FINAL
Environmental Assessment for
Proposed Habitat Conservation Plan and Incidental Take Permit

High Prairie Renewable Energy Center
Adair and Schuyler Counties, Missouri

May 2021

USFWS
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Acronyms and Abbreviations

Ameren	Ameren Missouri
Applicant	Ameren Missouri
BBCS	Bird and Bat Conservation Strategy
BGEPA	Bald and Golden Eagle Protection Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
ECP	Eagle Conservation Plan
EIS	Environmental Impact Statement
EoA	Evidence of Absence
ESA	Endangered Species Act
Project	High Prairie Wind Energy Project
FONSI	Finding of No Significant Impact
FR	Federal Register
HCP	Habitat Conservation Plan
ITP	incidental take permit
m/s	meters per second
MBTA	Migratory Bird Treaty Act
MDC	Missouri Department of Conservation
MET	meteorological tower
mph	miles per hour
MW	megawatt
NEPA	National Environmental Policy Act
NLCD	National Land Cover Database
OCRU	Ozark-Recovery Unit
Permit Area	High Prairie Renewable Energy Center or Project area
Plan Area	Habitat Conservation Plan Area
Project	High Prairie Renewable Energy Center
REA Model	Resource Equivalency Analysis Model for wind energy projects
Recovery Plan	Indiana Bat Draft Recovery Plan: First Revision
Service	U.S. Fish and Wildlife Service
TAL	Technical Assistance Letter
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WNS	white-nose syndrome

CHAPTER 1. PROJECT OVERVIEW, BACKGROUND, PURPOSE AND NEED

1.1 INTRODUCTION

The U.S. Fish and Wildlife Service (Service or USFWS) has prepared this final Environmental Assessment (EA) pursuant to the National Environmental Policy Act (NEPA) 42 U.S.C. § 4321 *et seq.* The public had 30 days to review the draft EA (December 1–30, 2020); public comments and responses are provided in Appendix G.

This EA evaluates the effects of issuing an Incidental Take Permit (ITP) pursuant to section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA;16 United States Code [USC] §§ 1531–1544) and implementing the Habitat Conservation Plan (HCP) for the High Prairie Renewable Energy Center (Project) in Adair and Schuyler counties, Missouri (Figure 1). The Project is located in areas that support the federally endangered Indiana bat (*Myotis sodalis*), the federally threatened northern long-eared bat (*Myotis septentrionalis*), and the non-listed little brown bat (*Myotis lucifugus*) throughout the bat active season. The Applicant has decided to request take coverage for these species in their ITP.

The Project is owned and operated by Ameren Missouri (Ameren or Applicant). The Project was developed by TG High Prairie, LLC under the terms of a 'Build-Transfer Agreement' with Ameren. Upon completion of the Project, TG High Prairie, LLC transferred all assets and liabilities to Ameren who became the successor-in-interest and is responsible for all aspects of the Project. As the Applicant, Ameren is responsible for all outstanding and ongoing obligations set forth in the ITP issued for the Project, including those reflected in the associated HCP. Accordingly, the Applicant will comply with qualification, assurance, and mitigation requirements necessary to hold such permit and with all other requirements of the permit and HCP.

If issued, the ITP will authorize the incidental taking[1] of two federally listed species: the endangered Indiana bat and threatened northern long-eared bat. The ITP would also authorize the incidental taking of the little brown bat. The little brown bat is not currently listed under the ESA, and the Service has not been petitioned to list the species. However, the Service is currently completing a discretionary assessment to determine if the species is warranted for listing under the ESA. Together the three species are collectively referred to as the Covered Species.

The Service received an application for an ITP from the Applicant on November 4, 2020. Under section 10(a)(2)(A) of the ESA. Any application for an ITP must include a conservation plan (e.g., HCP) that details, among other things, the impacts of the take and the steps taken to minimize and mitigate such impacts to Covered Species. As part of this application, the Applicant has developed an HCP to ensure that impacts to the above referenced species are avoided, minimized, and mitigated to the maximum extent practicable in accordance with the requirements of section 10 of the ESA. The ITP, if issued, would authorize the incidental take of these species during the operations and implementation of mitigation measures for the Project for a term of 6 years (see Section 2.2.2). The Service has prepared this EA to inform the public of the Federal Action, the effects of the Federal Action, and its alternatives, as well as to seek information from the public and to use information collected and analyzed to ensure that information regarding environmental impacts is available to federal decision-makers before a decision is made on this ITP application.

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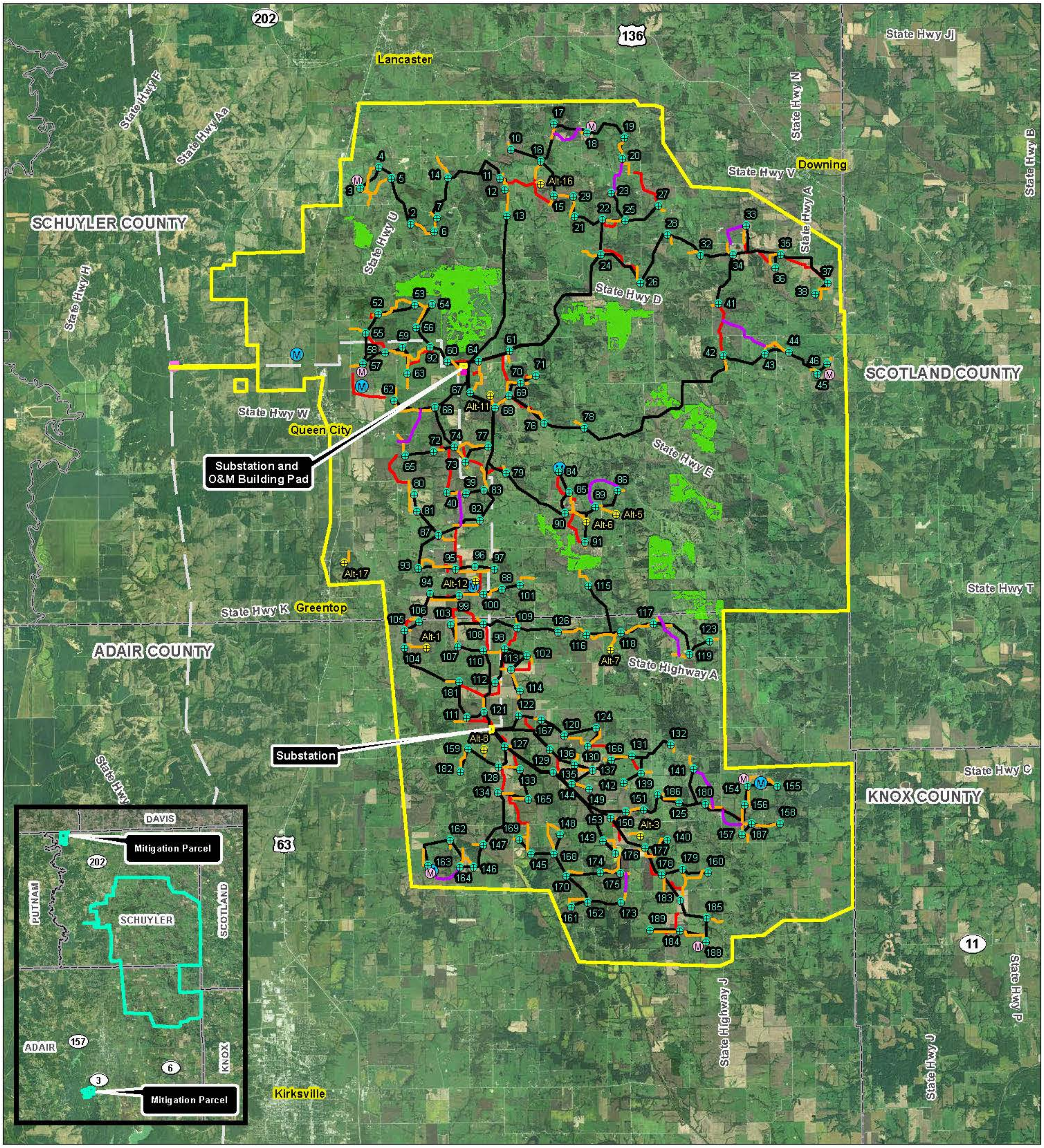
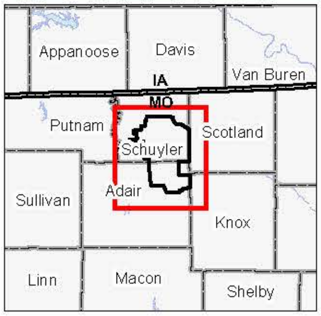
[1] The ESA and its implementing regulations prohibit the take of any fish or wildlife that is designated as a threatened species or endangered species under section 4 of the ESA (federally listed species) without prior approval pursuant to either section 7 or section 10(a)(1)(B) of the ESA. The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." (16 U.S.C. §1532(19)). Pursuant to the Code of Federal Regulations (CFR), "incidental taking" means "any taking otherwise prohibited, if such taking is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" (50 CFR 17.3). "Harm" is defined in the CFR as "an act which actually kills or injures [federally listed] wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures [federally listed] wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 CFR 17.3). "Harass" means "an intentional or negligent act or omission which creates the likelihood of injury to [federally listed] wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (50 CFR 17.3).





Legend

- Project Boundary and Permit Area 4/11/2019
- Turbine v14
- Alternate Turbine v14
- Permanent Met Tower
- Met Tower
- Collection Line
- Temporary Crane Path
- Proposed Crane Landing
- Access Road
- Substation
- O&M Building Pad
- Existing Transmission Line
- Jamison March Switchyard
- Exclusion Area
- Plan Area

Data Sources: Stantec, TG High Prairie LLC, USGS, NADS

Figure No.
1

Title
Project Location and Project Components

Client/Project
Ameren Missouri
High Prairie Renewable Energy Center
Habitat Conservation Plan

Project Location
Schuyler and Adair Counties, MO

0 1.5 3 Miles

N

Issuance of a section 10 ITP constitutes a discretionary federal action by the Service and is thus subject to NEPA, which requires that all federal agencies assess the effects of their actions on the human environment by preparing an EA or an Environmental Impact Statement (EIS) to document the potential effects of the federal action (42 USC § 4332). Accordingly, the Service has prepared this EA to evaluate the potential impacts associated with issuance of an ITP and implementation of the HCP and to evaluate alternatives. Two alternatives to the Applicant's Proposed HCP are considered in this EA, including a no-action alternative and a lower take alternative. The consequences of these actions on various resources are discussed in this EA.

1.2 PROPOSED FEDERAL ACTION – ISSUANCE OF THE ITP

This EA evaluates our federal action: the potential issuance of an ITP authorizing incidental take of the Covered Species caused by implementation of the covered activities (i.e., operation of industrial wind turbines) as described in the Applicant's HCP. Specifically, the Service's action includes incidental take authorization, along with the associated avoidance, minimization, mitigation, and monitoring provisions in the proposed HCP and any conditions of the ITP[2] that would go into place upon issuance. The proposed action is prompted by the request from the Applicant for a 6-year ITP to implement their proposed HCP. The purpose of issuing an ITP to the Applicant is to authorize take of the Covered Species that is incidental to their otherwise lawful activities, which is operation of the Project turbines. Project construction is not included in the HCP.

In evaluating the Federal Action, we consider all elements of the natural and human environment that may be affected, including other wildlife that may occur within the Plan Area (Section 3.1.1 describes the Plan and Permit areas; Section 3.1 describes the Affected Environment). Consistent with Service guidance, we also consider, among other things, the effectiveness of the action alternatives in reducing impacts to migratory birds and other bat species.

1.3 THE HIGH PRAIRIE WIND ENERGY CENTER

The Project is located in northeastern Missouri, north of the city of Kirksville (Figure 1). The Project has an expected maximum nameplate generation capacity of 400 megawatts (MW) based on the construction and operation of 175 wind turbine generators. Construction of the Project began in 2020, and the Project is expected to be fully operational in January 2021. In addition to the turbines, the Project components include the following:

- 163 2.2-MW turbines and 12 3.45-MW turbines and foundations
- 6 permanent and 6 temporary meteorological (MET) towers
- operations and maintenance building
- turbine access roads
- underground electrical collection system and fiber optic communication lines
- interconnection switchyard and two collector substations
- combined generation tie-line and substation line (16.5-mile, 345-kilovolt [kV] transmission line)

Please refer to Section 2.5.1 of the HCP for more information and details on Project components and turbines.

The Permit Area (Figure 1) is the 113,873.2 acres encompassed by the outer Project boundary where impacts of the activities could occur for which ITP coverage is requested. The Plan Area for the requested ITP includes the Permit Area and the 217-acre mitigation area, totaling 114,090.2 acres. The Permit Area is described in Section 2.4 of the HCP, and areas of mitigation land are described in Section 7.2.2 of the HCP.

1.3.1 Life of the Project and Permit Duration

High Prairie is seeking a 6-year ITP for the Covered Species for the first 6 years of Project operations. The anticipated life of the Project is approximately 30 years. However, in consultation with the Service, the Applicant has chosen to apply for a shorter-term permit (6 years) and conduct rigorous post-construction monitoring to provide site-specific data on local bat populations to inform longer-term management decisions (including operating

[2] Standard conditions include compliance with the HCP and other Federal, Tribal, and local laws. Other conditions may include those in accordance with 50 CFR 17.32 (b)(3)

parameters) at the Project. Based on the site-specific data collected during the first 6 years of operations, the Applicant may choose to use these data to develop a new HCP and pursue a separate, long-term ITP. Conversely, the Applicant would operate turbines under a protocol that would avoid take of federally listed species (as explained in HCP Section 1.1). If the Applicant decides to pursue a subsequent ITP, the review and potential issuance of this ITP would constitute a separate federal action. The Service would evaluate that ITP application and comply with NEPA accordingly, and the approval of the HCP and ITP considered in this EA has no bearing on a future permit decision.

1.3.2 Covered Activities and Scope

The proposed action is issuance of an ITP by the Service pursuant to the provisions of section 10(a)(1)(B) of the ESA, which would authorize the incidental take of the federally endangered Indiana bat, federally threatened northern long-eared bat, and the little brown bat, resulting from the operation of the Project.

The Service does not authorize the siting, construction, repowering, or operations of wind energy facilities. Rather, an ITP from the Service provides an applicant with incidental take coverage for listed species under the ESA for lawful activities. The only activity for which the applicant has requested take coverage is Project operations, which may cause take of listed bat species. In their Bird and Bat Conservation Strategy (BBCS), High Prairie committed to avoidance measures for construction and associated activities that will avoid take of other federally listed species from these activities (see High Prairie BBCS in Appendix A of this EA and Section 7.2 of the HCP). As required by the NEPA, this EA will evaluate the effects on the human environment resulting from the issuance of the permit and the implementation of the associated HCP. Specifically, this EA evaluates the effects of the change in operations of the Project as a result of the issuance of the 6-year ITP and implementation of the HCP, as well as alternatives to the issuance of the ITP, as currently proposed.

1.4 PURPOSE AND NEED OF THE PROPOSED ACTION

Under section 10 of the ESA, the Secretary of the Interior may, where appropriate, authorize the taking of federally listed fish or wildlife if such taking occurs incidentally to otherwise legal activities. The Service was charged with regulating the incidental taking of listed species under its jurisdiction, and section 10 of the ESA specifically directs the Service to issue an ITP to non-federal entities for incidental take of endangered and threatened species when the criteria in section 10(a)(2)(B) are satisfied by the applicant. Once we receive an application for an ITP, we need to review the application to determine if it meets issuance criteria. We also need to ensure that issuance of the ITP and implementation of the Habitat Conservation Plan (HCP) complies with other applicable federal laws and regulations.

The Service's purpose in considering the proposed action is to fulfill our authority under the ESA, and section 10(a)(1)(B). More specifically, the Service's purpose for the proposed action is to respond to an application from High Prairie requesting an ITP for the incidental take of the federally endangered Indiana bat, federally threatened northern long-eared bat, and the little brown bat, pursuant to the ESA section 10(a)(1)(B) and its implementing regulations and policies. The permit decision should ensure that the issuance of the ITP and the implementation of the HCP provide for the long-term conservation of the Covered Species and their ecosystems in the Plan Area. The permit decision should also ensure the Applicant will not appreciably reduce the likelihood of survival and recovery of the Covered Species in the wild, within the context of the ITP and associated HCP.

1.5 DECISION TO BE MADE

We must decide whether to issue the ITP or deny the permit request. The Service shall issue the ITP to the applicant if the issuance criteria and implementing regulations for the ESA and general permitting are met (section 10(a)(2)(B) of the ESA; 50 CFR 17.22(b)(2) and 17.32(b)(2); 50 CFR 222.307(c)(2)); and 50 CFR 13.21(b)). The Service may decide to issue a permit conditioned upon implementation of the HCP as submitted by the Applicant, or to issue a permit conditioned upon implementation of the HCP as submitted together with other measures specified by the Service. We are required to deny the permit if these criteria are not satisfied.

1.6 REGULATORY AND POLICY BACKGROUND

This EA was developed in compliance with and consideration of the following guidance resources, laws, and regulations. The Council on Environmental Quality (CEQ) issued a final rule to update its NEPA implementing regulations, which went into effect on September 14, 2020. Because the Applicant's permit application was sufficiently complete prior to the effective date of the new NEPA regulations, the Service is exercising the discretion to conduct this NEPA analysis under the regulations in effect prior to September 14, 2020.

- Land-based Wind Energy Guidelines (LWEG; USFWS 2012a)
    - The Service published the voluntary LWEG in 2012 to be used in conjunction with the appropriate regulatory tools in order to form the best practical approach for conservation of species of concern.
    - https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf
- Habitat Conservation Planning and Incidental Take Permit Processing Handbook (HCP Handbook)
    - The Service and the National Marine Fisheries Service jointly published the HCP Handbook in 2016.
    - The HCP Handbook describes requirements, procedures, and guidance for incidental take permits and habitat conservation plan development under the ESA.
    - https://www.fws.gov/endangered/what-we-do/hcp_handbook-chapters.html
- National Environmental Policy Act of 1970 (NEPA)
    - NEPA requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions.
    - https://www.epa.gov/nepa/what-national-environmental-policy-act
- Endangered Species Act of 1973 (ESA)
    - Federally listed threatened and endangered species and designated critical habitat are governed by the ESA and its implementing regulations (50 CFR parts 13 and 17).
    - The 1982 amendments to the ESA established a provision in section 10 that allows for "incidental take" of endangered and threatened species of wildlife by non-federal entities (16 U.S.C. §1539).
    - https://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/endangered-species-act.html
    - The 2016 HCP Handbook provides comprehensive guidance to applicants on the ITP process (https://www.fws.gov/endangered/esa-library/pdf/HCP_Handbook.pdf)
- Migratory Bird Treaty Act of 1918 (MBTA)
    - The MBTA makes it illegal for anyone to intentionally take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations as interpreted by Solicitor's M-Opinion 37050 (Dec. 22, 2017).
    - https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php
- Bald and Golden Eagle Protection Act of 1940 (BGEPA)
    - The BGEPA prohibits the take of a bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*).
    - On September 11, 2009, the Service published a final rule (Eagle Permit Rule) under the BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles (74 Federal Register [FR] 46836-46879). This rule was revised and finalized on December 16, 2016 (2016 Eagle Rule; 81 FR 91494-91554).
    - https://www.fws.gov/birds/policies-and-regulations/laws-legislations/bald-and-golden-eagle-protection-act.php
    - On May 2, 2013, the Service announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2 (http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf).
- Wildlife Code of Missouri (3 CSR 10-4.111)
    - The Wildlife Code of Missouri provides for the protection of endangered wildlife and lists species considered to be threatened with extinction. The code defines "endangered species" as those fish and wildlife designated by the Missouri Department of Conservation (MDC) and listed by the USFWS.

The MDC maintains a list of endangered species, i.e., any species considered threatened with extinction, along with species and communities of conservation concern.
  - https://mdc.mo.gov/about-us/about-regulations/wildlife-code-missouri/endangered-species
- Missouri Renewable Energy Standard (sections 393.1020 to 393.1030, RSMo)
  - The Renewable Energy Standard of 2008 establishes annual minimal benchmarks for renewable energy generation and energy efficiency. Under this law, electric utilities in Missouri are required to meet defined percentages of total retail electrical sales by renewable resources.
  - https://energy.mo.gov/about/laws-regulations

CHAPTER 2. ALTERNATIVES

The NEPA requires environmental documents prepared for a proposed action to discuss a range of alternatives (40 CFR 1505.1(e)). Therefore, this chapter describes the development of reasonable alternatives, alternatives eliminated from detailed study, and then alternatives explored and evaluated in the EA relevant to the Federal Action (i.e., issuance of an ITP by the Service pursuant to the provisions of section 10(a)(1)(B) of the ESA).

2.1 DEVELOPMENT OF ALTERNATIVES

The scope of reasonable alternatives is defined by the purpose and need for the action and guided by the goals and objectives of the Service. Reasonable alternatives include those that are practical or feasible from both a technical and economic standpoint and are based on common sense. We developed alternatives that address the potential for take of Covered Species during Project operation and therefore focus on operational changes to the Applicant's curtailment strategy (i.e., the wind speed at which turbines begin generating power). All curtailment studies to date show a consistent inverse relationship between cut-in speed and bat mortality (see HCP Table 7-1).

Alternatives do not address turbine siting or construction because the Project has been constructed and no additional siting or construction activities are proposed in the Applicant's HCP.

The Applicant has applied for a 6-year ITP, and the alternatives carried forward for detailed analysis assess the impacts of different operational protocols (and associated take of Covered Species) within a 6-year timeframe. Alternatives that were considered but eliminated from detailed analyses (pursuant to 40 CFR 1502.14(a)), including the discussion of a longer-term permit alternative, are explained in Section 2.3. As explained in Section 1.3.1 above, the Applicant may choose to apply for a longer-term ITP following the proposed 6-year permit or avoid take of listed bats at the Project for the remaining 24 years of operational life. The long-term operational protocols and associated species impacts at the Project will be informed by the data collected under the proposed 6-year ITP. For the purposes of our analysis, we assume that the Project will avoid take of federally listed species following the proposed 6-year permit term because it is not reasonable to try to predict the long-term operational protocols at the Project at this time or assume that a permit will be issued. Because the long-term operations would be informed by the 6-year HCP, attempting to predict operational protocols and impacts would also be highly speculative. Should the Applicant decide to pursue another ITP, the impacts associated with that permit decision would be analyzed and fully disclosed under a separate permit decision and NEPA analysis.

