large contiguous blocks of habitat?
Courtenay	Potential whooping crane habitat (majority of the project is *outside of* 95% migration corridor) Potential piping plover habitat (alkali wetlands) present Potential Dakota skipper habitat (grasslands of poor quality)	High value wildlife habitat types (wetlands)	Potential whooping crane habitat (majority of the project is outside of 95% migration corridor) Waterfowl and shorebird migration stopover habitat present	None identified
Cleveland	Potential whooping crane habitat (within 90% migration corridor) Potential piping plover habitat (alkali wetlands) present	High value wildlife habitat types (wetlands) Immediately adjacent to Leo M. Kirsch WMA Several WPAs are located within the project boundaries	Potential whooping crane habitat (within 90% migration corridor) Waterfowl and shorebird migration stopover habitat present	Potential grassland habitat present[2]
Sheridan Hills	Potential whooping crane habitat (within 75% migration corridor) Potential piping plover habitat present and documented nesting near the western edge of the Project area Natural Heritage biological conservation database record for dry mesic tallgrass prairie	FWS grassland easements FWS wetland easements High value wildlife habitat types (wetlands and native prairie)	Potential whooping crane habitat (within 75% migration corridor) Documented piping plover nesting near the western edge of the Project area Waterfowl and shorebird migration stopover habitat present	Native mixed-grass prairie present

[1]Examples of designated areas include, but are not limited to: federally-designated critical habitat; high-priority conservation areas for non-government organizations (NGOs); or other local, state, regional, federal, tribal, or international organizations.
[2] Based on a review of aerial photographs; not confirmed through a site visit

Reviewed Materials:

NDPR. May 11, 2008. RE: Sheridan Ridge I & II Wind Farm Projects Proposal.

NDGFD. April 28, 2009. RE: Proposed Sheridan Ridge I & II Wind Farm Projects – Sheridan County, North Dakota.

USFWS. May 7, 2009. RE: Proposed wind energy development project in Sheridan County, North Dakota.

NDGFD. November 16, 2010. RE: Courtenay Wind Project – Stutsman County, North Dakota and Grayson Wind Project (Cleveland) – Stutsman County, North Dakota.

USFWS. March 18, 2011. RE: Proposed Courtenay Wind Project, Stutsman County, North Dakota.

USFWS. March 21, 2011. RE: Proposed Grayson (Cleveland) Wind Project, Stutsman County, North Dakota.