2.2 ALTERNATIVES RETAINED FOR DETAILED ANALYSIS

We retained 3 alternatives for detailed analyses:

- **Alternative 1: No-Action Alternative/ 6.9 m/s Cut-in Speed** (No ITP Issued and No HCP Required for the life of the Project)
- **Alternative 2: Proposed Operations/ 5.0 m/s Cut-in Speed** (Applicant's proposed 6-year HCP, assuming the Project operates in a manner that avoids take of Covered Species for the remaining 24 years [i.e., 6.9 m/s cut-in speed])

- **Alternative 3: More Restrictive Operations/6.5 m/s Cut-in Speed Alternative** (More Restrictive Operations in 6-year HCP to reduce take, assuming the Project operates in a manner that avoids take of Covered Species for the remaining 24 years [i.e., 6.9 m/s cut-in speed])

These alternatives are described in the following sections and summarized in Table 2-1. All alternatives under consideration would implement cut-in speed adjustments. We evaluate these alternatives based on their capacity to meet stated goals and objectives of the Service's action (explained in Chapter 1) and the Applicant's Project intent (explained in Section 2.2.2). The potential effects on the human environment for each of the retained alternatives are described in Chapter 3. Affected Environment and Environmental Consequences.

Table 2-1. Comparison of alternatives considered for detailed analysis for the High Prairie Wind Energy Project HCP and ITP

Alternative	Permit term	Cut-in speed [1]		Fatality monitoring [1]	ITP / implement HCP	Implement BBCS and ECS
		Project operation years 0–6	Project operation years 7–30			
1. No-Action	N/A	6.9 m/s	6.9 m/s	Yes; Years 1–6, Mar 15–Oct 31	No	Yes
2. Applicant's HCP	6 years	5.0 m/s	6.9 m/s	Yes; Years 1–6, April 1–Oct 31	Yes	Yes
3. More Restrictive	6 years	6.5 m/s	6.9 m/s	Yes; Years 1–6, April 1–Oct 31	Yes	Yes

[1] Under the No-Action Alternative, turbine blades would be feathered below the cut-in speed from 45 minutes before sunset to 45 minutes after sunrise when ambient air temperature is above 40°F during Mar 15–Oct 31. Under either Alternative 2 or Alternative 3, turbine blades would be feathered below the cut-in speed from 45 minutes before sunset to 45 minutes after sunrise when ambient air temperature is above 40°F during Apr 1–Oct 31. The No-Action Alternative includes additional measures to avoid even the lower periods of risk, seasonally and diurnally.

2.2.1 Alternative 1: No-Action Alternative

Under the No-Action Alternative, the Service would not issue an ITP. As a result, the Project would operate in a manner where take of listed species is unlikely for the life of the Project or until a different HCP and ITP Application were prepared, submitted, and approved. The Service would provide a Technical Assistance Letter[3] (TAL) specifying operating parameters where take of listed bat species is unlikely, and the Project would implement those operational protocols. Specifically, operating parameters would include feathering turbines when minimum wind speeds (as detected at the minute resolution) are at or below 6.9 m/s from 45 minutes before sunset to 45 minutes after sunrise. If the minimum wind speeds are at or below 6.9 m/s, turbines will remain feathered until minimum wind speeds remain above 6.9 m/s for 20 consecutive minutes. This operational protocol would be applied when temperatures are above 40ºF from March 15 through July 31. The operational protocol would be applied regardless of temperature from August 1 through October 31. These operational protocols would be implemented from March 15 through October 31, which is broader than the span of the active season for the Indiana bats and northern long-eared bats. To verify anticipated avoidance of take, the Applicant would conduct post-construction monitoring as specified in the TAL (Appendix E). Since the publication of the draft EA, we changed the No-Action Alternative to include a more protective temperature threshold (40ºF versus 50ºF) and a longer duration when turbines adjust operations before sunset and after sunrise (45 minutes versus 30 minutes before sunset and after sunrise). Changes to these parameters are explained below.

Under the No-Action Alternative, the Service would update conservation measures in the TAL, as necessary, if new information at the site indicates current measures are not sufficiently protective of the Covered Species or if new information (e.g., results from ongoing research on bat activity under various meteorological parameters) provides

[3] A Technical Assistance Letter (TAL) is a tool the Service uses to provide guidance and recommendations on how to avoid potential impacts to federally listed species.

alternative parameters to avoid impacts. The No-Action Alternative meets the Service's purpose and need in providing for the long-term conservation of the Covered Species and their ecosystems in the Plan Area.

While preparing their application for an ITP, the Applicant worked with the Service to develop conservation measures that they would implement while testing and commissioning turbines to make take of listed bat species unlikely unless or until an ITP was issued. As a result, the Applicant committed to fully feathering all turbines below speed of 6.9 m/s (as measured on a 10-minute rolling average) from 30 minutes before sunset to 30 minutes after sunrise when temperatures were above 50ºF from March 15 through October 31, annually. The Applicant committed to implementing this operational protocol both during the commissioning and testing phase and when the Project became fully operational. The Project also committed to post-construction monitoring to confirm that take was unlikely. The Service provided a TAL for the Project, dated June 5, 2020, that concurred take was unlikely under this operational regime and identified monitoring and reporting protocols (Appendix E). Throughout the Midwest Region, the USFWS typically considers that when turbines are feathered below wind speeds of 6.9 m/s from dusk through dawn during migration, it is unlikely for operations to result in take of listed bats.[4]

The Applicant began testing and commissioning in July of 2020. During this time, turbines were operating in accordance with parameters specified in the TAL provided from the Service. A male Indiana bat carcass was discovered while turbines were being tested and commissioned under the TAL parameters. This bat was identified visually, and genetic testing confirmed species identification. The fatality was estimated to have occurred on September 30, 2020, based on timing of carcass searches, and nights in which the turbine under which it was found was operating.

This fatality indicated the initial TAL parameters may not be as effective at the Project as observed at other wind energy facilities. The Service examined the wind parameters during the night the bat was killed and determined that there was a period of time where *minimum* wind speeds were below 6.9 m/s, even though the 10-minute rolling *average* wind speed was above 6.9 m/s and the Project was operating within the TAL parameters. The cut-in speed of 6.9 m/s, when implemented on a 10-minute rolling average, has proven effective at other wind Project locations across the Midwest. However, the density of occupied and suitable Indiana bat habitat in the Permit Area is unique in the Region. Given our examination of the wind parameters on the night of the fatality, we have recommended to the Applicant that take of listed species would be unlikely if a more conservative operational protocol is observed .

Based on the minimum wind speed data, the Service asked the Applicant if turbines could be programmed to adjust operations based on minimum wind speeds, rather than average wind speeds. If the programming could be modified to respond to minimum wind speeds and the Service did not issue an ITP, the No-Action Alternative would include a new TAL that specified a more conservative operational protocol where turbines would be feathered when minimum wind speeds (as detected at the minute resolution) are at or below 6.9 m/s from 30 minutes before sunset to 30 minutes after sunrise. If the minimum wind speeds are at or below 6.9 m/s, turbines would remain feathered until minimum wind speeds remain above 6.9 m/s for 20 consecutive minutes. This operational protocol would have been applied when temperatures are above 50ºF from March 15 through July 31. The operational protocol would have been applied regardless of temperature from August 1 through October 31. The Applicant indicated the update in the TAL recommendations would be a reasonable change to operations and began considering necessary functional changes that would take place at the Project if the Service provided a new TAL, in the absence of an ITP. In addition, the Applicant committed to operating at avoidance for the life of the Project in the absence of an ITP (HCP Section 1.1). This No-Action Alternative was specified in the draft EA published for public review and comment on December 1, 2020. However, the Final No-Action Alternative was updated after public review as explained below.

The Service began preparing final permit issuance documents but was unable to complete the permit before the start of the bat-active season on March 15, 2021. The Applicant began discussions with Vestas (turbine manufacturer) to understand and facilitate programming turbines to respond to minimum wind speeds. The Applicant also began discussions with the Service on a revised TAL (to replace the June 5th, 2020 TAL). To avoid take while the Service completed permit documents, the Applicant agreed to feather turbines when temperatures are above 50ºF, regardless of wind speeds, from 45 minutes before sunset to 45 minutes after sunrise. The Service agreed it would be unlikely to take Covered Species if turbines ceased operating when temperatures are above 50ºF based on Service data and

[4] Evidenced by post construction fatality monitoring at wind energy facilities operating at cut-in speeds of 6.9 m/s (publicly available data provided from Pioneer Trail Wind Farm in Illinois (ARCADIS 2013, 2014) and Wildcat Wind Farm in Indiana (Stantec 2014a, b, 2015)).

Indiana bat research that suggest Indiana bats do not emerge when temperatures are below 50ºF. In addition to these operational adjustments, the Applicant continued monitoring at the level specified in the June 5th TAL.

As the Service continued completing permit documents, turbines were operating in accordance with the agreed upon parameters described above. An Indiana bat carcass was discovered on April 15, 2021. The bat was identified visually, and the Applicant is currently awaiting the results of genetic testing to confirm species identification. The fatality was estimated to have occurred on the evening of April 13, 2021, based on the level of carcass decomposition, timing of carcass searches, and the temperature and wind speeds during the nights in which the turbine was operating. The April fatality demonstrated that the 50°F-temperature threshold was not protective enough, and therefore, we have revised the No-Action Alternative to reduce the temperature threshold to 40°F. In response to the April fatality the Applicant committed to additional protective measures in the proposed HCP, and this is explained in Section 2.2.2. In addition, the Applicant did not operate turbines at night (from 45 minutes before sunset to 45 minutes after sunrise) to avoid take until obtaining an ITP.

2.2.2 Alternative 2: 5.0 m/s Cut-in Speed Alternative (Applicant's Proposed HCP)

Under Alternative 2, the Applicant would feather all turbines at wind speeds below 5.0 m/s from 45 minutes before sunset to 45 minutes after sunrise, when temperatures are above 40ºF from April 1 through October 31, annually. The hub would not be locked, but blades will be feathered to the wind such that revolutions per minute are minimal during periods when wind speed is less than 5.0 m/s. The feathering/cut-in process will be computer-controlled on a real-time basis; turbines will feather or cut-in throughout the night as wind speed fluctuates below and above 5.0 m/s. The Applicant would implement the HCP for a term of 6 years, as detailed in Section 7.0 of the HCP. The Service would issue an ITP to authorize take of Covered Species associated with the implementation of the proposed HCP, including post-construction monitoring, adaptive management, and mitigation, as summarized below. The Applicant would implement their BBCS (see Appendix A) to reduce the potential for affecting migratory birds and their Eagle Conservation Strategy (see Appendix A of BBCS) to reduce the potential for affecting bald eagles. The Applicant would comply with all other applicable laws, including BGEPA, and is in the process of obtaining an Eagle Take Permit. The Service's Migratory Birds Program received the permit application on August 10, 2020.

Since the publication of the draft EA the Applicant has updated their conservation program in the HCP to be more protective of Covered Species by bolstering the minimization protocols and adaptive management strategies. Standard minimization protocol was updated to include a more protective temperature threshold (40ºF versus 50ºF) and a longer duration when turbines adjust operations before sunset and after sunrise (45 minutes before sunset and after sunrise versus at sunset and sunrise). Changes to the operating parameters were made in response to the April Indiana bat fatality explained above (Section 2.2.1), which indicated that Indiana bats may be active when temperatures are below 50ºF. Changes to strengthen adaptive management, including the addition of a detected bat trigger (i.e., a bat-in-hand as opposed to calculated take estimate), were also made in response to the April fatality, and these are fully explained in Section 2.2.2.2.3, and briefly summarized in the paragraph below.

The April Indiana bat take happened prior to the effective date of the ITP, and, therefore, the take was unauthorized. However, the Applicant was operating turbines in a manner where take of Covered Species was unlikely, and the Service was in the process of completing final permit documents. In response to the fatality, the Applicant updated the HCP such that the April fatality is included as part of the impact expected under the implementation of the HCP (HCP Section 7.5). Specifically, the fatality is treated as a take that occurred during HCP implementation and is "counted" towards the adaptive management thresholds that limit the extent of the impact that could occur during HCP implementation. Therefore, when an ITP is issued one bat will already be counted for the annual take limit adaptive management threshold (1 of 3 Indiana bats detected); the annual take rate threshold (evaluated annually); the projected total take threshold (evaluated annually); and the maternity colony adaptive management strategy (1 of 4 bats detected, and as part of the calculated take threshold). <u>In summary, the ITP does not authorize take that occurred prior to the effective date of the permit, but the HCP was modified to ensure the impacts of the April fatality are considered during HCP implementation such that the project stays within the sideboards of the impact of the taking analyzed in the HCP, the Service's EA, and the Service's Biological and Conference Opinion.</u>

Upon the expiration of the 6-year ITP, the Applicant must operate the Project in a manner that avoids take of Covered Species (i.e., as described for Alternative 1) to comply with ESA or prepare a separate HCP and ITP application. For the purposes of the impact analysis under this alternative, we assume that take of listed species would be avoided after the 6-year ITP, no HCP would be prepared, no additional mitigation would be needed, and no ITP would be issued. While the Applicant may choose to pursue a new long-term ITP that is informed by the results of the 6-year permit, it would be speculative for the Service to try to predict what the operational strategy and potential impacts would be. Furthermore, any impacts that would occur under a subsequent permit would be analyzed separately under the relevant ESA and NEPA regulations.

2.2.2.1 Measures to Mitigate the Impact of the Taking

The mitigation plan is described in detail in Section 7.2.2 of the HCP. Although raising the cut-in speed and feathering blades will minimize take of Covered Species, some level of unavoidable incidental take may still occur (within the known limits provided by the adaptive management triggers, explained in Section 2.2.2.2.3). Therefore, the Applicant will mitigate for the impacts of take of Covered Species through cooperation with a mitigation provider to protect and conduct enhancement activities in summer maternity habitat. To fulfill the mitigation requirements, the Applicant will use the Chariton Hills Conservation Bank, which the Service authorized pursuant to a Conservation Bank Enabling Instrument (dated July 11, 2018; USFWS 2018).

Since the publication of the draft EA and HCP (December 1, 2020), the Applicant has committed an additional 10 acres of mitigation in the conservation program of the Final HCP (Final HCP Section 7.2.2) to provide additional benefits to Covered Species. As a result, 217 acres (previously 211.1 acres) of forested habitat will be protected, monitored, and managed at Chariton Hills Conservation Bank in perpetuity.

Since the publication of the draft EA and HCP, the amount of mitigation required to fully offset the impact to Covered species has decreased from 211.1 acres to 162.2 acres. The decrease in the required mitigation is a result of final coordination with Chariton Hill's Conservation Bank on calculations through the Resource Equivalency Analysis Models (REA Model) for wind energy projects (USFWS 2016*d*, *e*, *f*).[5] Based on the outputs from the REA Models, the Applicant is required to provide 162.2 acres of credits (further described in HCP Section 7.2.2) to fully offset the taking. However, the Applicant has voluntarily reserved 217 acres of credits, which is 54.8 more acres (33%) than required to fully offset the taking.

2.2.2.2 Monitoring

Two distinct types of monitoring will be conducted during the implementation of the HCP. *Maternity colony monitoring* provides information on the persistence and population dynamics of maternity colonies within the Permit Area and does not trigger adaptive management under the HCP. *Mortality monitoring* triggers adaptive management strategies that will ensure impacts remain within the predetermined limits of the HCP (adaptive management is explained in Section 2.2.2.3).

2.2.2.2.1 Maternity Colony Monitoring (HCP Section 7.4)

The 6-year HCP proposes to investigate the impacts of wind energy operations on local maternity colonies to inform long-term management. To accomplish this, the Applicant and the Service will monitor populations of on-site colonies during the course of HCP implementation. Monitoring methods are summarized below.

- Monitoring will begin when a maternity colony is detected during implementation of the maternity colony adaptive management strategy, and no later than year 4 of HCP implementation
- Mist-net surveys will be conducted at a minimum of 20 mist-net site locations, and will be based on locations of detected colonies, previous sites surveyed, and additional habitat surveyed during HCP implementation

[5] *Note on REA module inputs:* The REA user guide (USFWS 2014) specifies that mitigation parcels need to be protected in perpetuity and that benefits can reasonably be expected to accrue for 10 years from the last year that the mitigation is monitored. Therefore, the "project end year" input cell in the REA module should equal the last year for which the project proponent is responsible for monitoring mitigation plus an additional 10 years to account for a reasonable period the mitigation would continue to accrue benefits. However, the Applicant is mitigating through the Chariton Hills Conservation Bank, where monitoring and habitat management and protection will continue for perpetuity. Therefore, for the Project, USFWS supports modifying the "project end year" input to be consistent with Chariton Hills Conservation Bank calculations (52-year term).

- Surveys will include a minimum of two mist-net sites within each maternity colony identified in 2016 and 2018 studies and track up to three bats per species (if captured) for up to 7 days, targeting a minimum of 14 roosting events per maternity colony. Emergence counts will be conducted at roost trees. These surveys will be conducted based on the most current version of the Range-wide Indiana Bat Survey Guidelines (USFWS 2019d)
- The population dynamics of the monitored colonies on-site will be compared to control sites, off-site colonies monitored by MDC, and pre-construction survey results. Changes in population dynamics will be analyzed and will inform future long-term management strategies that protect maternity colonies after the permit term

2.2.2.2.2 Mortality Monitoring (HCP Section 7.3)

Mortality monitoring includes standardized carcass searches that occur regularly throughout the implementation of the HCP, from April 1 through October 31. The monitoring strategy was designed using the USGS Evidence of Absence (EoA) software (Dalthorp et al. 2017) to verify the strategy would statistically result in the desired probability of carcass detection (g= 0.2[6] or above). To achieve the desired probability of detection, mortality monitoring will include a twice weekly search interval, and include 105 plots (60% of turbines) on roads and pads as well as 70 plots (40% of turbines) cleared within 60 meters of the turbines. The Applicant will work to achieve an average detection probability of 20% throughout the 6-year HCP.

In accordance with the adaptive management protocol, the Applicant will implement predetermined management strategies in response to the following circumstances:

- Dead or injured Covered Species: If a dead or injured Covered Species is found, Ameren will notify the Service within 48 hours, and include the circumstances of the fatality (e.g., location, date, meteorological conditions, etc.).
- Dead female bat: If the fatality is a female bat killed during April 1–September 30th, Ameren will immediately act in accordance with the maternity colony adaptive management strategy (described below).
- Annual reassessment: At the end of each bat active season, Ameren will use EoA to calculate the annual take rate and the total projected mortality for the remainder of the permit term. These calculations use the number of detected carcasses corrected for searcher efficiency, area adjustment, and carcass persistence. These results of mortality monitoring inform the adaptive management strategies for permitted level of take, and for maternity colonies (summarized in sections below).

2.2.2.2.3 Adaptive Management

The feedback loops among mortality monitoring, adaptive management, and operational adjustments allows the Applicant to evaluate the effectiveness of minimization measures and react accordingly with increasingly protective measures for Covered Species. The Applicant will utilize adaptive management to ensure that the Project's bat conservation program is effective in meeting the biological goals and objectives of the HCP and take of Covered Species at the Project does not exceed the permitted level of take.

Adaptive Management for Permitted Level of Take (HCP Section 7.5.2)
The adaptive management strategy for permitted level of take causes turbines to operate in an incrementally more protective manner and ensures the permitted level of take will not be exceeded. The number of detected fatalities (X) and the cumulative annual take rate (λ) for each species will be used to trigger adaptive management to prevent the cumulative take estimate ($M_{Cumulative}$) from reaching the take limits of any of the Covered Species. If the number of detected fatalities (X) reaches an adaptive management threshold, all turbines will immediately respond accordingly (cut in at incrementally higher wind speeds of 5.5, 6, or 6.5 m/s; HCP Table 7-3). At the end of each year, the average annual take rate will be evaluated, and turbine operations may be further refined based on the calculated take rate, spatial, and seasonal data in consultation with MDC and USFWS, and approved in writing by USFWS. If

[6] In regard to EoA, the Service considers robust monitoring that which yields a 20% probability of detection. This is a rigorous threshold to reach, as most *Myotis* fatalities at wind energy facilities are rare events.

the calculated take rate reaches an adaptive management threshold, turbines will cut-in at higher wind speeds. If calculated projected fatalities reach the level of permitted take, turbines will operate in a manner that avoids take entirely.

The number of fatalities detected was added as an adaptive management threshold in the final EA and HCP in response to the April Indiana bat fatality (explained in Section 2.2.2). The detected fatality trigger is a back-stop that ensures turbines are responsive to adaptive management prior to the end of the year when the cumulative annual take rate is calculated and assessed. In the draft EA and HCP only the cumulative annual take rate was included as an adaptive management threshold. The April fatality is considered as a take that counts towards the detected fatality and annual take rate adaptive management thresholds. Thus impacts of the Project are consistent with the levels analyzed in the HCP, the Service's EA, and the Service's Biological and Conference Opinion. For more information on these adaptive management thresholds, see Section 7.5.2 of the final HCP.

Adaptive Management for Maternity Colonies (HCP Section 7.5.1 and HCP Appendix B)

We do not know the location of all colonies in the Permit Area, so the adaptive management strategy relies on detected bat mortalities to indicate where a colony could be and becomes increasingly protective of those potential colonies.

Pre-construction surveys demonstrated maternity colonies in the Permit Area, and this adaptive management strategy ensures impacts are minimized at the level of the maternity colony population. Implementation of the Applicant's adaptive management strategy is part of our analysis of impacts,[7] which is explained for each alternative in Section 3.4.2.1.2. Below, we summarize the key elements of the maternity colony adaptive management strategy.

Indiana bats are used below to demonstrate how detection of a potential maternity colony works.

> Single fatality: If a single Indiana bat[8] was found, it could be part of a maternity colony population that exists in any of the suitable forested habitat within a 2.5-mile-radius[9] around the turbine that caused the fatality.
>
> Second fatality: If a second Indiana bat was found and the 2.5-mile radius around the turbine that caused that fatality overlaps with the radius from the first carcass, then both bats could be from the same maternity colony population which would potentially exist in the suitable habitat of the overlapping area.

Considering the amount and distribution of suitable forested habitat in the Permit Area, it is possible that each bat in this example (above) could be part of a separate maternity colony population. However, for the purposes of the adaptive management strategy, if the 2.5-mile radii from any carcasses overlap we would assume they belong to the same maternity colony population in the overlapping area (unless further bat surveys indicate otherwise). Errors in this assumption are to the benefit of the Covered Species because an error would only assume a higher level of impact to a single population and trigger adaptive management.

Using the methods explained above, this strategy protects potential colonies in the Permit Area by assuming a maternity colony population exists in areas with overlapping fatalities and adjusting turbine operations to become more protective of those presumed colonies. In accordance with this strategy, the Applicant will immediately evaluate fatalities and determine whether adaptive management action is required (as prescribed in the HCP, and summarized below). Table 2-2 and Table 2-3 demonstrate the maternity colony adaptive management thresholds and actions for Indiana bats and little brown bats, respectively. There are no tiered adaptive management thresholds for northern long-eared bats and all turbines within 1.5 miles of a detected northern long-eared bat fatality will adjust cut-in speeds to avoid further take.

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[7] We analyzed the impact to resident maternity colonies under the worst-case scenario allowed by the maternity colony adaptive management strategy (i.e., the most intense impact in the shortest amount of time, before an adaptive management threshold is reached and further take is avoided). The analysis is fully explained in Section 3.4.2.1.2.

[8] The maternity colony adaptive management strategy specifically relates to females found between April 1 and September 30 because these are the individuals and period of risk relevant to summer maternity colonies.

[9] The 2.5-mile radius is the foraging distance for Indiana bats. This is based on radio-tracking studies and is a standard metric used by the Service. Specifically, we assume Indiana bat summer maternity colonies use suitable habitat within 2.5 miles of primary roost trees. Therefore, the maternity colony adaptive management strategy assumes that an Indiana bat fatality may have originated from a population within 2.5 miles of the carcass. The same principle is applied to little brown bats using a 3.9-mile foraging distance, and northern long-eared bats using a 1.5-mile foraging distance. More information about the foraging distance can be found in Indiana bat survey guidelines and wind guidance https://www.fws.gov/midwest/Endangered/mammals/inba/pdf/inbaS7and10WindGuidanceFinal26Oct2011.pdf.

Table 2-2. Maternity colony adaptive management thresholds for Indiana bat

Threshold	Description	Adaptive Management Action	Result
1	4 Indiana bat carcasses found within 2.5 miles of the same suitable habitat	All turbines within 2.5 miles of the same suitable habitat will adjust cut-in speeds to avoid additional impact to the population for the remainder of the permit term	Any turbines associated with the assumed colony no longer affect that population Other turbines (outside the affected area) continue to operate as usual
2	The first threshold has been met, and 3 Indiana bat carcasses have been found within 2.5 miles of the same suitable habitat	All turbines within 2.5 miles of the same suitable habitat will adjust cut-in speeds to avoid additional impact to the population, for the remainder of the permit term	Any turbines associated with the assumed colony no longer affect that population Other turbines outside of the two assumed populations continue to operate as usual
3	The first two thresholds have been met, and 2 Indiana bat carcasses have been found within 2.5 miles of the same suitable habitat	All turbines within 2.5 miles of the same suitable habitat will adjust cut-in speeds to avoid additional impact to the population for the remainder of the permit term	Any turbines within 2.5 miles of the 2 Indiana bat fatalities no longer affect the population

Table 2-3. Maternity colony adaptive management thresholds for little brown bat

Threshold	Description	Adaptive Management Action	Result
1	4 little brown bat carcasses found within 3.9 miles of the same suitable habitat	All turbines within 3.9 miles of the same suitable habitat will adjust cut in speeds to avoid additional impact to the population for the remainder of the permit term	Any turbines associated with the assumed colony no longer affect that population Other turbines (outside the affected area) continue to operate as usual
2	The first threshold has been met, and elsewhere in the permit area 3 little brown bat carcasses have been found within 3.9 miles of the same suitable habitat	All turbines within 3.9 miles of the same suitable habitat will adjust cut in speeds to avoid additional impact to the population, for the remainder of the permit term	Any turbines associated with the assumed colony no longer affect that population Other turbines outside of the two assumed populations continue to operate as usual
3	The first two thresholds have been met, and an additional little brown bat is found.	All turbines within 3.9 miles of the fatality will adjust cut in speeds to avoid additional impact to the population for the remainder of the permit term	Any turbines within 3.9 miles of any additional little brown bat fatality no longer affect assumed population

Although the thresholds listed in Table 2-2 and Table 2-3 are explained as a linear progression, they have the potential to be simultaneously triggered for the respective Covered Species. For example, if 3 Indiana bat carcasses were found within 2.5 miles of the same suitable habitat in the southeast region of the Permit Area and an additional 3 female bat carcasses were found in the southwest region, a subsequent detection of a fourth bat in either of those areas would simultaneously trigger the first and second thresholds. The third threshold then would apply moving forward.

The April Indiana bat fatality is considered as a take that counts towards the maternity colony adaptive management thresholds. Over the course of the permit, no more than 3 additional female Indiana bats can be found within 2.5 miles of the turbine where the April fatality occurred before meeting the detected bat threshold, and each subsequent fatality near that turbine will be evaluated to determine whether the calculated take threshold is met. Meeting either threshold would trigger adaptive management. Because the April fatality is considered as a take that counts towards the maternity colony adaptive management threshold, the impacts of the Project are consistent with the levels analyzed in the HCP, the Service's EA, and the Service's Biological and Conference Opinion. For more information on these adaptive management thresholds, see Section 7.5.1 and Appendix B of the final HCP.

Operations for the remaining life of the Project (years 7 to 30, after the term of the 6-yr permit expires) are expected to have no negative effects on Covered Species and there would be no mitigation and conservation measures in place to provide beneficial impacts. Within the context of the Project, Alternative 2 meets the Service's purpose and need for protecting and conserving the Covered Species and providing for the long-term conservation of the Covered Species and their ecosystems in the Plan Area.

2.2.3 Alternative 3: 6.5 m/s Cut-in Speed Alternative

Under Alternative 3, the Service would issue an ITP based on an HCP addressing the unavoidable incidental take of Covered Species expected from operating all turbines at a cut-in speed of 6.5 m/s from 45 minutes before sunset to 45 minutes after sunrise, when temperatures are above 40ºF from April 1 through October 31, annually. The Applicant would be expected to implement a revised BBCS that will reflect measures in the HCP for the modified cut-in speed. The HCP would outline a conservation program including mitigation, monitoring, and adaptive management requirements that meets the requirements set forth in section 10(a)(1)(B)(2)(A) of the ESA. The monitoring and adaptive management programs described for Alternative 2 would apply, and mitigation would be similar to that described for Alternative 2 but scaled to account for changes in the amount of take and resulting impacts to Covered Species.

Upon the expiration of the 6-year ITP, we presume that the Applicant would operate the Project in a manner that avoids take of Covered Species (i.e., as described for Alternative 1) unless a separate HCP is prepared and a new ITP is issued. For this EA, we assume that take of listed species would be avoided after the 6-year ITP, no HCP would be prepared, no additional mitigation would be implemented, and no ITP would be issued. Therefore, the operations for the remaining life of the Project would have an overall neutral effect on Covered Species because it would not result in take or benefits derived from implementation of the mitigation and conservation measures proposed under the HCP.

Within the context of the Project, Alternative 3 meets the Service's purpose and need for protecting and conserving the Covered Species and providing for the long-term conservation of the Covered Species and their ecosystems in the Plan Area.

2.3 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

NEPA requires that federal agencies thoroughly consider and objectively evaluate all reasonable alternatives and briefly explain the basis for eliminating those alternatives not retained for detailed analysis (40 CFR 1502.14). Early discourse between the Service and the Applicant on potential minimization and mitigation measures resulted in an initial list of potential alternatives for achieving the purpose and need of the Project. Some of these alternatives were later determined to not meet the purpose and need of either the Service or Applicant. Therefore, there were three alternatives considered but eventually dismissed from detailed analysis for reasons summarized below.

2.3.1 Long-Term HCP and ITP

A Long-Term HCP and ITP Alternative would include the preparation of an HCP with a permit term covering the life of the Project (i.e., 30 years). The HCP would include minimization, adaptive management, and mitigation measures for the 30-year permit term. Mitigation to offset the impacts of the taking of Covered Species over 30 years would also be identified in the HCP. The take estimate and associated impacts to the Covered Species would be calculated using the information and methods currently available (as described in 7.2 of the HCP prepared for

Alternative 2). The long-term take estimate and predicted impacts to Covered Species would not be informed by site-specific fatality monitoring data.

Within the context of this Project, the Long-Term HCP Alternative would not meet the Service's purpose and need to ensure long-term conservation of the Covered Species and their ecosystems in the Plan Area. In the absence of the site-specific information about the impact of take at the Project, we are uncertain if we can accurately predict the long-term impacts of take at the site and determine if a Long-Term HCP and ITP Alternative would meet issuance criteria as identified in section 10(a)(1)(B) of the ESA and associated implementing regulations [50 CFR 17.22(b)(2) and 17.32(b)(2)]. Therefore, this alternative was dismissed from further consideration.

2.3.2 Less Restrictive Alternative (Cut-in Speed Less Than 5.0 m/s with HCP and ITP)

Under the Less Restrictive Alternative, the Applicant would operate all turbines at cut-in speed less than 5.0 m/s. This cut-in speed would be implemented sunset to sunrise from April 1 through October 31. Under this alternative, the Applicant would prepare an HCP and ITP application that would describe the associated minimization, adaptive management, and mitigation measures over a 6-year permit term. Because this cut-in speed would be lower than the cut-in speed proposed in the Applicant's HCP (5.0 m/s; see Section 2.2.2 Alternative 2), the impacts associated with this alternative would be higher than in the proposed HCP. This alternative is not reasonable because the Service would not issue a permit for impacts to the species that are greater than proposed in the Applicant's HCP. Therefore, this alternative was dismissed from further analysis because it is not reasonable, and it does not meet the Service's purpose and need as explained in Chapter 1.

2.3.3 Restricted Operations (Cut-in Speed between 5.0 and 6.5 m/s with HCP and ITP)

The Service considered curtailment regimes where turbine blades would be feathered below wind speeds greater than 5.0 m/s but less than 6.5 m/s. Post-construction monitoring studies, to-date, have evaluated reductions in bat fatality rates at 5.5 m/s and 6.0 m/s cut-in speeds. These studies have shown that the percent reductions in bat fatalities at 5.5 m/s ranged from 60% to 73% with an average reduction of 66%. Only one study evaluated the reduction in bat fatalities at 6.0 m/s, which was 63%. Evaluating cut-in speeds between 5.0 m/s and 6.5 m/s would only examine a very small difference in bat fatality reductions and would not be meaningful. Therefore, we dismissed analyzing the incremental curtailment regimes using cut-in speeds between 5.0 and 6.5 m/s due to the small differences expected in mortality reduction.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 AFFECTED ENVIRONMENT

It is necessary to understand the resources affected, and to what extent, to make an informed decision about which alternative to select. In this EA, the affected environment provides the context in which impacts will occur, including the relevant geographic area and resources (i.e., biological, physical, socioeconomic) potentially affected by the Federal Action.

Relative to the Applicant's proposal, the affected environment includes the Plan Area (described below in Section 3.1.1) where any Covered Activities (i.e., operations and mitigation) will occur. The Federal Action of issuing an ITP and the associated implementation of the HCP would only influence the operation of the Project and the mitigation for Covered Species. As described in Chapter 2 above, the alternatives are structured around turbine operational strategies (the wind speeds at which the turbine blades are spinning) that change the amount of Covered Species take and associated mitigation that would be authorized in an ITP. More specifically, the turbine operational strategies in the alternatives involve changing cut-in speeds at night, for various seasons throughout the year.

Mitigation under all action alternatives would consist of habitat protection in the form of credits purchased at a conservation bank. Monitoring would occur under all alternatives and would include searches of turbine roads and pads and cleared plots, according to the protocol described the HCP and would be the same under each alternative.

In defining affected resources, we considered potential impacts caused by the Federal Action and associated alternatives. Specifically, we first considered whether the Action could potentially impact the following resources: air quality and climate, general wildlife, vegetation, geology and soils, surface and ground water, socioeconomics, environmental justice, land use, visual resources, cultural resources, transportation, communication, noise, economics, avian resources, and bat resources. In evaluating these resources, we have determined that the covered activities do not affect some resource categories at all, affect some resource categories only minimally, and affect others measurably such than an effects analysis is warranted. Then, we focused the scope of our analyses to include only those resources that could be affected in a measurable or meaningful way or may be of particular interest to the public (based on public comments the Service received while working with other wind energy facilities).

All alternatives would include fatality monitoring at the Project, and both action alternatives would involve mitigation in the form of forested habitat protection through purchase of credits at a conservation bank. Fatality monitoring would include clearing of agricultural ground for crops and seasonal employment of workers (e.g., consulting firm employees). Mitigation would involve purchase of bank credits to permanently protect existing forested habitat that is occupied by the Covered Species. These activities are not expected to have a measurable or permanent effect on vegetation resources, land-use, or socioeconomics due to their temporary nature, and therefore impacts to these resources are not carried forward for further analysis.

Because the Project is built and the Federal Action is limited to operational changes, the alternatives are not likely to have measurable effects to general wildlife (other than bats), geology and soils, surface and ground water, environmental justice, visual resources, cultural resources, transportation, and communications. Operations of the Project will not generate emissions and therefore is not expected to affect local air quality. Therefore, our review does not include analyses of these resources.

Temporally, we analyzed potential impacts that could occur within the context of the 6-year proposed permit period, as well as potential impacts throughout the life of the Project (beyond the proposed 6-year permit term). We assessed the long-term effects of the Project in years 7–30 because they are related to the Federal Action in that the 6-year permit term is expected to inform the long-term operational strategy at the site. As explained in Section 2.1, we assume the Project will operate in accordance with the No-Action Alternative in years 7–30.

Geographically, we considered potential impacts in the context of Bird Conservation Region 22 (BCR 22; for birds), the Ozark Central Recovery Unit (OCRU; for Indiana bats), and the Service's Legacy Region 3 (Region 3; for all other bat species). Where appropriate for the Covered Species, we analyze effects at smaller population levels.

In summary, the scope of our analyses consists of resources affected by the alternatives under consideration as described in Chapter 2 (i.e., three operational adjustments associated with turbine cut-in speeds, along with corresponding mitigation measures). Our detailed analysis is confined to the affected biological environment (i.e., bats), a brief analyses of impacts to birds, and physical environment (noise).

3.1.1 Overview of the Permit and Plan Areas

The Project is located in Adair and Schuyler counties in northcentral Missouri, northeast of Kirksville and near Queen City. The Plan Area for the Project covers 113,873.2 acres and the Chariton Hills Conservation Bank[10] (Figure 1). Adair and Schuyler counties include many small towns with residential, commercial, and agricultural land uses, connected by a network of local and state roads and major and minor transmission lines. The setting comprises agricultural land (i.e., row crops and pasture) and woodlands. Large and small tracts of forest, rural residences, and farmsteads are scattered throughout. The Permit Area is in the North Central Glaciated Plains Section of the Prairie Parkland Province. This Section is characterized by moderately dissected, glaciated, flat to

[10] More information on the Chariton Hills Conservation Bank can be found at https://info.burnsmcd.com/mitigationbankingusa/chariton-hills-conservation-bank#service.

rolling plains that slope gently toward the Missouri and Mississippi River valleys (USDA-FS 1995). Elevations in Adair and Schuyler counties range from 446 to 807 feet above sea level.

Section 3.1 and Section 3.2 of the HCP describe land use and land cover in the Permit Area; Table 3-1 and Figure 3 in the HCP provide details on cover types in the Permit Area. The National Land Cover Database (NLCD) identifies 73.7% of the land cover in the Permit Area as pasture/hay and cultivated crops (see HCP Table 3-1). Forested areas, 17.2% of the Permit Area, are largely associated with streams and ditches and occur mostly as small patches or strips (Figure 2). Developed land makes up 4% of the Permit Area and occurs largely as open space. Although not described in the NLCD, streams and rivers feature prominently in the Permit Area and surrounding landscape (see HCP, Figure 3). Larger streams include North Fork Salt River, Floyd Creek, North Fork South Fabius River, and South Fork Middle Fabius River, all which are tributaries of the Mississippi River. Wetlands are not prominent features in the landscape. The National Wetland Inventory (NWI) data show wetlands as riverine features, ponds, and emergent wetlands (Westwood 2018). The wetland delineation mapped 12 acres of wetlands in the 5,896-acre delineation corridor (Westwood 2018). These were mainly palustrine emergent and palustrine unconsolidated bottom wetlands.

Figure 2. Typical forest cover in the HCP Permit Area

The Applicant will use the Chariton Hills Conservation Bank in northern Missouri to fulfill their mitigation requirements. The entire conservation bank includes two areas that both abut Missouri state conservation areas and contain areas associated with the Chariton River and its tributaries.

3.2 ENVIRONMENTAL CONSEQUENCES

The sections below (organized by each resource analyzed [i.e., birds, bats, and noise]) explain environmental impacts of the alternatives retained for detailed analysis (summarized in Table 2-1). Cumulative effects of wind Project build-out and disease are considered for affected resources. In addition, population analyses for each alternative include the direct, indirect, and long-term effects by incorporating the lost reproductive output of individuals and propagating the effects throughout time.

3.2.1 Cumulative Effects

The CEQ guidelines acknowledge, "…in a broad sense all the impacts on affected resources are probably cumulative." Nonetheless, it is important to "count what counts" and narrow the focus of the analysis to important national, regional, and local issues (CEQ 1997). The CEQ recommends the NEPA analysis should include those potential cumulative effects with direct influence on the agency's action and decision-making. Thus, as per the CEQ guidelines, resources that would not be impacted by the Federal Action or alternatives, have beneficial effects, or are only subject to temporary effects were excluded from this analysis (CEQ 1997).

Following the tiered approach recommended by the CEQ guidelines (1997), we focused our effects analysis on potential impacts to the Covered Species, all other bats, and birds, as these are the resources Project operations may affect. Furthermore, only bats would be affected to varying degrees by the alternatives considered in this EA as we have determined based on the available studies that operational adjustments do not affect bird mortality. (Marques et al. 2014). Similarly, this analysis largely focuses on cumulative effects of current, proposed, and projected wind energy development. We also briefly discuss effects associated with other mortality sources, such as other types of collisions for birds. We also discuss WNS and explain how the cumulative impacts of WNS are also accounted for as an underlying effect in our population analyses of the Covered Species.

3.2.1.1 Projected Wind Energy Development

According to 2019 data compiled by the American Wind Energy Association (AWEA 2020), 14,424 turbines totaling 26,324 MW are currently installed in the eight states that make up Region 3 (Table 3-1). The U.S. Energy Information Administration's energy forecasts recently indicated a nationwide growth rate of 1.8% annually for installed wind energy capacity between 2019 and 2050 (USEIA 2020). Applying this growth rate to the current installed capacity in the states in Region 3 over the years of the Permit term (2021–2026), we estimate a total capacity of 29,825 MW in the Region by the end of year 2026, we also estimate a total capacity of 45,765 MW in the Region by the end of year 2050.

Table 3-1. Installed and projected wind energy development in Service Region 3, OCRU, and BCR 22.

	Current Installed Capacity		***Projected Installed Capacity***			
	2019		***2026***		***2050***	
State	*# MW* [1]	*# Turbines* [1]	*# MW* [2]	*# Turbines* [3]	*# MW* [2]	*# Turbines* [3]
Iowa	10,190	5,410	11,545	6,414	17,716	9,842
Illinois	5,350	2,933	6,062	3,368	9,301	5,167
Minnesota	3,843	2,379	4,354	2,419	6,681	3,712
Indiana	2,317	1,264	2,625	1,458	4,028	2,238
Michigan	2,190	1,165	2,481	1,378	3,807	2,115
Missouri	959	499	1,087	604	1,667	926
Ohio	738	388	836	465	1,283	713
Wisconsin	737	386	835	464	1,281	712
Total Region 3	**26,324**	**14,424**	**29,825**	**16,570**	**45,765**	**25,425**
Total OCRU [4]	**16,499**	**8,842**	**18,694**	**10,385**	**28,684**	**15,936**
Total BCR 22 [5]	**19,554**	**10,494**	**22,155**	**12,308**	**33,995**	**18,886**

[1] From state fact sheets AWEA (2020), as of December 31, 2019
[2] Assuming 1.8% annual growth, the estimated nationwide trend during 2019–2040 (USEIA 2020)
[3] Assuming 1.8-MW turbines on average; i.e., MW divided by 1.8
[4] OCRU total is the sum of the installed capacity of Illinois, Missouri, and Iowa. The OCRU also includes the eastern edge of Oklahoma and northern Arkansas, but these areas have no facilities.
[5] BCR 22 total is the sum of installed capacity in Iowa, Missouri, Indiana, Illinois, and Ohio

We estimated wind energy development in the OCRU by adding the estimates for Iowa, Illinois, and Missouri. Although the OCRU also includes eastern Oklahoma and northern Arkansas, no wind energy facilities occur in these areas. The OCRU does not include all of Iowa, but it would be difficult to identify what wind energy facilities occur only in the OCRU. Hence, all facilities in Iowa are included in our analysis for the OCRU. Currently, the OCRU includes 8,842 turbines, totaling 16,499 MW of installed capacity. Applying the same 1.8% annual growth rate to the installed capacity in the OCRU yields an estimate of 18,694 MW installed capacity by the end of year 2026 28,864 MW by the end of year 2050.

BCR 22 stretches from the eastern edges of Oklahoma, Kansas, and Nebraska to southeastern Minnesota and the western half of Ohio, and it includes the northern halves of Missouri and Indiana and nearly all of Iowa and Illinois (Figure 3). We estimated wind energy development in BCR 22 by including all wind energy facilities in Iowa, Missouri, Indiana, Illinois, and Ohio. Currently, these five states have 10,494 turbines, totaling 19,554 MW of installed capacity. Applying the same 1.8% annual growth rate to the installed capacity in these five states yields an estimate of 22,155 MW of installed capacity by the end of year 2026 and 33,995 MW by the end of year 2050.

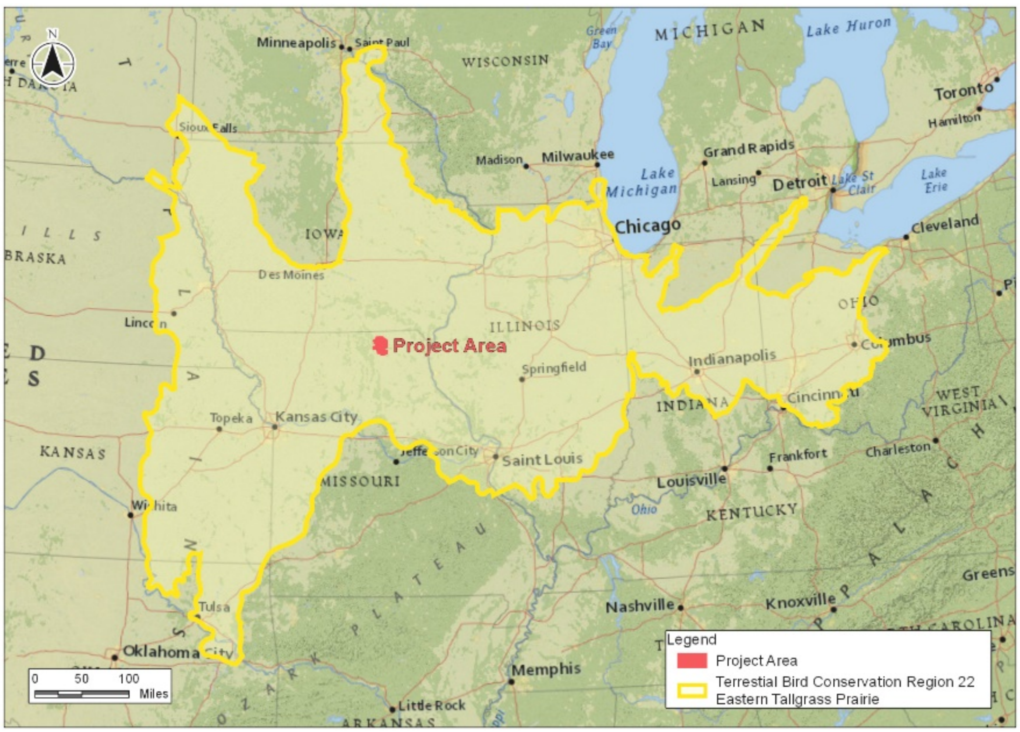

Figure 3. **Bird Conservation Region 22**
Source: Bird Studies Canada and NABCI (2014)

3.3 AVIAN RESOURCES

Operational impacts to avian resources are expected under all of the alternatives, but these impacts are not expected to differ among the alternatives as there is currently no evidence that suggests varying turbine cut-in speeds affects birds either through disturbance/displacement or mortality (Marques et al. 2014). However, we anticipate public interest in impacts to birds and therefore summarize the Facilities potential effects to avian resources.

The scope of this assessment includes avian resources within the Permit Area and within BCR 22. Birds are highly mobile, and dispersal and migration are important aspects of their life strategies and survival. Birds will occur within and travel through the Permit Area while making daily commutes and during migration. Our analysis focuses on species of birds protected under the ESA, BGEPA, and Missouri's Wildlife Code, but also considers species that are common to the Permit Area and surrounding region. Abundant species are expected to occur more frequently and will, therefore be more likely to experience impacts from the Project. This analysis considers site-specific habitat and land cover information and site-specific pre-construction avian survey data. Also, our assessment is focused on the impacts of the Project to birds as a result of the operation of the Project (i.e., spinning of the turbine blades) because that is the scope of the Federal Action. Effects to birds caused by the presence of the Project (such as displacement) and associated infrastructure (collisions with transmission lines or meteorological towers) are not discussed because the existence of the Project and associated infrastructure is independent of the Federal Action. Conservation measures implemented by the Applicant that are associated with the Project and infrastructure are described in the BBCS (see Appendix A).

3.3.1 Existing Conditions in the Permit Area

The Applicant consulted the Service and MDC and conducted pre-construction surveys to identify potential concerns related to risk to birds associated with Project development and operations. The Permit Area is dominated by lands in hay and pasture, and birds that use these kinds of open habitats are likely to occur during the breeding season, but a few species may use them in winter. Forests are fragmented into large and small blocks that are scattered throughout the Permit Area. The forest type is oak-hickory in the uplands and mixed hardwoods in the bottomlands. Cultivated crops and development represent approximately 15% of the land use. The Permit Area is expected to support an array of bird species, particularly species that tend to use open habitats.

3.3.1.1 Pre-construction Surveys

Baseline surveys were conducted from May 2016 through April 2019 and included small- and large-bird use, eagle use, and raptor nest surveys. Table 3-2 summarizes results from the on-site surveys. Bird surveys are discussed further in the BBCS (Appendix A) and in the survey reports (Stantec 2018b, 2019; Appendix B).

3.3.1.1.1 Rare, Threatened, and Endangered Birds

No federally listed bird species are known to occur in or migrate through the Permit Area (per Information for Planning and Consultation report, dated August 3, 2020). However, MDC (2019) lists two state-listed endangered birds with the potential to occur in Adair and Schuyler counties, the king rail (*Rallus elegans*) and northern harrier. The Permit Area provides suitable habitat for northern harrier, and 350 northern harriers were documented during the small- and large-bird surveys. Breeding Bird Survey routes proximal to the Permit Area include one near Queen City in Schuyler County and one near Kirksville in Adair County. Species recorded on these two routes also included northern harriers Pre-construction bird surveys recorded 2 peregrine falcons.

3.3.1.1.2 USFWS Birds of Conservation Concern

The Service tracks Birds of Conservation Concern throughout the U.S. by BCR, the geographic region specific to the planning scale for Birds of Conservation Concern. Birds of Conservation Concern are those "species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing" under the ESA (USFWS 2008). The Permit Area is within BCR 22, Eastern Tallgrass Prairie, where 39 species of birds are listed as Birds of Conservation Concern (USFWS 2008). Among these 39 species, small and large bird-use surveys (Stantec 2019) detected 15 species, including pied-billed grebe (*Podilymbus podiceps*, n=2), solitary sandpiper (*Tringa solitaria*), upland sandpiper (*Bartramia longicauda*, n=1), black-billed cuckoo (*Coccyzus erythropthalmus*, n=1), short-eared owl (n=26), red-headed woodpecker (*Melanerpes erythrocephalus*, n=179), northern flicker (*Colaptes auratus*, n=90), loggerhead shrike (n=1), Bell's vireo (V*ireo bellii*, n=1), wood thrush (*Hylocichla mustelina*, n=2), field sparrow (*Spizella pusilla*, n=130), grasshopper sparrow (*Ammodramus savannarum*, n=36), Henslow's sparrow (*Centronyx henslowii*, n=7), dickcissel (*Spiza americana*, n=270), and rusty blackbird (*Euphagus carolinus*, n=10). Species recorded on the two BBS survey routes, mentioned in the previous section, have included upland sandpiper, black-billed cuckoo, red-headed woodpecker, northern flicker, loggerhead shrike, Bell's vireo, field sparrow, grasshopper sparrow, Henslow's sparrow, and dickcissel.

Table 3-2. Summary of pre-construction bird surveys conducted in the High Prairie Renewable Energy Center Permit Area

<table>
<tr><th>Survey</th><th>Summary</th><th>Report Citation</th></tr>
<tr><td>Small-bird use</td><td>
• 93 point-count locations, visited 12-15 times May 2016–November 2018
• 115 bird species identified (12,542 individual bird observations)
• Most birds included common species (European starling (Sturnus vulgaris), red-winged blackbird (Agelaius phoeniceus), and mourning dove (Zenaida macroura).
State Endangered Bird Species
• northern harrier (Circus hudsonius, 34 incidental observations)
• peregrine falcon (Falco peregrinus, 1 incidental observation)
State Special Concern Bird Species
• pine siskin (Spinus pinus, 4 observations)
• brown creeper (Certhia americana, 2 observations)
• chestnut-sided warbler (Setophaga pensylvanica, 1 observation)
• loggerhead shrike (Lanius ludovicianus, 1 observation)
• bald eagle (Haliaeetus leucocephalus, 67 incidental observations[1])
• short-eared owl (Asio flammeus, 1 incidental observation)
• sharp-shinned hawk (Accipiter striatus, 3 incidental observations)
• trumpeter swan (Cygnus buccinator; 2 incidental observations)
</td><td>Stantec (2019)</td></tr>
<tr><td>Large-bird and eagle use</td><td>
• 80-93 point-count locations visited 24 times during May 2016–Oct 2019
• 37 bird species identified (19,388 individual bird observations)
• Frequent observations of common species including turkey vulture (Cathartes aura), snow goose (Anser caerulescens), Canada goose (Branta canadensis), American crow (Corvus brachyrhynchos), and red-tailed hawk (Buteo jamaicensis)
• 955 bald eagle observations; 9 golden eagle observations
State Endangered Bird Species
• northern harrier (316 observations)
• peregrine falcon (1 observation)
State Special Concern Bird Species Observed
• osprey (1 observation plus 2 incidental)
• sandhill crane (Grus canadensis, 2 observations)
• short-eared owl (25 observations plus 4 incidental)
• sharp-shinned hawk (35 observations plus 2 incidental)
• trumpeter swan (29 observations)
• loggerhead shrike (1 incidental)
</td><td>Stantec (2019)</td></tr>
<tr><td>Raptor nest</td><td>
• Ground and aerial search for nests in 2018, including 10-mile buffer
• 5 within Permit Area, 13 within buffer, 1 outside buffer. Of 19 nests, 1 red-tailed hawk nest occupied, within buffer
• 22 bald eagle nests, 3 within Permit Area (1 active), 17 within 10-mile buffer (11 active), and 2 outside buffer (2 active)
</td><td>Stantec (2018b)</td></tr>
</table>

[1] Incidental observations were those made outside the point-count survey plot or of large birds detected during the small-bird use survey.

3.3.2 Environmental Consequences

3.3.2.1 Direct and Indirect Effects

3.3.2.1.1 Project Operations

As explained above (3.1.1), operational impacts to avian resources are expected under all of the alternatives being analyzed. Impacts to avian resources are not expected to differ among the alternatives because the only technique proven to minimize impacts to birds is turbine shutdown during high-risk periods triggered by real-time field observations and/or automated detectors (Marques et al. 2014). Therefore, in our analysis, we assume feathering turbines would not affect avian resources, and the impacts under each alternative are identical.

Collision Related Mortality
Avian fatalities from turbine collisions are expected to occur at the same rate under any of the three alternatives and are not expected to be affected by the Federal Action. However, we included this analysis because the public has expressed interest in impacts to avian resources from wind energy projects in the past. Avian collision mortality at wind energy facilities is well documented. Smallwood (2013) estimated 573,000 bird fatalities per year (with 83,000 raptor fatalities) at 51,630 MW of installed wind energy capacity in the U.S. as of 2012. Considering mortality estimates from wind energy facilities in different regions of the U.S., weighted averages range from 1.5 birds per turbine per year in the Rocky Mountains to 4.27 birds per turbine per year in the East (NRC 2007).

For the purpose of analyzing avian collision risk at the Project, we calculated an average bird fatality rate based on 12 post-construction monitoring studies conducted at 9 wind energy facilities (see Appendix C, Table C-1). Annual bird fatality rates ranged from 0.33 to 7.17 birds per MW. The mean mortality rate is 3.22 birds per MW per study. We expect annual avian mortality for the Project to be within the range of mortality estimates from the facilities listed in Table C-1 given the similarity in landscape, land cover, and region. In addition, the Project is not proximal to any Important Bird Areas and does not have unique landscape or aerosphere features to concentrate birds any differently from other wind energy facilities in the region. To note, this average is slightly higher than an average reported for the Midwest region in AWWI (2019), which derived an average rate of 2.63 birds per MW per year.

Based on the mean mortality rate of 3.22 birds per MW per study, the Project is predicted to kill approximately 1,288 birds annually, 7,728 birds over the 6-year Permit term, and 38,640 over the 30-year life of the Project. Confidence intervals for birds per MW per study were provided in only two of the 12 monitoring studies listed in Table C-1 (Appendix C). For those two that did, the highest was 9.94 birds per MW per study (Gruver et al. 2009). Applying this value, the 400 MW Project could result to 3,976 bird fatalities per year (a worst-case scenario). In most years we would predict values closer to the average than the high end of variation. These estimates and mortality rates are aligned with those in other EAs for wind energy HCPs in the Midwest Region as estimates are derived from the same publicly available post-construction monitoring reports. Also, these fatalities are expected to consist of numerous species, as described below. Finally, these impacts are expected to occur with or without the federal action, and do not vary among alternatives.

Potentially Impacted Bird Species
Among bird groups, small passerines are most commonly involved in fatalities at wind energy facilities followed by diurnal raptors, doves and pigeons, and upland game birds (NRC 2007, Erickson et al. 2014a, AWWI 2019). Erickson et al. (2014) estimated that 62.5% of reported bird fatalities from wind energy facilities in the U.S. and Canada consisted of small passerines. For all wind energy facilities currently operating in North America, Erickson et al. (2014) estimated there are 2.10 to 3.35 passerine fatalities per installed MW per year. Avian collision mortality occurs during both the breeding and migration seasons, but observed mortality at communication towers, buildings, wind turbines, and other man-made structures suggest that the majority of fatalities occur during spring and fall migration (NRC 2007, AWWI 2019).

Regarding raptors, studies have documented high raptor avoidance behaviors of turbines at modern wind energy facilities (Chamberlain et al. 2006, Whitfield and Madders 2006), which may decrease their chance of collision. Raptors' mechanism for turbine avoidance is unknown; however, most raptors are diurnal and have good eyesight, suggesting they may be able to detect turbines visually as well as acoustically. Some research suggests replacing the older style turbines with the larger, monopole turbines may have reduced raptor collision risk, including the use of tubular towers to eliminate perches and larger blades to increase visibility (Smallwood and Karas 2009, Brown et al. 2016). The relationships between turbine design and bird collision risk requires further study. The issue is likely to be complicated by several elements, such as landscape context, Project layout, and microhabitat features.

Eagles are killed occasionally at wind energy facilities in the Midwest and may be at risk of collision at facilities where eagles or active nests were observed during pre-construction surveys. The Applicant documented the presence of bald and golden eagles and an active bald eagle nest during pre-construction surveys and has developed an Eagle Conservation Plan and applied for an Eagle Take Permit on 08-19-2020.

Regarding state-listed species in the Permit Area, northern harrier and peregrine falcon have a low likelihood of colliding with Project turbines during breeding or migration periods. To date, there have been 19 northern harrier and 4 peregrine falcon fatalities (AWWI 2019). The incidence of northern harrier fatalities is low relative to their high incidence at wind energy facilities in agricultural landscapes. Northern harriers are considered low risk for collision due to their habit of coursing low over the ground while hunting. Flight heights during the pre-construction survey in the Permit Area were less than 44 meters (144 feet; Stantec 2019).

The pre-construction avian use survey detected 10 special concern species, of which 8 have been documented as fatalities at wind energy facilities (number shown in parentheses): brown creeper (16), short-eared owl (13), loggerhead shrike (10), chestnut-sided warbler (8), sharp-shinned hawk (8), osprey (5), pine siskin (1), and bald eagle (unknown number of fatalities[11]). These species of concern were not detected during the breeding season, but they could all occur within or proximal to the Permit Area and the aerosphere above during migration. The occurrence of species of concern within the Permit Area during migration is expected to be infrequent and for short durations.

In addition to the state-listed species discussed above, the avian use survey detected 13 Birds of Conservation Concern, of which 8 have been documented as fatalities at wind energy facilities (numbers of carcasses shown in parentheses): northern flicker (32), wood thrush (18), grasshopper sparrow (18), black-billed cuckoo (13), field sparrow (8), upland sandpiper (6), dickcissel (5), and pied-billed grebe (2). Detections in the Permit Area were very low for wood thrush, black-billed cuckoo, upland sandpiper, and pied-billed grebe (Stantec 2019).

It is possible that the Project will kill or injure northern flickers, grasshopper sparrows, field sparrows, and dickcissels. For populations at the regional level (BCR 22), northern flicker, field sparrow, and grasshopper sparrow appear to have experienced significant decreases and are of regional concern (Partners in Flight 2019b). Dickcissels appear to have experienced moderate decreases (Partners in Flight 2019b).

To date, no significant population level impact to any species has been documented as a result of mortality from wind energy facilities. This is largely because species with the greatest risk of collision are abundant wherever they occur, engage in flight behaviors leading to collision, and migrate at night at lower altitudes (NRC 2007, Johnson et al. 2002, Arnold and Zink 2011, AWWI 2019). Summaries show the species with the highest number of incidents and percentage of fatalities at wind energy facilities in the U.S. include horned lark, mourning dove, red-eyed vireo (*Vireo olivaceus*), western meadowlark (*Sturnella neglecta*), golden-crowned kinglet (*Regulus satrapa*), and American kestrel (AWWI 2019). The avian use survey in the Permit Area detected all of these except golden-crowned kinglet and few western meadowlarks (13) and red-eyed vireos (8) (Stantec 2019). Table 3-3 shows the Partners in Flight estimates for the North American populations of three of these species (Partners in Flight 2019a). For populations in BCR 22, American kestrel appears to have experienced significant increases, mourning dove may have experienced a small decrease, and horned lark appears to have experienced a significant decrease (Partners in Flight 2019b).

[11] Fatalities of bald eagles at wind energy facilities have been reported (Pagel et al. 2013, AWWI 2019); the USFWS has not made a formal estimate of the number.

Table 3-3. North American population estimates for regionally abundant species that have been involved in collision mortality at wind energy facilities in North America.

Species	North American estimate
horned lark	100,000,000
mourning dove	130,000,000
American kestrel	2,800,000

Source: Partners in Flight (2019a)

Given the above, it is unlikely that fatalities from Project operations would result in significant impacts to any avian populations because fatalities are expected to be distributed across numerous species and the most commonly killed species at wind farms have very large population sizes. Most avian fatalities occur during migration, such that individuals killed would likely be from various breeding and wintering populations. Therefore, fatalities are not expected to disproportionately affect any single population. Most avian fatalities occur during migration, such that individuals killed would likely be from various breeding and wintering populations.

Effects of Mitigation, and Monitoring

No mitigation would occur under Alternative 1, as no take of the Covered Species is expected. Therefore, no ITP would be needed, and no HCP would be prepared. Non-raptor avian and BCC species would therefore not receive the habitat conservation benefits (i.e., mitigation) expected under the other considered alternatives.

Under Alternatives 2 and 3, mitigation would be implemented for Covered Species, but no specific mitigation is proposed for avian resources. Forest birds would receive the habitat enhancement and protection benefits inherently associated with the Covered Species' summer habitat protection proposed under an HCP. We assume that every acre of forested habitat protected would also provide an acre of habitat for forest bird species whose range overlaps with the mitigation site. While the goal of the summer habitat mitigation is to protect summer habitat for Covered Species, the mitigation project will also provide benefits to forest-dwelling birds. The proposed mitigation will preserve forest lands located in a landscape dominated by agriculture. In the long-term, these forested parcels will offer enhanced habitat for breeding birds and may also provide high quality stopover habitat for migrants.

All three alternatives would implement post-construction monitoring as described in the BBCS or HCP, which will include searcher efficiency and carcass persistence trials where carcasses are placed in the Project area to assess searcher success and carcass removal by scavengers (i.e., mammals and birds). Effects to birds resulting from post-construction monitoring may include disturbance, injury, or death due to increased vehicle traffic (but see collisions, above) and human presence. Furthermore, carcass trials may attract avian scavengers (e.g., vultures, raptors, crows). Cleared turbine pads would make fatalities easily detectable to birds. Avian scavengers could collide with spinning turbine blades while attempting to scavenge a carcass. However, carcasses are collected when found, trial carcasses are removed after trials, and therefore the risk of this impact would be temporary and occur only during the trials. Given the above, effects to avian resources as a result of mitigation and monitoring are expected to be minor and not significant.

3.3.2.2 Cumulative Effects

For the purposes of this EA, the cumulative effects analysis area includes the Project Permit Area and BCR 22.

3.3.2.2.1 Wind Energy Mortality

Birds are exposed to injury and mortality at all wind energy facilities. To estimate bird mortality, we used the average fatality rate of 3.22 birds per MW/year from 12 post-construction studies at 9 wind energy facilities in the Midwest (see Appendix C, Table C-1). To show a potential range of mortality, we also provide estimates using fatality rates at the low and high ends observed at facilities in the Midwest. Annual and cumulative bird mortality for the Project and BCR 22 are summarized in Table 3-4 and Table 3-5, respectively.

Table 3-4. Estimates for cumulative avian mortality for the High Prairie Renewable Energy Center

Fatality rate (birds/MW/year)		400 MW installed capacity				
		Years 2021–2026			Years 2027–2050	
		Annual	6-year total	% total wind mortality in BCR 22	24-year total	% total wind mortality in BCR 22
Min [1]	0.33	132	792	1.9	3,168	1.4
Max [2]	9.94	3,976	23,856	1.9	95,424	1.4
Mean	3.22	1,288	7,728	1.9	30,912	1.4

[1] Lowest rate observed among 12 post-construction studies.
[2] Highest rate observed as the upper confidence interval among 12 post-construction studies.

Table 3-5. Estimates for cumulative avian mortality from wind energy facilities in BCR 22

Fatality rate (birds/MW/year)		20,264–22,155 MW [1]			33,995 MW [1]	
		Years 2021–2026			Years 2027–2050	
		Annual in 2021[1]	Annual in 2026[1]	6-year total	Annual in 2050[1]	24-year total
Min[2]	0.33	6,687	7,311	41,973	11,218	220,978
Max [3]	9.94	201,427	220,220	1,264,270	337,912	6,656,123
Mean	3.22	65,251	71,339	409,552	109,464	2,156,209

[1] Estimated installed capacity in those states in BCR 22 (Iowa, Illinois, Indiana, Missouri, and Ohio) based on a projected annual growth of 1.8% a year (USEIA 2020) beginning with the installed capacity at the end of 2019 (AWEA 2020)
[2] Lowest rate observed among 12 post-construction studies.
[3] Highest rate observed as the upper confidence interval among 12 post-construction studies.

As discussed in Section 3.3.2.1.1, bird mortality at the Project is expected to be the same regardless of the alternative under which the Project operates, i.e., approximately 1,288 birds per year. This is roughly 1.9% of the total bird mortality from installed facilities in BCR 22 over 6 years and 1.4% of the total bird mortality over the 24 years after the ITP term (Table 3-4). Based on the average mortality rate, the Project may kill 7,728 birds over the permit term and 38,540 birds over the life of the Project.

Using the average fatality rate of 3.22 birds per MW per year, wind energy facilities operating in BCR 22 in 2021 may kill roughly 65,000 birds. Over the 6-year permit term, wind energy facilities operating in BCR 22 may kill roughly 400,000 birds. About 70% of these fatalities will be passerines, i.e., 280,000 passerines. During years 2027–2050, the remaining 24 years of Project life after the ITP expires, wind energy facilities operating in BCR 22 may kill roughly 2.2 million birds.

Carcass data from the wind energy facilities listed in Table C-1 in Appendix C included 5 Birds of Conservation Concern for BCR 22 that were also detected during pre-construction surveys conducted in the Permit Area (Table 3-6). To derive a fatality ratio for each species, we included carcass data from the 9 facilities listed in Table C-1 plus those from 1 other Project in Wisconsin, Forward Wind Energy Center. For total carcasses, we omitted those individuals that were classified as unidentified passerine, small bird, sparrow, or bird. But we retained those that may have not been identified to species but were classified sufficiently to be distinct from the 5 Birds of Conservation Concern, e.g., unidentified large bird, unidentified sandpiper, unidentified duck, etc. There were 360 carcasses identified to species that included 1 black-billed cuckoo, 1 loggerhead shrike, 1 wood thrush, 2 grasshopper sparrows, and 1 dickcissel.

Table 3-6. Potential effects on Birds of Conservation Concern from the High Prairie Renewable Energy Center and other facilities in BCR 22 over the 6-year permit term and remainder of Project life

			Estimated Project Fatalities				Estimated BCR Fatalities	
Species	**BCR 22 Population [1]**	**Fatality Ratio**	**Annual**	**% of the Population Affected Annually**	**Years 1-6 / Years 7-30 Cumulative**	**Fatalities in 2026**	**Years 1-6 / Years 7-30 Cumulative**	**% Annual Contribution of the Project to Annual Cumulative Fatalities in the BCR[2]**
black-billed cuckoo	23,000	0.002976	3.83	0.0166	23 / 92	212	1,219 / 6,417	1.8868 / 1.4337
loggerhead shrike	92,000	0.002976	3.83	0.0042	23 / 92	212	1,219 / 6,417	1.8868 / 1.4337
wood thrush	370,000	0.002976	3.83	0.0010	23 / 92	212	1,219 / 6,417	1.8868/ 1.4337
grasshopper sparrow	2,700,000	0.005952	7.67	0.0003	46 / 184	425	2,438 / 12,834	1.8868 / 1.4337
dickcissel	9,300,000	0.002976	3.83	0.0001	23 / 92	212	1,219 / 6417	1.8868 / 1.4337
Total birds of all species	--	--	1,228	--	7,728	71,339	409,552	--

[1] Source: Partners in Flight (2019a)
[2] This is the proportion of the cumulative fatalities across the BCR that can be attributed to the Project.

We estimate the Project will kill 1,288 birds annually, and all facilities in BCR 22 will kill 65,000–71,000 annually during the Years 1–6, the ITP term (Table 3-4 and Table 3-5). Of these total fatalities, we estimate the Project and other facilities in the region will result in fatalities of the 5 Birds of Conservation Concern (Table 3-6), as has been observed during past post-construction monitoring studies. Based on the estimated large population sizes, and the very small number of fatalities expected, we do not anticipate the level of mortality predicted for wind energy facilities to significantly affect any species

Table 3-7 lists estimates of anthropogenic sources of bird mortality for the U.S. in general. We recognize the national level is not the cumulative effects analysis area selected for birds in this EA. However, similar data scaled to any region of the U.S. are not easily summarized.

Under each of the considered alternatives, we estimate the Project could kill approximately 1,288 birds annually and 7,728 birds over the 6-year Permit term. Also, the Project could kill 38,640 birds over 30 years, which would contribute 1.5% to the total bird mortality from wind development in BCR 22 over the life of the Project (Table 3-4 and Table 3-5). Compared to other sources of avian fatality (listed in Table 3-7), the effect of wind energy on birds in Region 3 is minor. Likely affected species will be those detected during pre-construction surveys and are common in the Permit Area. This mortality is expected to occur under any of the three alternatives and would occur regardless of the federal action.

Table 3-7. Estimated annual avian mortality from anthropogenic causes in the U.S.

Mortality source	Estimated annual mortality	% of overall mortality
Depredation by domestic cats	1.4–3.7 billion	71-75
Collisions with buildings (including windows)	97-1,200 million	5-23
Collisions with power lines	130-174 million	3-7
Legal harvest	120 million	6
Automobiles	50-100 million	2-3
Pesticides	67-72 million	4
Communication towers	4-50 million	<1
Oil pits	1.5-2 million	<1
Wind turbines	20,000-440,000	<1
Total mortality	1.9-5.2 billion	

Sources: USFWS (2002), Erickson et al. (2005), Thogmartin et al. (2006), Dauphiné and Cooper (2009), Manville (2009), Loss et al. (2013).

3.3.2.3 Summary of Environmental Consequences to Avian Resources

Wind energy is one of many potential sources of direct mortality of birds (Table 3-7) but accounts for less than 1% of the overall estimated annual avian fatality documented in the United States. None of the Covered Activities under any of the alternatives are expected to individually adversely impact the population viability of any bird species at a local or regional level or cumulatively. Impacts to birds will be related only to fatality or injury from Project operations, and mortality is assumed to be the same under all alternatives, as cut-in speed adjustments have not been shown affect avian mortality. Some forest bird fatalities resulting from operations may be offset by the mitigation implemented for the Covered Species, as birds may receive the habitat enhancement and protection benefits inherently associated with the bat habitat protection mitigation proposed under the action alternatives. In sum, the federal action is not expected to change existing mortality rates of avian resources, but this analysis has been presented because of comments the Service has received on other similar actions.

The Applicant will address potential effects to bald eagles and golden eagles in a separate Eagle Conservation Plan (ECP) associated with a separate Eagle Permit (permit application dated August 10, 2020). A bald eagle was found during planned turbine searches on April 3, 2021 and reported to the Service's Migratory Bird Program and Office of Law Enforcement, and MDC. The Service will process the Applicant's ECP and BGEPA permit application according to all BGEPA and NEPA regulations and make a permit decision accordingly. Previous BGEPA actions have included conservation measures that minimize risk to eagles, and these modifications typically occur during daylight hours, at specific periods during the year. There is currently no evidence that suggests varying turbine cut-in speeds at night affects eagles, and therefore we do not anticipate any impacts to eagles to differ among the alternatives analyzed in this EA.

3.4 Bat Resources

This section first describes bat resources in general then discusses the existing conditions for bats within the Permit Area. For the purpose of this EA, Covered Species and all bats are addressed together in this section. In Section 3.4.1.2, we provide additional information specific to each of the Covered Species.

3.4.1 Affected Environment

3.4.1.1 All Bats

Fourteen bat species have potential to occur in Missouri (MDC 2018a), nine of which could occur in Adair and Schuyler counties (BCI 2019; Table 3-8) based on their normal ranges (IUCN 2018). Of these species, the Indiana bat is federally and state-listed as endangered, and the northern long-eared bat is federally listed as threatened and a state endangered species. The Service is also reviewing the status of the little brown bat, tri-colored bat to determine if threats to the species may be increasing its risk of extinction. Listing considerations and status reviews for both the northern long-eared bat and little brown bat have largely focused on impacts from white-nose syndrome (WNS), a fungal disease affecting cave-hibernating bats (discussed in more detail in Section 3.4.2.3).

Table 3-8. Bat species and their potential to occur in the Permit Area

Species	Status[1]	Dates and Mist-net Captures [2]	
Indiana bat *Myotis sodalis*	Federal and state endangered	May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	37 23 60
Northern long-eared bat *Myotis septentrionalis*	Federal threatened; state endangered	May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	8 1 0
Little brown bat *Myotis lucifugus*	State species of conservation concern	May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	14 7 2
Silver-haired bat *Lasionycteris noctivagans*	State species of conservation concern	May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	0 4 1
Tri-colored bat *Perimyotis subflavus*	State species of conservation concern	May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	0 0 0
Big brown bat *Eptesicus fuscus*		May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	46 151 144
Eastern red bat *Lasiurus borealis*		May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	45 116 73

Species	Status[1]	Dates and Mist-net Captures [2]	
Hoary bat *Lasiurus cinereus*		May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	3 5 4
Evening bat *Nycticeius humeralis*		May 9–Jul 29, 2011 Jul 21–Aug 5, 2016 Jun 18–Aug 5, 2018	18 124 104

[1] Per Missouri's Wildlife Code (3 CSR 10-4.111), federal ESA, Missouri Species and Communities of Conservation Concern Checklist (MDC 2019)

[2] Sources: Robbins et al. (2012), Stantec (2016, 2018a)

Based on acoustic data from surveys, all nine species shown in Table 3-8 could occur in the Permit Area during the bat-active season. Based on the results of mist-net surveys, hoary bats (*Lasiurus cinereus*) and silver-haired bats (*Lasionycteris noctivagans*) are uncommon during the summer maternity season. Bat species likely to occur in the Permit Area forage in a variety of habitats and include species adapted to foraging in cluttered and open habitats. Foraging habitat preference varies among species, likely driven by distribution and abundance of suitable insect prey and morphology of each bat species.

Bats roost in a variety of habitats, including tree crevices or cavities, underneath loose tree bark, and in buildings or other structures. Reproductive females of *Myotis* species, tri-colored bat, and evening bat typically form maternity colonies of several individuals in suitable roosts, occasionally switching among various roosts. Males and non-reproductive females of these species are typically solitary during the spring and summer but will also roost in trees, buildings, or other suitable structures (England et al. 2001). Regional information is limited on seasonal habitat and distribution of migratory tree bats, i.e., hoary bats, eastern red bats (*Lasiurus borealis*), and silver-haired bats.

Bats listed in Table 3-8 include both short-distance migrants that hibernate colonially (typically in caves or mines) and long-distance migrants that migrate out of the region in winter and are thought to hibernate primarily in trees. Bats of all species are typically absent from the northern Missouri landscape from November through March and either emerge from hibernacula or migrate through the region in spring (late-March–May).

Information is limited on the migratory behavior and ecology of bats. Cave-hibernating bats disperse up to several hundred miles from hibernacula during summer (Fenton 1969, Humphrey and Cope 1976, Kurta and Murray 2002, Norquay et al. 2013), with females often dispersing further from hibernacula than males (Fleming and Eby 2003). Seasonal timing and species composition of bat mortality at wind energy facilities indicate bats are at increased risk of collision during migration, particularly during fall migration. This increased risk of mortality may be related to an attraction to tall structures, mating or courtship behavior, increased flight height, or failure to detect turbines during migratory flight (Kunz et al. 2007*a*, *b*, Cryan 2008).

3.4.1.2 Rare, Threatened, and Endangered Bats

This section focuses on the Covered Species, including federally listed Indiana bat and northern long-eared bat, and little brown bat. Indiana bats and northern long-eared bats are state-endangered in Missouri, and the little brown bat is a species of special concern. Section 4.0 of the HCP provides in-depth accounts of each of the Covered Species. Table 3-9 summarizes Covered Species status, biology, behavior, and habitat requirements relevant to this EA and its analysis. For a more detailed description of these species, please refer to the additional references noted.

Table 3-9. Covered Species' status, biology, behavior, and habitat requirements

	Indiana bat	References
Status	• Originally listed as in danger of extinction March 11, 1967 (32 FR 4001). State endangered per Missouri's Wildlife Code (3 CSR 10-4.111) • The 2019 OCRU population is estimated to be 276,317; winter counts at Sodalis Nature Preserve totaled 180,801 during 2018/19 surveys • WNS is a primary threat to the species' continued existence. However, Missouri population estimates do not demonstrate a decline	HCP Section 4.1, USFWS (1967, 2007) MDC (2018b) USFWS (2019) Section 3.4.2.3 for a description of WNSs
Hibernation	• No hibernacula are known to occur within the Permit Area or counties • Sodalis Nature Preserve is >65 miles away; contains the largest known Indiana bat hibernaculum with 180,081 individuals (60% ORCU, 34% total population) • Band return data indicate bats hibernating in Sodalis Nature Preserve move across the landscape and disperse in all directions; to the north, northwest, and west; and to a lesser extent northeast, east, and south	
Seasonal migration	• Maternity colonies tend to disband beginning in the first 2 weeks of August, with most bats leaving summer ranges by mid-September • Highly mobile during fall, eventually congregating near hibernacula August–October and swarming on a nightly basis for several weeks • Migrating bats generally follow a straight-line migration path but do not fly in rain or when temperatures are <48.2ºF in spring and fall	Humphrey et al. (1977), Kurta et al. (1993) Cope and Humphrey (1977), USFWS (2007) Roby and Gumbert (2016)
Summer roosting	• Roosts primarily in trees in summer, usually under exfoliating bark and occasionally in narrow crevices or cracks in trees located in semi-open areas of forest with sufficient solar exposure • The Applicant found 7 maternity groups in the Permit Area, and estimates 8 maternity colonies are present; summer population of 1,185 individuals (480 females, 426 males, 279 pups)	USFWS (2007) HCP Section 4.1.9
Foraging	• Nocturnal insectivore, feeds exclusively on flying insects. Typically forage 6–100 feet above ground; hunts primarily around, not within, tree canopy	USFWS 2007
	Northern long-eared bat	**References**
Status	• Proposed for listing as endangered on October 2, 2013, listed as threatened on April 2, 2015. WNS is the primary threat to the species' continued existence. Region 3 population estimated to be 2.8 million • WNS is the primary threat to the species' continued existence • Tends to occur in small numbers in numerous hibernacula across range. Difficult to find in caves and rarely found in large numbers • Hibernacula counts are inadequate; hence Service estimates populations using a combination of occupancy rate and hibernacula counts • Based on occupancy rate, estimated pre-WNS population in Missouri is 428,922 individuals • Based on post-WNS occupancy rate, estimated current population in Missouri is 140,664 individuals (67% decline from pre-WNS estimate) • Hibernacula counts since the 2010/2011 winter showed a 99% decline in Missouri	HCP Section 4.2, USFWS (2015, 2016*a*, *b*) Griffin (1940), Barbour and Davis (1969), Caire et al. (1979), Amelon and Burhans (2006), ASRD and ACA (2009) Appendix F
Seasonal migration	• Occupies summer range April–September; swarms near hibernacula in August or September • Shares hibernacula with other bat species; individuals may rouse and switch hibernacula throughout the winter	Griffin (1940), Caire et al. (1979), Fitch and Shump (1979), Whitaker and Rissler (1992), Caceres and Barclay (2000), USFWS (2015)

	Northern long-eared bat (cont.)	References
Summer roosting	• Inhabits forests; roosts singly or in colonies in cracks, crevices, and bark of both live and dead trees • May roost in structures, such as buildings, barns, sheds, and cabins • The Applicant has not found a roost tree in the Permit Area, but estimates 12 maternity colonies; summer population of 615 individuals (240 females, 240 males, 135 pups)	Lacki and Schwierjohann (2001) Foster and Kurta (1999), Perry and Thill (2007) HCP Section 4.2.8
Foraging	• Forages on a variety of insects, such as moths, beetles, and spiders • Shows preference for forested hillsides and ridges versus riparian areas	Foster and Kurta (1999), Brack and Whitaker (2001), Owen et al. (2003), Feldhamer et al. (2009), Jung (2009)
	Little brown bat	**References**
Status	• Not afforded protection under the federal ESA or Missouri's Wildlife Code; Species of Conservation Concern in Missouri; Service is currently evaluating if ESA-listing is warranted during a discretionary status review • WNS is the primary threat to the species continued existence • Hibernacula counts in Missouri since the 2012-2013 winter show an 84% decline since the onset of WNS; occur throughout Missouri in summer, but no longer common anywhere • Based on Missouri post-WNS occupancy rates, estimated current population in Missouri is 147,306 individuals, and 863,823 individuals in Region 3	Section 4.3 of the HCP MDC (2019) Colatskie (2017), MDC (2018c) Appendix F
Seasonal migration	• In fall, migrates to caves / mines with constant temperatures to hibernate; in spring, migrates both short and long distances to summer habitats • Migration distances of up to 282 miles have been documented	Barbour and Davis (1969) USFWS (2016c)
Summer roosting	• In 2016, individuals tagged and tracked successfully to 10 roosts in Permit Area, average emergence count of 10.8 bats per night • Applicant found 1 maternity colony in the Permit Area, estimates 4 maternity colonies are present resulting in a summer population of 580 individuals (200 females, 240 males, and 180 pups)	Stantec (2016) HCP Section 4.3.8
Foraging	• Forages on aquatic or soft-bodied insects, such as wasps, moths, mosquitoes, gnats, and crane flies • Forages singly on habitat early evening and in hunting groups above open water in late evening • Forages for flying insects above wetlands, waterways, and between open areas and denser cover	Barbour and Davis (1969) Fenton and Barclay (1980)

3.4.1.3 Pre-construction Surveys and Bat Habitat Assessment

Data presented in this EA are summarized from the HCP and pre-construction surveys (Table 3-10). Pre-construction surveys in the Permit Area focused on identifying suitable habitat, establishing species composition, determining when and how habitat is used by bats, and identifying and locating maternity colonies.

Table 3-10. Summary of pre-construction bat surveys.

Survey	Summary	References
Bat habitat assessment	• Desktop review of recent aerial photography and Geographic Information Systems data • 23,893 acres suitable habitat for Indiana bat and northern long-eared bat (21.0% of Permit Area) • 113,873.2 acres suitable habitat little brown bat (100% of Permit Area)	HCP Section 3.4.2.1 and Figure 4; Stantec (2018a)
Acoustic (2010-2011)	• Conducted on 4,500 acres in Schuyler County in 2010 and 2011; detectors paired with mist-netting and deployed on ground and MET tower • Nine bat species detected including Covered Species • On average (over all detectors and years) silver haired bats were majority of recorded passes (22.25%) followed by eastern red bat (18.4%),and big brown bat (15%)	Robbins et al. (2010, 2012a,b) HCP Section 3.4.2.5
Acoustic (2016, 2018)	• Ground detectors sampled summer maternity season in Permit Area • Nine bat species detected including Covered Species • On average big brown bats were majority of recorded passes (23.2%), followed by eastern red bats (18.3%) and hoary bats (13.2%)	HCP Section 3.4.2.2 and Table 3-3; Stantec (2016, 2018a)
MET tower acoustic (2018)	• Detectors deployed on 5 MET towers in Permit Area April 26–November 7, 2018 • Nine bat species detected including the Covered Species • Species percentages: hoary bat 30.9%, big brown bat 21.0%, and eastern red bat 16.6% • Bat activity consistently higher at ground-based detectors compared to MET tower detectors	HCP Section 3.4.2.3 and Table 3-4
Mist-net and telemetry (2010-2011)	• Conducted on 4% of the Permit Area to locate and study maternity colonies • Three Indiana bat colonies; colony sizes of 180, 132, and 69 bats • Three little brown bat colonies; colony sizes of 950 (including big brown bats), 183, and 80 bats • One northern long-eared bat colony with 10 bats	Robbins et al. (2012) HCP Section 3.4.2.5
Mist-net and telemetry (2016 and 2018)	• Conducted to locate and study on-site maternity colonies • In 2016, found 13 Indiana bat roosts and 10 little brown bat roosts, highest emergence from a roost was 147 bats • In 2018, found 12 Indiana bat roosts; highest roost emergence was 48 bats	HCP Section 3.4.2.4 and Table 4-2; Stantec (2016, 2018a)

3.4.2 Environmental Consequences

The Federal Action has the potential to impact nine bat species and we assess these impacts below. For Covered Species, we analyzed potential impacts to the state-wide northern long-eared bat and little brown bat populations, and the Indiana bat hibernaculum population for each action alternative. For the proposed action, we also evaluated potential impacts to maternity colonies considering the proposed maternity colony adaptive management strategy (2.2.2.2). For all other bat species, we evaluated the differences in fatalities among all action alternatives and consider population impacts in light of available literature.

3.4.2.1 Direct and Indirect Effects

3.4.2.1.1 Disturbance/Displacement

Limited information is available regarding the disturbance/displacement of bats at wind energy facilities (Kunz et al. 2007a). Based on the number and frequency of documented deaths of bat species observed at wind energy facilities throughout North America, there appears to be little to no avoidance of wind energy facilities by bats. Some research suggests migratory tree bats (hoary bats, eastern red bats, and silver-haired bats) may be attracted to wind turbines due to migratory and mating behavior patterns (Kunz et al. 2007b, Cryan 2008). At dawn, these tree bats may mistake wind turbines for roost trees, thereby increasing the risk of fatality (Kunz et al. 2007b). Cryan (2008) suggested that male tree bats may be attracted to wind turbines by mistaking them as tall trees used as communal breeding sites. Due to the lack of avoidance, bats are not expected to be disturbed/displaced from the Permit Area due to Project operations.

3.4.2.1.2 Turbine-Related Fatality

Researchers have hypothesized and tested various elements potentially connected to bat-turbine interactions. These elements include the role of land cover and environmental conditions in attracting bats to turbine sites, behavioral factors that might make turbines attractive to bats, pressure changes from rotating blades causing "barotrauma," or collision of unsuspecting bats (Johnson et al. 2004, Kerns et al. 2005, reviewed in Kunz et al. 2007b, Baerwald et al. 2008, Horn et al. 2008). Whether bats are attracted to turbines and the exact mechanisms by which turbines cause fatalities are still unclear (reviewed in Kunz et al. 2007b).

Migratory tree bat species (i.e., hoary bat, eastern red bat, and silver-haired bat) are most affected by wind energy facilities (see Table D-1 in Appendix D) and mostly emit low-frequency calls (Johnson et al. 2004; reviewed by Kunz et al. 2007b). Bats that use low-frequency calls may be more inclined to forage above the forest canopy where there are few obstructions. Thus, tree bats may be more likely to fly in the rotor-swept zone of turbines when compared to smaller bat species that have different foraging and migration strategies. Arnett et al. (2008) compiled data from 21 studies at 19 wind energy facilities in the U.S. and Canada and found bat fatalities reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, hoary bat, eastern red bat, and silver-haired bat have contributed nearly 75% of the total documented fatalities at wind energy facilities (Kunz 2007a). Other studies found higher percentages (Table D-1 in Appendix D). Studies at several wind energy facilities have demonstrated that curtailment (i.e., adjusting the cut-in speed at which turbines begin generating power and/or feathering turbine blades to prevent freewheeling below cut-in speed) significantly influences bat mortality (Fiedler 2004, Kerns et al. 2005, Arnett et al. 2008, Baerwald et al. 2008, Good et al. 2011, 2012). Therefore, it is expected that bat species mortality at the Project would vary depending on the alternative implemented.

Several recent genetic analyses of two migratory tree bats (eastern red bat and hoary bat) killed at wind energy facilities in Texas, Ohio, and Minnesota suggest individuals of each species are from a single range-wide panmictic population (i.e., mating is random with equal probability regardless of geographical location or genotype) (Korstian et al. 2015, Vonhof and Russell 2015, Sovic et al. 2016). Korstian et al. (2015) found no recent evidence of population declines in either species, and both species exhibit high-levels of gene flow, connectivity, and effective population sizes (varies across species, but consistently large on the order of 10^5–10^6; Sovic et al. 2016).[12]

Seasonal timing of bat mortality has been consistent among wind energy facilities, with most mortality occurring during the presumed fall migratory period between mid-August and mid-October (Arnett and Baerwald 2013). At the Fowler Ridge Wind Farm, 90% of estimated bat mortality occurred between August 1 and October 15 (Good et al. 2012). Typically, post-construction monitoring data do not show a comparable spring peak in collision mortality despite that bats also migrate during spring. Although reasons for this remain unclear, factors may include differing flight height during spring and fall migration, different spring and fall migration routes, or mating behavior and courtship flight during fall migration (Cryan 2008, Cryan and Barclay 2009).

[12] Effective population differs from actual or census population and is used to assess the genetic health of populations and their capacity to respond to environmental and/or anthropogenic changes through selection (Vonhof and Russell 2015).

Since 2009, post-construction studies have documented 14 Indiana bat fatalities, 48 northern long-eared bat fatalities, and 1,148 little brown bat fatalities. Infrequent mortalities of protected bat species support the use of increase cut-in speeds as an effective minimization measure to reduce risk to these species at wind energy Facilities. Little brown bat morality remains high for facilities not adopting increased cut-in speeds. (Tables in Appendix D list available details on Indiana bat and northern long-eared bat fatality records.)

Both this EA and the HCP use an all-bat fatality rate to estimate overall bat and Covered Species fatalities. The Service compiled a database of bat mortality from wind energy facilities in the Midwest and eastern U.S. We used several criteria for selecting the studies and applied corrections to address differences in search area and study period. For Region 3, we used fatality rates from 89 studies to derive an all-bat fatality rate of 15.34 bats per MW (10.37–20.31 95% confidence interval). Upon this newer analysis, both the Service and the Applicant conservatively used the upper 95% confidence interval of 20.31 bats per MW or 46.42 bats per turbine.[13] Given the 400 MW (175 turbines) of the Project, it is estimated that approximately 8,124 bats would be killed each year at the Project prior to any minimization.

To estimate seasonal bat mortality across the three alternatives, we used the all-bat fatality rate 20.31 bats per MW per absent any operational adjustments, feathering or curtailment. Table 3-11 summarizes the estimated impacts to bats for each alternative. Estimated mortality for the Covered Species and all bats are based on our derived all-bat fatality rate and assumed fatality reductions, which are based on the results of published post-construction monitoring studies that examined fatality rates from implementation of one or more cut-in speeds that were greater than the turbines' rated cut-in speed. These studies' results are summarized in Table 7.1 of the HCP. Details on impact analysis by alternative are provided in the following sections. Note estimates for all bats include Project-related mortality alone, while our subsequent population analyses of the impact of the take also includes lost reproductive potential into the future.

Table 3-11. Comparison of direct effects to bats for each alternative

Alternatives	Indiana Bat	Northern Long-eared Bat	Little Brown Bat	All Bats
Alternative 1: No-Action (6.9 m/s - take avoidance)	No mortality	No mortality	No mortality	1,544 annually [1] 9,261 for permit term 37,056 for years 7-30
Alternative 2: Applicant's HCP (5.0 m/s)	12 annually 72 for permit term	3 annually 18 for permit term	16 annually 96 for permit term	3,087 annually [1] 18,523 for permit term 37,056 for years 7-30
Alternative 3: More Restrictive (6.5 m/s)	7.44 annually 44.64 for permit term	1.68 annually 10.08 for permit term	10.08 annually 60.48 for permit term	1,948 annually [1] 11,699 for permit term 37,056 for years 7-30

[1] Calculated using a fatality rate of 20.31 bats per MW followed by application of the assumed fatality percentage of the all-bat fatality rate: 19% for the No-Action Alternative, 38% for Alternative 2, 24% for Alternative 3. Percentages are based on findings from curtailment studies that included turbines operating at 6.9 m/s, 5.0 m/s, and 6.5 m/s cut-in speeds (Arnett et al. 2011, Good et al. 2011, Young et al. 2013, Hein et al. 2013, 2014; Tidhar et al. 2013).
Note: Values derived using a spreadsheet. Direct calculations using values shown in table will vary slightly due to rounding.

Alternative 1: No-Action Alternative

The Service concludes that feathering turbines at the Project when wind speeds are less than 6.9 m/s is unlikely to pose a risk of collision mortality for *Myotis* (USFWS 2012a). Therefore, there would be no mortality of Covered Species under Alternative 1, and no mitigation would be required. Although there would be no mortality from the Project under the No-Action Alternative, Covered Species populations will continue to be influenced by the impacts of WNS. The baseline condition of Covered Species populations is modeled as part of the analysis in Section

[13] While species composition and seasonal timing of bat mortality have been consistent across wind energy facilities, magnitude of bat mortality, usually expressed as the estimated number of bats killed per MW or per turbine, has varied among facilities and across regions. Estimated bat fatality rates have been lower at wind energy facilities in agricultural landscapes of the Midwest versus those on forested ridges in the Appalachians.

3.4.2.1.2, Subsection “Alternative 2 Covered Species Mortality” and used as comparison to the result of action alternatives (i.e., as a percent change).

Although we estimate no mortality of Covered Species, collisions would still occur among the larger, strong-flying bats, e.g., the migratory tree bats and big brown bats (Arcadis 2013, Tidhar et al. 2013, Stantec 2014a, b). This operating regime would yield a fatality rate of 3.86 bats per MW (19% of the all-bat fatality rate; 20.31 bats per MW). Approximately 9,261 bat fatalities are expected over the 6-year permit term, and an additional 37,056 bat fatalities over the remaining life of the Project (i.e., Project years 7 through 30).

As explained at the beginning of this section, migratory tree bats make up most of the mortality associated with the operation of wind turbines. Recent research suggests that migratory tree bats exist as a single range-wide panmictic population and have not yet started to show genetic evidence of population declines (Korstian et al. 2015, Vonhof and Russell 2015, Sovic et al. 2016) despite impacts from wind energy facilities. Given the results of these studies, we do not expect that migratory tree bat fatality under this alternative will have species-level impacts under the No-Action Alternative.

Alternative 2: 5.0 m/s (Proposed Alternative)

All Bat Mortality

Feathering turbines blades below a cut-in speed of 5.0 m/s during the bat-active season is estimated to result in a bat fatality rate of 7.72 bats per MW (38% of the baseline all-bat fatality rate). Under this alternative, take of all bats would be approximately 3,087 bats annually and 18,523 bats over the 6-year permit term, and an additional 37,056 bats over the remaining life of the Project (Table 3-11). Alternative 2 is estimated to result in twice the number of bat fatalities estimated for the No-Action Alternative.

As explained at the beginning of this section, migratory tree bats make up most of the mortality associated with the operation of wind turbines. Recent research suggests that migratory tree bats exist as a single range-wide panmictic population and have not yet started to show genetic evidence of population declines (Korstian et al. 2015, Vonhof and Russell 2015, Sovic et al. 2016) despite impacts from wind energy facilities. Given the results of these studies, we do not expect that migratory tree bat fatality under this alternative will have species-level impacts.

Under Alternative 2, the Applicant will carry out mitigation measures to compensate for the impact of taking Covered Species by protecting forested habitat through the Chariton Hills Conservation Bank. Although the mitigation is designed specifically to fully offset impacts to Covered Species, the protection of this forested habitat will benefit all bat species by increasing the amount of protected roosting and foraging habitat.

Covered Species Mortality

The expected impacts to maternity colonies are modeled in the HCP using a Leslie Matrix (HCP Appendix A). The HCP projections were used to develop the maternity colony adaptive management strategy, which minimizes impacts such that Covered Species populations decline by no more than 30% when compared to the modeled population with no impacts of wind (HCP Appendix B).

Rather than duplicating the HCP Leslie Matrix analyses, we evaluated the potential impacts of the Project to Covered Species’ populations, cumulatively with the impacts of WNS, using the Bat Tool (Erickson et al. 2014b). Unlike the Leslie Matrix, the Bat Tool incorporates environmental and demographic stochasticity, and summarizes results for many (i.e., 10,000) iterations and out to 50 years. The timeframe and modeled iterations capture the effects of the randomized population viability metrics. The Bat Tool also uses the Thogmartin et al. (2013, 2015) population model in R, which forecasts the stage-based population dynamics of *Myotis,* subject to WNS, whereas the Leslie Matrix projections use constant population vital rates informed by Thogmartin et al. (2013, 2015). We first analyzed the impact of these fatalities to maternity colonies while considering the sideboards of the proposed adaptive management strategy for the maternity colony, as well as the adaptive management triggers associated with annual take rates and cumulative take (Section 2.2.2.2.2). Regarding maternity colonies, we modeled an *expected* and *highest impact scenario.* The *highest impact scenario* is specific to Alternative 2, because the proposed maternity colony adaptive management strategy defines thresholds where, if realized, all impacts cease.

Under the *expected scenario*, we assume all of the summer impacts and half of the impacts to bats during migrating months impact maternity colonies onsite, and the remaining impacts are dispersed among many populations located outside of the Permit Area. This assumption is supported by the results of research and wind energy facilities, which indicate most take occurs while bats are migrating, particularly in the fall (USFWS 2016a). This assumption is also conservative with respect to the species because it is likely mortality during migrating months are dispersed over many offsite populations, and any error results in an assumption of greater impacts modeled to the onsite populations than what is likely in reality.

Under the *highest impact scenario* we calculated the highest amount of take, in the shortest amount of time, a single colony could experience before an adaptive management threshold would cause all turbines to cease impacts on bats (i.e., maternity colony threshold, annual take rate threshold, cumulative take threshold). The resulting calculated impact was modeled at the maternity colony population level. Although this scenario is useful for comparison purposes, it is highly unlikely that this scenario would be realized because it would require an amount and rate of take that has never been observed at a permitted wind Project in Region 3.

We also modeled the impact of the take to the next population level beyond the onsite maternity colony populations (i.e., hibernaculum, and state-level) to understand the implications of the overall take to affected populations beyond the Permit Area.

Below we present the results of the Bat Tool Analyses, which include the probability of extinction in 50 years (the probability that a simulated population [i.e., a single maternity colony population, or hibernaculum, etc.] is lost within 50 years), and the percent change from the No-Action Alternative, for each modeled scenario. Percent change from the No Action Alternative is an important metric because the impacts of WNS are an important population driver regardless of the alternative, No-Action Alternative or either of the action alternatives.

<u>Proposed Indiana Bat Take Limit and Impact of the Taking</u>

Table 3-11 provides fatality estimates for Indiana bat under each of the three alternatives. Project operation is the only activity expected to result in Indiana bat take (mortality is not expected to occur during maintenance, decommissioning, or mitigation activities). As explained in HCP Section 6.2.6, this operating regime would yield an annual fatality rate of 12 Indiana bats a year and 72 Indiana bats over the 6-year permit term.

As a result of our analyses, the probability of extinction of a single Indiana bat maternity colony ranges from 0.81–0.84 (expected and highest impact scenarios, respectively) at year 50. This is a 4.6–8.8% increase from the No-Action Alternative, where no impacts from Project operations would be expected.

In addition, we modeled the impact of the take to the hibernaculum population (Sodalis Nature Preserve, where Indiana bats onsite have been demonstrated to hibernate). Inputs include the female population size and structure as detected from bi-annual counts (90,400.52 females). The probability of extinction of the hibernaculum population is ≤0.001 throughout the life of the Project.

The highest impact scenario is extremely unlikely because it would require all adaptive management thresholds to be reached within the 6-year permit term, and that would require a level of take has not been observed at any permitted wind Project throughout the Service's Midwest Region. Even if the worst-case scenario is realized, it would only result in the loss of a single colony; adaptive management triggers ensure no more than a single colony can experience the highest estimated impact. Our analyses demonstrate that even under the highest impact scenario, impact at the larger population level (i.e., hibernaculum population) would be undetectable (≤0.001 difference from No-Action Alternative throughout life of Project). Therefore, the impact of the proposed take for Indiana bats is not likely to meaningfully reduce the population, and there is not a meaningful difference when compared to the No-Action Alternative).

Our analyses do not incorporate the fact that the impacts of the taking would be more than fully offset using a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. However, the impact of the taking would be more than offset by the Applicant, and therefore no net loss to the species is expected.

<u>Proposed Northern Long-eared Bat Take Limit and Impact of the Taking</u>

Table 3-11 provides fatality estimates for northern long-eared bat under each of the three alternatives. Project operation is the only activity expected to result in northern long-eared bat take (mortality is not expected to occur during maintenance, decommissioning, or mitigation activities).

As a result of our analyses, the probability of extinction of a single northern long-eared bat maternity colony is 0.82–0.83 (expected and highest impact scenarios, respectively) at year 50. This is a 1.1–2.2% increase from the No-Action Alternative, where no impacts from Project operations would be expected.

In addition, we modeled the impact of the take to the estimated Missouri population. Inputs include the female population size and structure as estimated in Appendix F. The probability of extinction of the Missouri population is ≤0.001 throughout the life of the Project.

The highest impact scenario is extremely unlikely because it would require all adaptive management thresholds to be reached within the 6-year permit term, and that would require a level of take has not been observed at any permitted wind Project throughout the Service's Midwest Region. Even if the worst-case scenario is realized, it would only result in the loss of a single colony; adaptive management triggers ensure no more than a single colony can experience the highest estimated impact. Our analyses demonstrate that even under the worst-case scenario, impact at the larger population level (i.e., Missouri population) would be undetectable (≤0.001 difference from No-Action Alternative throughout life of Project). Therefore, the impact of the proposed take for northern long-eared bats is not likely to meaningfully reduce the population, and there is not a meaningful difference when compared to the No-Action Alternative.

Our analyses do not incorporate the fact that the impacts of the taking would be more than fully offset using a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. However, the impact of the taking would be more than offset by the Applicant, and therefore no net loss to the species is expected.

Proposed Little Brown Bat Take Limit and Impact of the Taking

Table 3-11 provides fatality estimates for little brown bat under each of the three alternatives. Project operation is the only activity expected to result in little brown bat take (mortality is not expected to occur during maintenance, decommissioning, or mitigation activities). Implementing the proposed turbine operations, the Applicant predicts the Project will take 16 little brown bats per year. Hence, the Applicant expects to take 96 little brown bats over the 6-year permit term and the life of the Project.

As a result of our analyses, the probability of extinction of a single little brown bat maternity colony is 0.81–0.86 (expected and highest impact scenarios, respectively) at year 50. This is a 23.1–27.5% increase from the No-Action Alternative, where no impacts from Project operations would be expected.

The highest impact scenario is extremely unlikely because it would require all adaptive management thresholds to be reached within the 6-year permit term, and that would require a level of take has not been observed at any permitted wind Project throughout the Service's Midwest Region. Even if the worst-case scenario is realized, it would only result in the loss of a single colony; adaptive management triggers ensure no more than a single colony can experience the highest estimated impact.

In addition, we modeled the impact of the take to the estimated Missouri population. Inputs include the female population size and structure as estimated in Appendix F. The probability of extinction of the Missouri population is ≤0.001 throughout the life of the Project.

Our analyses do not incorporate the fact that the impacts of the taking would be more than fully offset using a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. However, the impact of the taking would be more than offset by the Applicant, and therefore no net loss to the species is expected.

Alternative 3: 6.5 m/s (More restrictive operations, followed by take avoidance)

All Bats

Feathering turbines blades below a cut-in speed of 6.5 m/s during the bat-active season is estimated to result in a bat fatality rate of 4.87 bats per MW (24% of the baseline all-bat fatality rate). Under this alternative, take of all bats would be 1,948 bats annually and 11,699 bats over the 6-year permit term, and 37,056 additional bats over the remaining life of the Project (Table 3-11). Alternative 3 would result in 26% more bat fatalities than that estimated for the No-Action Alternative.

As explained at the beginning of this section, migratory tree bats make up most of the mortality associated with the operation of wind turbines. Recent research suggests that migratory tree bats exist as a single range-wide panmictic population and have not yet started to show genetic evidence of population declines (Korstian et al. 2015, Vonhof and Russell 2015, Sovic et al. 2016) despite impacts from wind energy facilities. Given the results of these studies, we do not expect that migratory tree bat fatality under this alternative will have species-level impacts.

Under this alternative, the Applicant will carry out mitigation measures to compensate for the impact of taking Covered Species by protecting forested habitat through the Chariton Hills Conservation Bank. Although the mitigation is designed specifically to fully offset impacts to Covered Species, the protection of this forested habitat will benefit all bat species by increasing the diversity and extent of roosting and foraging habitat.

Covered Species

Direct effects to Covered Species under Alternative 3 are summarized in Table 3-11. Feathering turbines blades below a cut-in speed of 6.5 m/s during the bat-active season is estimated to result in annual fatality rates of approximately 7.44 Indiana bats, 1.68 northern long-eared bats, and 10.08 little brown bats.

We analyzed the expected impact of these fatalities to maternity colonies assuming all of the summer impacts and half of the migration period impacts to bats during migrating months impact maternity colonies onsite, and the remaining impacts are dispersed among many populations not located within the Permit Area. This assumption is supported by the results of research and wind energy facilities, which indicate most take occurs while bats are migrating, particularly in the fall (USFWS 2016a). This assumption is also conservative with respect to the species because it is more likely that bats killed in migrating months are from offsite populations, and any error results in an assumption of greater impacts modeled to the onsite populations than what is likely in reality.

We also modeled the impact of the take to the next population level beyond the onsite maternity colony populations (i.e., hibernaculum, and state-level).

Indiana bat

As a result of our analyses, the probability of extinction of a single Indiana bat maternity colony is 0.78 at year 50. This is a 0.98% increase from the No-Action Alternative, where no impacts from Project operations would be expected.

In addition, we modeled the impact of the take to the hibernaculum population (Sodalis Nature Preserve, where Indiana bats onsite have been demonstrated to hibernate). Inputs include the female population size and structure as detected from bi-annual counts (90,400.52 females). The probability of extinction of the hibernaculum population is ≤0.001 throughout the life of the Project for all alternatives.

Our analyses demonstrate that impact to populations outside of the Permit Area (i.e., hibernacula population) would be undetectable (≤0.001 difference from No-Action Alternative throughout the life of Project). Therefore, the impact of take in Alternative 3 is not likely to meaningfully reduce the population, and there is not a meaningful difference when compared to the No-Action Alternative.

Our analyses do not incorporate the fact that the impacts of the taking would be fully mitigated using a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. However, full mitigation of the impact of the taking would be implemented by the Applicant, and therefore no net loss to the species is expected.

Northern long-eared bat

As a result of our analyses, the probability of extinction of a single northern long-eared bat colony is 0.82 at year 50. This is a 1.3% increase from the No-Action Alternative, where no impacts from Project operations would be expected.

In addition, we modeled the impact of the take to the estimated Missouri population. Inputs include the female population size and structure as estimated in Appendix F. The probability of extinction of the Missouri population is ≤0.001 throughout the life of the Project, under any scenario.

Our analyses demonstrate that impact at the larger population level (i.e., Missouri population) would be undetectable (≤0.001 difference from No-Action Alternative throughout life of Project). Therefore, the impact of the proposed take for northern long-eared bats is not likely to meaningfully reduce the population, and there is not a meaningful difference when compared to the No-Action Alternative.

Our analyses do not incorporate the fact that the impacts of the taking would be fully mitigated using a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. However, full mitigation of the impact of the taking would be implemented by the Applicant, and therefore no net loss to the species is expected.

Little brown bat

As a result of our analyses, the probability of extinction of a single little brown bat maternity colony is 0.71% at year 50. This is a 14.0% increase from the No-Action Alternative, where no impacts from Project operations would be expected.

In addition, we modeled the impact of the take to the estimated Missouri population. Inputs include the female population size and structure as estimated in Appendix F. The probability of extinction of the Missouri population is ≤0.001 throughout the life of the Project, under any scenario.

Our analyses do not incorporate the fact that the impacts of the taking would be fully mitigated using a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. However, full mitigation of the impact of the taking would be implemented by the Applicant, and therefore no net loss to the species is expected.

3.4.2.2 Cumulative Effects

Our cumulative effects analysis for bats focuses on mortality attributed to Project operations in the context of other existing and future wind energy facilities in the OCRU for the Indiana bat and Missouri and Region 3 for the northern long-eared bat, little brown bat, and all bats. Although the take from the Project is unlikely to have effects at these spatial scales, the impact of wind is much broader and has implications for the affected species throughout their ranges. These spatial scales allow us to make comparisons on the cumulative impacts of wind to impacted resources in comparable landscapes and are relevant to larger population scales of bat species. The cumulative effects analysis used a 6-year timeframe, the requested duration of the ITP, and a 24-year timeframe[14] (i.e., the estimated remaining life of the Project). The selected spatial and temporal scales provide a reasonable assessment of past, present, and reasonably foreseeable future cumulative effects, including wind energy development, habitat loss, climate change, destruction/disturbance of hibernacula, and the spread of WNS. In this section we also consider the effects of mortality in light of WNS. However, the current and future impacts of WNS were integrated in population analyses presented in Section 3.4.2.1.2., above. We considered the cumulative impacts of WNS and the Project's added turbine-related mortality to populations under each alternative, rather than separately in the sections below, because population models were designed to project the impacts of the disease into the future based on disease spread in the northeast (Thogmartin et al. 2013, 2015).

3.4.2.2.1 Wind Energy Project Mortality

See Section 3.2.1.1 and Table 3-1 for the explanation of installed and projected wind energy development in the OCRU and Region 3. Below we focus on mortality attributable to the Project in the context of other existing and future wind energy facilities in Region 3 and the OCRU for Indiana bat. Bat fatalities within Region 3 and the OCRU are extrapolated for each alternative in Table 3-12, Table 3-13, and Table 3-14.

All Bats

As explained in Section 3.4.2.1.2, most bat mortality at wind energy facilities is attributed to migratory tree bats. Rates of mortality of unlisted bats vary substantially among projects and depend largely on operational decisions and turbine characteristics, both of which are subject to change over time as the wind industry grows and becomes more informed. Applying the baseline all bat fatality rate of 20.31 b/MW/y, to the current installed in Region 3 (26,324 MW) yields a mortality estimate of approximately 534,640 bats per year, of which 85% (454,444) are expected to be migratory tree-roosting bats based on documented bat fatalities at nine wind energy projects in Region 3 (Buffalo Ridge Phases I–III, Johnson et al. 2003; Buffalo Ridge Lake Benton I & II, Johnson et al. 2003; Blue Sky Green Field, Gruver et al. 2009; Kewaunee County, Howe et al. 2002; Cedar Ridge, BHE 2011; Crescent

[14] Regarding cumulative effects in years 7-30 of the project (i.e., after the expiration of the requested 6-year ITP), the Project will operate in accordance with Alternative 1 and avoid take of federally listed bats. Therefore, the Project will not contribute to cumulative effects to Covered Species after the permit term, although we estimate cumulative all-bat mortality in. Mortality of other bat species at the Project is still expected after year 6 of the project, and we consider cumulative effects for other bat species for the remaining life of the Project.

Ridge, Kerlinger et al. 2007; Top of Iowa, Jain 2005; Forward Energy Center, Grodsky and Drake 2011; and Fowler Ridge, Good et al. 2012). Applying this rate to the projected installed capacity of 45,765 MW of wind turbines in year 2050 (life of the Project) indicates annual mortality of approximately 929,487 unlisted bats in Region 3, of which 790,064 are expected to be migratory tree-roosting bats. These rates assume turbines at future installations are freewheeling and not feathered below manufacturer's rated cut-in speeds. This assumption likely overestimates bat fatalities in Region 3 because 1) the Service works with many wind energy facilities across the Midwest to minimize and avoid risks to federally protected and imperiled bat species by recommending curtailment regimes, 2) ongoing research is informing the use of smart curtailment methods which are expected to reduce bat fatalities, and 3) facilities that pose a collision risk to federally protected species are likely to operate under the HCP/ITP regime common for Region 3 wind ITPs. Therefore, for the purpose of this analysis we assume bat fatality rates at projected wind energy facilities will fall within the range associated with AWEA guidelines (feather all turbines below manufacturers' rated cut-in speeds; AWEA 2015) and the rate associated with feathering turbines at wind speeds below 5.0 m/s (i.e., wind speeds at most Region 3 wind energy facilities with ITPs).

Given the curtailment assumptions above, at the end of the proposed permit, the annual cumulative mortality rate in Region 3 would range from 230,249-424,111 bats per year, considering the projected build-out over the next 6 years. At the end of the life of the Project, the annual cumulative mortality rate in Region 3 would range from 353,306-650,778 bats per year, considering the projected build-out over the next 30 years. The cumulative fatality estimated from projected wind energy build-out could have a substantial effect on migratory tree bat species, including potentially substantial declines in populations (Frick et al. 2017). However, other recent research has shown that migratory tree bat populations are large and well-connected and have not yet started to show genetic evidence of population declines (Korstian et al. 2015). It is unknown whether migratory tree bat populations can be sustained under the assumed level of future wind development, and these estimated impacts are anticipated to occur with or without this Project.

The Project would contribute 0.36-0.85% to the projected Region 3 mortality at the end of the permit term, depending on the alternative (Table 3-12). The Project would contribute 0.36–0.80% to the projected Region 3 cumulative mortality at the end of the life of the Project, depending on the operations in the first 6 years of the project life (Table 3-12). Regardless of the alternative, the Project contributes to less than 1% of the projected Region 3 mortality of bat species, this additional impact is unlikely to affect Regional trends in all bat mortality, and there is not a meaningful difference among alternatives in all bat cumulative mortality.

Table 3-12. Estimates for cumulative all bat mortality from the Project and other facilities in Region 3 during permit term and years following permit term for life of Project (assuming no long-term permit)

	Project 400 MW			**Region 3 Buildout 2026: 29,825 MW 2050: 45,765 MW**
All bats Project (20.31 b/MW/y) [1]	**Alt 1 No-Action** (3.86 b/MW/y) [3]	**Alt 2 Applicant's HCP** (7.72 b/MW/y) [3]	**Alt 3 More Restrictive** (4.87 b/MW/y) [3]	**5.0 m/s / Rated Cut-in Speed** [2] (7.72 / 14.22 b/MW/y) [3]
Years 1–6 annual mortality	1,544	3,088	1,948	230,252-424,117
Permit % contribution to regional mortality annually [4]	0.36–67%	0.73–1.3%	0.46–0.85%	--
6-year cumulative mortality	9,261	18,523	11,699	1,321,865–2,434,834
Permit % contribution to regional cumulative mortality annually [4]	0.36–67%	0.73–1.3%	0.46–0.85%	--
Years 7-30 annual mortality [5]	1,544	1,544	1,544	353,305–650,778 [6]
Permit % contribution to regional mortality annually [4]	0.24–0.44%	0.24–0.44%	0.24–0.44%	--
24-year cumulative mortality	37,056	37,056	37,056	6,959,348–12,818,903 [6]
Permit % contribution to cumulative mortality [4]	0.29–0.53%	0.29–0.53%	0.29–0.53%	--

[1] The fatality rate is the baseline for all bats derived from regional post-construction monitoring studies.
[2] Estimation of Region 3 mortality assumes all facilities will operate within the range of two possible scenarios; feathered at 5 m/s and manufacturer's rated cut-in speeds.
[3] Modified fatality rates are based on reductions observed at regional curtailment studies that tested the corresponding cut-in speed.
[4] Percent contributions are based on the range in predicted take at projected wind energy facilities operating within manufacturer's rated to 5.0 m/s cut-in speeds.
[5] Estimated mortality for first 6 years under respective alternative and 24 subsequent years operating in accordance with No-Action Alternative
[6] Mortality estimates in Year 30 (2050); MW are added to the Region 3 landscape at 1.8% annual growth
Note: Mortality = (fatality rate) X (number of MW). Values derived using a spreadsheet. Direct calculations using values shown in table may vary slightly due to rounding.

Covered Species

Cumulative effects for Covered Species are summarized in Table 3-13 and Table 3-14. We estimated the cumulative bat mortality rate across relevant regions for the conservation and recovery of the Covered Species, over the permit term. Unlike our analyses for all bats, we do not analyze cumulative effects to Covered Species over the life of the Project, because we assume the Project will operate in accordance with the no action alternative in years 7-30, as explained in Chapter 2.1, above. As explained above, for the purpose of this analysis we assume bat fatality rates at projected wind energy facilities will fall within the range associated with AWEA guidelines (feather all turbines below manufactures' rated cut-in speeds; AWEA 2015) and the rate associated with feathering turbines at wind speeds below 5.0 m/s (i.e., wind speeds at most Region 3 facilities with ITPs).

Indiana Bat

At the end of the proposed permit, the annual mortality from projected wind energy installations in the OCRU would range from 551–1,015 bats per year (less than 1% of the 2019 OCRU population), considering the projected build-out in year 2026. The Project would contribute up to 2.18% of the projected OCRU mortality annually, depending on the alternative (Table 3-13). Cumulatively over the 6-year permit period, we estimate wind energy facilities would result in 3,166–5,827 fatalities; the Project would contribute up to 2.27% of this cumulative mortality.

The Project's contribution to wind mortality is not expected to change the trend in OCRU wind fatalities because the full impact of the Project's taking will be mitigated by a Service-approved mitigation banking instrument, as explained in Section 7.2.2 of the HCP. Therefore, the Project would have no net impact to the OCRU population. The Service concludes the extent of wind mortality from the Project and cumulatively to the OCRU is not likely to lead to population-level declines of Indiana bats.

Table 3-13. Estimates for cumulative Indiana bat mortality from the Project and other facilities in the OCRU during permit term and years following permit term for life of Project (assuming no long-term permit)

	Project 400 MW			OCRU Buildout 2026: 18,694 MW
Indiana bat (0.0775 b/MW/y) [1]	**Alt 1 No-Action** (0 b/MW/y) [3]	**Alt 2 Applicant's HCP** (0.0295 b/MW/y) [3]	**Alt 3 More Restrictive** (0.0186 b/MW/y) [3]	**5.0 m/s / Rated Cut-in Speed** [2] (0.0295 / 0.0543 b/MW/y) [3]
Years 1–6 annual mortality	0	12	7.44	551–1,015
Permit % contribution to OCRU mortality annually[4]	0	1.18–2.18%	0.71–1.35%	--
6- year cumulative mortality	0	72	44.64	3,166–5,827 [5]
Permit % contribution to OCRU cumulative mortality	0	1.23–2.27%	0.77–1.41%	--

[1] The fatality rate is the baseline for Indiana bats derived in the HCP.
[2] Estimation of OCRU mortality assumes all facilities will operate within the range of two possible scenarios; feathered at 5.0 m/s to manufacturer's rated cut-in speeds.
[3] Modified fatality rates are based on reductions observed at regional curtailment studies that tested the corresponding cut-in speed.
[4] Percent contributions are based on the range in predicted take at projected wind energy facilities operating within manufacturer's rated to 5.0 m/s cut-in speeds.
[5] Mortality estimates in Year 6 (2026); MW are added to the OCRU landscape at 1.8% annual growth
Note: Mortality = (fatality rate) X (number of MW). Values derived using a spreadsheet. Direct calculations using values shown in table may vary slightly due to rounding.

Northern Long-eared Bat

At the end of the proposed permit term, the annual mortality of northern long-eared bats in Region 3 would range from 200–367 bats per year (less than 0.01% of the Region 3 population; USFWS 2016a), considering the projected build-out of wind energy over the next 6 years. The Project would contribute up to 1.50% to the projected Region 3 wind mortality at the end of the permit term, depending on the alternative (Table 3-14). Cumulatively over the 6-year permit period, we estimate wind energy facilities would result in 1,147–2,106 northern long-eared bat fatalities (less than 0.08% of the Region 3 population); the Project would contribute up to 1.57% of this cumulative mortality.

The Project's contribution to wind mortality annually and cumulatively is unlikely to affect the Region 3 population because wind mortality impacts less than 0.01% of the population. This small contribution is unlikely to change the trend in Region 3 wind fatalities, and the full impact of the Project's taking will be mitigated by a Service-approved mitigation banking instrument as explained in Section 7.2.2. Therefore, take from the Project would not result in a net impact to the Region 3 population. The Service concludes the extent of wind mortality from the Project, and cumulatively to Region 3 is not likely to lead to population-level declines of northern long-eared bats.

Little Brown Bat

At the end of the proposed permit, the annual mortality of little brown bats in Region 3 would range from 1,190–2,192bats per year (up to 0.25% of the Region 3 population, Appendix F), considering the projected build-out of wind energy over the next 6 years. The Project would contribute up to 1.34% to the projected Region 3 wind energy mortality annually, depending on the alternative (Table 3-14). Cumulatively over the 6-year permit period, we estimate wind energy facilities would result in 6,832–12,585 little brown bat fatalities (roughly 1.5% of the Region 3 population); the Project would contribute up to 1.41% of this cumulative mortality.

The Project's contribution to wind mortality annually and cumulatively is unlikely to affect the Region 3 trends in little brown bat mortality because the cumulative projected impacts of wind energy are less than 2% of the population. Take at the Project would contribute less than 2% of the projected wind energy fatalities in Region 3, annually and cumulatively. This small contribution is unlikely to change the trend in Region 3 wind energy fatalities, and the full impact of the Project's taking will be mitigated by a Service-approved mitigation banking instrument as explained in Section 7.2.2 of the HCP. Therefore, take from the Project would not result in a net impact to the Region 3 population. The Service concludes the extent of wind mortality from the Project and cumulatively to Region 3 is not likely to lead to population-level declines of little brown bats.

Table 3-14. Estimates for cumulative northern long-eared bat and little brown bat mortality from the Project and other facilities in Missouri during permit term and years following permit term for life of Project (assuming no long-term permit)

	Project 400 MW			**Region 3 Buildout 2026: 29,825 MW**
Northern long-eared bat (0.0175 b/MW/y)[1]	**Alt 1 No-Action** (0 b/MW/y) [3]	**Alt 2 Applicant's HCP** (0.0067 b/MW/y) [3]	**Alt 3 More Restrictive** (0.0042 b/MW/y) [3]	**5.0 m/s / Rated Cut-in Speed** [2] (0.0067 / 0.0123 b/MW/y) [3]
Years 1– 6 annual mortality	0	3	1.68	200–367
Permit % contribution to regional mortality annually[4]	0	0.82–1.50%	0.46–0.84%	--
6-year cumulative mortality	0	18	10.08	1,147–2,106 [5]
Permit % contribution to regional cumulative mortality	0	0.85–1.57%	0.48–0.88%	--
Little brown bat (0.1050 (b/MW/y)[1]	**Alt 1 No-Action** (0 b/MW/y) [3]	**Alt 2 Applicant's HCP** (0.0399 b/MW/y) [3]	**Alt 3 More Restrictive** (0.0252 b/MW/y) [3]	**5.0 m/s / Rated Cut-in Speed** [2] (0.0399 / 0.0735 b/MW/y) [3]
Years 1–6 annual mortality	0	16	10.08	1,190–2,192
Permit % contribution to regional mortality annually[4]	0	0.73–1.34%	0.46–0.85%	--
6-year cumulative mortality	0	96	60.48	6,832–12,585 [5]
Permit % contribution to regional cumulative mortality	0	0.76–1.41%	0.48–0.89%	--

[1] The fatality rate is the baseline for the Covered Species derived in the HCP.
[2] Estimation of Region 3 mortality assumes all facilities will operate within two possible scenarios, feathered at 5.0 m/s and manufacturer's rated cut-in speeds.
[3] Modified fatality rates are based on reductions observed at regional curtailment studies that tested the corresponding cut-in speed.
[4] Range in percent contributions are based on the range in predicted take at projected wind energy facilities operating within manufacturer's rated to 5.0 m/s cut-in speeds.
[5] Mortality estimates in Year 6 (2026); MW are added to the Region 3 landscape at 1.8% annual growth
Note: Mortality = (fatality rate) X (number of MW). Values derived using a spreadsheet. Direct calculations using values shown in table may vary slightly due to rounding.

3.4.2.3 White-nose Syndrome

WNS has emerged as the largest single source of mortality for cave-hibernating bats in recent years. As of March 2020, WNS had been confirmed in 33 states and 7 Canadian provinces and suspected in 5 states (USFWS 2020b). Current estimates of total bat mortality reach 6.7 million bats since discovery of the disease in 2006 (USFWS 2012b). Turner et al. (2011) documented an 88% decline in overall numbers of hibernating bats comparing pre- and post-WNS counts at 42 sites in five northeastern states with declines varying by species. At these sites, northern long-eared bats decreased by 98%, little brown bats by 91%, tri-colored bats by 75%, Indiana bats by 72%, big brown bats by 41%, and eastern small-footed bats by 12% (Turner et al. 2011). *Pseudogymnoascus destructans* has been detected in silver-haired bats, but the diagnostic signs of WNS were not documented (USFWS 2020a).

As of winter 2017, WNS disease has been confirmed in numerous hibernacula in the OCRU. The Service estimated a decline of 8.1% and 10.4% in the number of Indiana bats in the OCRU and Missouri, respectively, between 2017 and 2019 (USFWS 2019). Declines are assumed to be primarily the result of WNS disease. Thogmartin et al.'s (2013, 2015) model of the impacts of WNS on Indiana bat populations suggested that WNS will cause local and regional extirpation of some wintering populations of Indiana bats, and overall population declines exceeding 86%. However, Thogmartin et al. (2012) noted that the causative processes associated with WNS spread and associated impacts are not well understood. WNS may not cause the same consequences on wintering bat populations (e.g., mortality may be less) as the disease moves west and south. Ehlman et al. (2013) suggested that bat populations experiencing shorter southern winters could persist longer than their northern counterparts when faced with WNS.

Bat population declines due to WNS across the region would likely reduce the probability of mortality at wind energy facilities but would also increase the ecological impact of all sources of mortality. Based on proportions of individuals of WNS-affected North American species with relatively high fungal loads but lower infection intensities, Hoyt et al. (2016) predicted that Indiana bats and big brown bats were unlikely to experience WNS-related extinction. In addition, Lilley et al. (2016) found that surviving little brown bats exhibited less frequent arousals than had been documented for bats dying due to WNS, suggesting that survivors may respond to the disease differently. However, northern long-eared bat populations may not have the same ability to stabilize or recover from WNS (Frick et al. 2015).

Research on the effects of WNS continues, and results are being used to inform population models to estimate trends into the future (e.g., Thogmartin et al. 2013, 2015). To evaluate the potential impacts of the Project to onsite maternity colony populations, cumulatively with the impacts of WNS, we used a stochastic, stage-based population model to forecast the population dynamics of each Covered Species. The results of these analyses are provided for each Covered Species above in Section 3.4.2.1.2.

These results indicate the cumulative impacts of WNS and impacts from the evaluated alternatives are unlikely to have significant cumulative impacts to Indiana bat hibernaculum populations, and the Missouri population of northern long-eared bat and little brown bat populations considering that all impact of wind is fully offset through mitigation required by the ITP. The Service worked with the Applicant to develop a study plan (Section 2.2.2.2.1) to further investigate on-site population trends with adjacent populations (i.e., as a control group) to monitor populations affected by WNS with and without the impacts of wind. The results of this research will be relevant to long-term operations of the Project, beyond the proposed 6-year permit term.

3.4.2.4 Habitat Loss and Fragmentation

Cumulative impacts of land use conversion and habitat fragmentation on bats in the Midwest have largely taken place in the past, as agricultural land use has dominated the region for decades and involved millions of acres of tree-removal. Construction of the Project and other facilities will result in minimal additional forest clearing, and some newer facilities may have or will create forested habitat through efforts to mitigate impacts to bats. Therefore, the Project and expansion of wind energy in the region are not expected to contribute to any significant incremental cumulative effects of summer bat habitat loss.

Similarly, winter bat habitat (caves and mines) are relatively static features on the landscape and are not being threatened by specific threats associated with habitat loss. WNS may have impacts on hibernating bat populations but will not alter the physical characteristics of hibernacula.

3.5 NOISE

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that interferes or disrupts normal activities. Although exposure to high noise levels can cause hearing loss, the most common human response to environmental noise is annoyance. Reaction of individuals to similar noise events is diverse and influenced by numerous factors, such as the type of noise, its perceived importance, the time of day during which the noise occurs, its duration, frequency, level, and community attitudes towards the source. In the context of this project, we would consider a significant noise impact to be the generation of noise that is substantially different in type or intensity than the existing noise profile such that injury to humans or wildlife is expected. Noise impacts that violate local regulations or ordinances would also be considered significant.

3.5.1 Affected Environment

The Permit Area is located in a landscape dominated by agricultural activities. The Project turbines are distributed in a loose group over 113,873.2 acres. The terrain is flat with minimal relief. Consequently, the wind turbines are in an exposed setting. Lightly traveled paved and unpaved roads cross the Permit Area. Farmsteads and residences dot the landscape.

Current ambient noise levels in the Permit Area were not measured. However, based on the location and land use, we assume that ambient noise is that of a typical farming landscape in northern Missouri. Sound levels include both steady background and short-term intrusive sounds. Characteristic sound sources in the Permit include farming operations, vehicle road noise, wind moving through vegetation, human voices, dogs barking, bird song, and aircraft flying overhead. Because the Project is already constructed, the operation of the Project's wind turbines is also part of the baseline noise levels in the Permit Area. Sensitive receptors to these sounds include residences in and proximal to the Permit Area.

Adair County does not have an ordinance that defines or restricts noise for rural areas. Similarly, Schuyler County zoning ordinances for wind energy facilities do not have specific guidelines or limits related to noise (Schuyler County 2019).

3.5.2 Environmental Consequences

The scope of our action influences the cut-in speeds in which turbines operate at night during the bat-active season. Noise levels and the rate of occurrence of noise within and surrounding the Project during daylight hours are not influenced by our Federal Action. Nighttime noise levels will not change, but the rate of occurrence of noise associated with operations may differ among the alternatives under consideration. Specifically, the action alternatives may result in the turbines operating more frequently at night than the No-Action alternative. Mitigation activities will not have a significant effect on noise, as mitigation is primarily protection of land, and any noise generated for enhancement activities (e.g., girdling of trees) would be temporary and infrequent. According to the noise studies conducted by the Applicant, the maximum noise level at any residential receptor would be 49 dBA. Otherwise, most residential receptors in the Permit Area would be exposed to 45.5 dBA or less. This noise level is comparable to a typical dishwasher in the next room or a quiet urban area (FAA 2020). Additionally, the U.S. Department of Health and Human Services considers sustained sounds at 85 dBA to be harmful to human hearing (US DHHS 2019). Based on this information, none of the alternatives under consideration will result in significant adverse or beneficial noise impacts within the Permit Area because no alternative will a) change the type or intensity of existing noise in the area, b) cause hearing injury, or c) violate local noise regulations.

CHAPTER 4. CONSULTATION AND COORDINATION

4.1 AGENCY COORDINATION

In support of their application to build a wind energy Project in Adair and Schuyler counties, the Applicant consulted with the Service, MDC, Missouri State Historic Preservation Office (SHPO), and other state and local agencies. The Service has engaged MDC in discussions on possible sites for conducting projects suitable for mitigating the unavoidable impacts of taking Covered Species.

4.2 DISTRIBUTION OF THE DRAFT EA

In accordance with NEPA and USFWS service policy, this Draft EA is being circulated for public review and comment. The public review period is initiated with the publication of the Notice of Availability in the Federal Register, and the public comment period will extend for 30 days from the date of publication.

CHAPTER 5. LIST OF PREPARERS

Table 5-1. Draft EA preparers and their roles and qualifications

Name, Title, and Location	Project Role and Relevant Experience
U.S. Fish and Wildlife Service	
Laurel Hill, Endangered Species Biologist Missouri Ecological Field Office	EA Project Manager; EA Preparation and Review
Amber Schorg, Endangered Species Biologist Illinois-Iowa Ecological Field Office	EA Preparation and Review
Karen Herrington, Field Supervisor Missouri Ecological Services Field Office	EA Review
Scott Blackburn, NEPA Coordinator Midwest Regional Office	EA Review
Stantec Consulting Services Inc.	
Elizabeth Annand, Senior Project Scientist Northampton, MA Office	EA Preparation; Bat Resources MS Wildlife Biology, 22 years preparing NEPA and ESA compliance documents
Sarah Boucher Gravel, Resource Specialist Topsham, ME Office	EA Preparation; Avian Resources MS Ecology, 14 years analyzing Wind/Wildlife interactions
Gino Carpentier, Senior GIS Analyst Topsham, ME Office	EA Graphics Preparation B.S. Geography and Wildlife Management 22 years' experience in graphics and GIS

CHAPTER 6. REFERENCES

Allison, T. D. 2012. Eagles and wind energy: identifying research priorities. A white paper of the American Wind Wildlife Institute, Washington, D.C. May.

Amelon, S., and D. Burhans. 2006. Conservation assessment: *Myotis septentrionalis* (northern long-eared bat) in the eastern United States. Pages 69-82 *in* F.R. Thompson, III, editor. Conservation assessments for five forest bat species in the eastern United States. General Technical Report NC-260, Technical Guide. USDA Forest Service North Central Research Station, Columbia, Missouri.

Arcadis. 2013. Fall 2012 and spring 2013 avian and bat post-construction mortality monitoring report, Pioneer Trail Wind Farm. Arcadis U.S., Inc. Milwaukee, Wisconsin. 14 August.

Arcadis. 2014. Fall 2013 and spring 2014 avian and bat post-construction mortality monitoring report, Pioneer Trail Wind Farm. Arcadis U.S., Inc. Milwaukee, Wisconsin. July.

Arnett, E. B., and E. F. Baerwald. 2013. Impacts of wind energy development on bats: implications for conservation. Pages 435-456 in R. A. Adams and S. C. Pedersen, editors. Bat evolution, ecology, and conservation. Springer, New York, New York.

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fiedler, B. L. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, and R. D. Tankersley, Jr. 2008. Patterns of bat fatalities at wind energy facilities in North America. Journal of Wildlife Management 72:61-78.

Arnett, E. B., M. M. P. Huso, M. R. Schirmacher, and J. P. Hayes. 2011. Altering turbine speed reduces bat mortality at wind-energy facilities. Frontiers in Ecology and the Environment 9: 209-214 doi:10.1890/100103.

Arnold, T. W., and R. M. Zink. 2011. Collision mortality has no discernible effect on population trends in North American birds. PLoS ONE 6(9): e24708. Doi:10.1371/journal.pone.0024708.

ASRD and ACA (Alberta Sustainable Resource Development and Alberta Conservation Association). 2009. Status of the northern Myotis (*Myotis septentrionalis*) in Alberta. Wildlife Status Report No. 3. Alberta Sustainable Resource Development, Edmonton, Alberta, Canada.

AWEA (American Wind Energy Association). 2015. Wind energy industry announces new voluntary practices to reduce overall impacts on bats by 30 percent. American Wind Energy Association press release. 3 September. <https://www.awea.org/resources/news/2017/wind-energy-industry-announces-new-voluntary-pract>. Accessed 2 August 2020.

AWEA. 2020. U.S. wind energy state facts. <https://www.awea.org/resources/fact-sheets/state-facts-sheets>. Accessed 1 March 2020.

AWWI (American Wind Wildlife Institute). 2019. AWWI technical report: a summary of bird fatality data in a nationwide database. American Wind Wildlife Institute, Washington, DC. 25 February. <www.awwi.org>. Accessed 2 January 2020.

Baerwald, E. F., G. H. D'Amours, B. J. Klug, and R. M. R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18: R695-R696.

Baerwald, E. F., J. Edworthy, M. Holder, and R. M. R. Barclay. 2009. A large-scale mitigation experiment to reduce bat fatalities at wind energy facilities. Journal of Wildlife Management 73:1077-1081.

Barbour, R. W., and W. H. Davis, W.H. 1969. Bats of America. University of Kentucky Press, Lexington.

BCI (Bat Conservation International). 2019. Species profiles: Missouri. <http://www.batcon.org/resources/media-education/species-profiles>. Accessed 1 December 2019.

BHE (BHE Environmental, Inc. 2011. Post-construction bird and bat mortality study, Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin, final report. BHE Environmental, Inc., Cincinnati, Ohio. February.

Bird Studies Canada and NABCI. 2014. Bird conservation regions. Published by Bird Studies Canada on behalf of the North American Bird Conservation Initiative. <https://www.birdscanada.org/bird-science/nabci-bird-conservation-regions>. Accessed 22 April 2029.

Brack, V., and J. O. Whitaker. 2001. Foods of the northern myotis, *Myotis septentrionalis*, from Missouri and Indiana, with notes on foraging. Acta Chiropterologica. 3: 203-210.

Brown, K., K. S. Smallwood, J. Szewczak, and B. Karas. 2016. Final report, 2012–2015, avian and bat monitoring project, Vasco Winds, LLC. Prepared for NextEra Energy Resources, Livermore, California.

Caceres, M. C., and R. M. Barclay. 2000. *Myotis septentrionalis*. Mammalian Species No. 634. American Society of Mammalogists, Lawrence, Kansas. 12 May.

Caire, W., R. K. LaVal, and M. L. LaVal, and R. Clawson. 1979. Note on the ecology of *Myotis keenii* in eastern Missouri. American Midland Naturalist 102: 404-407.

CEQ (Council on Environmental Quality). 1997. Considering cumulative effects under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President, Washington, D.C. January.

Chamberlain, D. E., M. R. Rehfisch, A. D. Fox, M. Desholm, and S. J. Anthony. 2006. The effect of avoidance rates on bird mortality predictions made by wind turbine collision risk models. Ibis 148: 198-202.

Colatskie, S. 2017. Missouri bat hibernacula survey results from 2011–2017, following white-nose syndrome arrival. Technical brief. Missouri Department of Conservation.

Cope, J. B., and S. R. Humphrey. 1977. Spring and autumn swarming behavior in the Indiana bat, *Myotis sodalis*. Journal of Mammalogy 58: 93-95.

Cryan, P. M. 2008. Mating behavior as a possible cause of bat fatalities at wind turbines. Journal of Wildlife Management 72: 845-849.

Cryan, P. M., and R. M. R. Barclay. 2009. Causes of bat fatalities at wind turbines: hypotheses and predictions. Journal of Mammalogy 90: 1330-1340.

Dalthorp, D., M. Huso, and D. Dail. 2017. Evidence of absence (v2.0) software and user guide. U.S. Geological Survey data series 1055. <https://pubs.er.usgs.gov/publication/ds1055>. Accessed 23 November 2020.

Dauphiné, N., and R. J. Cooper. 2009. Impacts of free-ranging domestic cats (*Felis catus*) on birds in the United States: a review of recent research with conservation and management recommendations. Pages 205-219 in Proceedings of the Fourth International Partners in Flight Conference, 13-16 February 2008, McAllen, Texas.

Ehlman, S. M., J. J. Cox, and P. H. Crowley. 2013. Evaporative water loss, spatial distributions, and survival in white-nose-syndrome-affected little brown myotis: a model. Journal of Mammalogy 94: 572–583.

England, A.B., B. French, K. Gaukler, C. Geiselman, B. Keeley, J. Kennedy, M. Kaiser, S. Kiser, R. Kowalski, D. Taylor, and S. Walker. 2001. Bats in eastern woodlands. Bat Conservation International, Austin, Texas.

Erickson, R. A., W. E. Thogmartin, and J. A. Symanski. 2014b. BatTool: an R package with GUI for assessing the effect of white-nose syndrome and other take events on *Myotis* spp. of bats. Source Code for Biology and Medicine 9, 9.

Erickson, W. P., G. D. Johnson, and D. P. Young, Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. USDA Forest Service General Technical Report PSW-GTR-191.

Erickson, W. P., M. M. Wolfe, K. J. Bay, D. H. Johnson, and J. L. Gehring. 2014a. A comprehensive analysis of small-passerine fatalities from collision with turbines at wind energy facilities. PLoS ONE 9(9): e107491. doi:10.1371/journal.pone.0107491.

FAA. (Federal Aviation Administration). 2020. Fundamentals of noise and sound. <https://www.faa.gov/regulations_policies/policy_guidance/noise/basics/>. Accessed 24 November 2020.

Feldhamer, G. A., T. C. Carter, and J. O. Whitaker Jr. 2009. Prey consumed by eight species of insectivorous bats from southern Illinois. American Midland Naturalist 162: 43-51.

Fenton, M. B. 1969. Summer activity of *Myotis lucifugus* (Chiroptera: Vespertilionidae) at hibernacula in Ontario and Quebec. Canadian Journal of Zoology 47: 597–602.

Fenton, M. B., and R. M. R. Barclay. *Myotis lucifugus*. Mammalian Species No. 142: 1–8. American Society of Mammalogists, Lawrence, Kansas. 20 November.

Fiedler, J. K. 2004. Assessment of bat mortality and activity at Buffalo Mountain Wind Farm, Eastern Tennessee. M.S. Thesis, University of Tennessee, Knoxville.

Fitch, J. H., and K. A. Shump. 1979. *Myotis septentrionalis*. Mammalian Species No. 121. American Society of Mammalogists, Lawrence, Kansas. 8 June.

Fleming, T. H., and P. Eby. 2003. Ecology of bat migration. Pages 156-197 *in* T. H. Kunz and M. B. Fenton, editors. Bat ecology. University of Chicago Press, Chicago, Illinois.

Foster, R., and A. Kurta. 1999. Roosting ecology of the northern bat (*Myotis septentrionalis*) and comparisons with the endangered Indiana bat (*Myotis sodalis*). Journal of Mammalogy 80: 659-672.

Frick, W. F., S. J. Puechmaille, J. R. Hoyt, B. A. Nickel, K. E. Langwig, J. T. Foster, K. E. Barlow, T. Bartonička, D. Feller, A. Haarsma, C. Herzog, I. Horáček, J. van der Kooij, B. Mulkens, B. Petrov, R. Reynolds, L. Rodrigues,

C. W. Stihler, G. G. Turner, and A. M. Kilpatrick. 2015. Disease alters macroecological patterns of North American bats. Global Ecology and Biogeography.

Frick, W. F., E. F. Baerwald, J. F. Pollack, R. M. R. Barclay, J. A. Szymanski, T. J. Weller, A. L. Russell, S. C. Loeb, R. A. Medellin, L. P. McGuire. 2017. Fatalities at wind turbines may threaten population viability of a migratory bat. Biological Conservation 209: 172–177.

Good, R. E, W. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat monitoring studies at the Fowler Ridge Wind Farm, Benton County, Indiana. April 1-October 31, 2010. Western EcoSystems Technology, Inc. Cheyenne, Wyoming. 28 January.

Good, R. E., A. Merrill, S. Simon, K. Murray, and K. Bay. 2012. Bat monitoring studies at the Fowler Ridge Wind Farm, Benton County, Indiana. April 1-October 31, 2011. Western EcoSystems Technology, Inc. Bloomington, Indiana. 31 January.

Griffin, D. R. 1940. Notes on the life histories of New England cave bats. Journal of Mammalogy 21: 181-187.

Grodsky, S. M., and D. Drake. 2011. Assessing bird and bat mortality at the Forward Energy Center. University of Wisconsin-Madison, Madison, Wisconsin.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-construction bat and bird fatality study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin July 21, 2008 – October 31, 2008 and March 15, 2009 – June 4, 2009. Western EcoSystems Technology, Cheyenne, Wyoming. 17 January.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013. Effectiveness of an operational mitigation experiment to reduce bat fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Bat Conservation International, Austin, Texas.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Shirmacher. 2014. Efficacy of an operational minimization experiment to reduce bat fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2013. Bat Conservation International. Austin, Texas.

Horn, J. W., E. B. Arnett, and T. H. Kunz. 2008. Behavioral responses of bats to operating wind turbines. Journal of Wildlife Management 72: 123–132.

Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of wind turbines on birds and bats in northeastern Wisconsin. Prepared for Wisconsin Public Service Corporation and Madison Gas and Electric Company. University of Wisconsin, Green Bay, Wisconsin. 21 November.

Hoyt, J. R., K. E. Langwig, K. Sun, G. Lu, K. L. Parise, T. Jiang, W. F. Frick, J. T. Foster, J. Feng, and A. M. Kilpatrick. 2016. Host persistence or extinction from emerging infectious disease: insights from white-nose syndrome in endemic and invading regions. Proceedings of the Royal Society of Biological Sciences 283: 20152861.

Humphrey, S. R., and J. B. Cope. 1976. Population ecology of the little brown bat, *Myotis lucifugus*, in Indiana and north-central Kentucky. Special publication no. 4, American Society of Mammalogists. 30 January.

Humphrey, S. R., A. R. Richter, and J. B. Cope. 1977. Summer habitat and ecology of the endangered Indiana bat, *Myotis sodalis*. Journal of Mammalogy 58: 334–346.

IUCN (International Union for Conservation of Nature). 2018. The IUCN red list of threatened species 2018. <https://www.iucnredlist.org>. Accessed 25 March 2019.

Jain, A. 2005. Bird and bat behavior and mortality at a Northern Iowa Wind Farm. M.S. Thesis. Iowa State University, Ames, Iowa.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30: 879-887.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2003. Mortality of bats at a large-scale wind power development at Buffalo Ridge, Minnesota. American Midland Naturalist 150: 332–342.

Johnson, G. D., M. K. Perlik, W. P. Erickson, and M. D. Sutherland. 2004. Bat activity, composition and collision mortality at a large wind plant in Minnesota. Wildlife Society Bulletin 32: 1278-1288.

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory bird and bat monitoring study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005–August 2006. Curry & Kerlinger, LLC, McLean, Virginia. May.

Kerns, J., W. P. Erickson, and E. B. Arnett. 2005. Bat and bird fatalities in Pennsylvania and West Virginia. Pages 24-95 in E. B. Arnett, editor. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bat Conservation International, Austin, Texas.

Korstian, J. M., A. M. Hale, and D. A. Williams. 2015. Genetic diversity, historic population size, and population structure in 2 North American tree bats. Journal of Mammalogy 96: 972–980.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D., Strickland, R. W. Thresher, and M. D. Tuttle. 2007*a*. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Frontiers in Ecology and the Environment 5: 315-324.

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007*b*. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71: 2449-2486.

Kurta, A., and S. W. Murray. 2002. Philopatry and migration of banded Indiana bats (Myotis sodalis) and effects of radio transmitters. Journal of Mammalogy 83: 585–589.

Kurta, A., J. Kath, E. L. Smith, R. Foster, M. W. Orick, and R. Ross. 1993. A maternity roost of the endangered Indiana bat (*Myotis sodalis*) in an unshaded, hollow, sycamore tree (*Platanus occidentalis*). American Midland Naturalist 130: 405-407.

Lacki, M. J., and J. H. Schwierjohann. 2001. Day-roost characteristics of northern bats in mixed mesophytic forest. Journal of Wildlife Management 65: 482-488.

Lilley, T. M., J. S. Johnson, L. Ruokolainen,, E. J. Rogers, C. A. Wilson, S. M. Schell, K. A. Field, and D. M. Reeder. 2016. White-nose syndrome survivors do not exhibit frequent arousals associated with *Pseudogymnoascus destructans* infection. Frontiers in Zoology 13:12.

Longcore, T., C. Rich, and S. A. Gauthreaux, Jr. 2008. Height, guy wires, and steady-burning lights increase hazard of communication towers to nocturnal migrants: a review and meta-analysis. Auk 125: 485–492.

Loss, S. R., T. Will, and P. P. Marra. 2013. The impact of free-ranging domestic cats on wildlife of the United States. Nature Communications 4: 1396. <http://www.nature.com/ncomms/journal/v4/n1/pdf/ncomms2380.pdf>. Accessed 15 March 2016.

Manville, A. M., II. 2009. Towers, turbines, power lines, and buildings—steps being taken by the U.S. Fish and Wildlife Service to avoid or minimize take of migratory birds at these structures. Pages 262-272 in T. D. Rich, C. Arizmendi, D. W. Demarest, and C. Thompson, editors. Tundra to Tropics: Proceedings of the 4th International Partners in Flight Conference 2008. Partners in Flight.

Marques, A. T., H. Batalha, S. Rodrigues, H. Costa, M. J. R. Pereira, C. Fonseca, M. Mascarenhas, and J. Bernardino. 2014. Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. Biological Conservation 179: 40–52.

MDC (Missouri Department of Conservation). 2018a. Bats, about 14 species in Missouri. <http://nature.mdc.mo.gov/discover-nature/field-guide/bats>. Accessed 26 March 2019.

MDC. 2018b. Indiana myotis (Indiana bat) *Myotis sodalis*. <http://nature.mdc.mo.gov/discover-nature/field-guide/indiana-myotis-indiana-bat>. Accessed 26 March 2019.

MDC. 2018c. Little brown myotis (little brown bat) Myotis lucifugus. <http://nature.mdc.mo.gov/discover-nature/field-guide/little-brown-myotis-little-brown-bat>. Accessed 28 March 2019.

MDC. 2019. Missouri species and communities of conservation concern checklist. January.

Norquay, K. J. O., F. Martinez-Nuňez, J. E. DuBois, K. M. Monson, and C. K. R. Willis. 2013. Long-distance movements of little brown bats (*Myotis lucifugus*). Journal of Mammalogy 94: 506–515.

NRC (National Research Council of the National Academies). 2007. Environmental impacts of wind-energy projects. Committee on Environmental Impacts of Wind Energy Projects, Board on Environmental Studies and Toxicology, Division of Earth and Life Studies. National Academies Press, Washington, D.C.

Owen, S. F., M. A. Menzel, W. M. Ford, B. R. Chapman, K. V. Miller, J. W. Edwards, and P. B. Wood. 2003. Home-range size and habitat used by the northern Myotis (Myotis septentrionalis). American Midland Naturalist 150: 352-359.

Pagel, J. E., K. J. Kritz, B. A. Millsap, 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. Journal of Raptor Research 47: 311–315.

Partners in Flight. 2019a. Population estimates database, version 3.0. <http://pif.birdconservancy.org/PopEstimates/>. Accessed 1 March 2020.

Partners in Flight. 2019b. Avian conservation assessment database, version 2019. <http://pif.birdconservancy.org/ACAD/>. Accessed 1 March 2020.

Perry, R. W., and R. E. Thill. 2007. Roost selection by male and female northern long-eared bats in a pine-dominated landscape. Forest Ecology and Management. 247: 220-226.

Robbins, L.W., B. T. Hale, C. R. Allen, J. Bowcock, J. R. Lemen, S. Romeling. 2010.Presence or absence of Indiana bats (*Myotis sodalis*) at a proposed wind power Project in Schuyler County. Missouri. Missouri State University, Springfield. November.

Robbins, L.W., B.T. Hale, S. Romeling, and J.R. Lemen. 2012a. Evaluation of *Myotis* activity: capture, telemetry, and acoustic analysis of potential interactions at a wind energy Project. Missouri. Missouri State University, Springfield. 7 March.

Robbins, L. W., S. E. Romeling, and B. T. Hale. 2012b. Bat activity at a proposed wind power Project in Schuyler County, Missouri. Missouri State University, Springfield. 7 March.

Schuyler County. 2019. Comprehensive plan and zoning regulations for Schuyler County, revised plan. Schuyler County Commission, Lancaster. 25 July.

Smallwood, K. S. 2013. Comparing bird and bat fatality-rate estimates among North American wind-energy projects. Wildlife Society Bulletin 37: 19–33.

Smallwood K. S., and B. Karas. 2009. Avian and bat fatality rates at old-generation and repowered wind turbines in California. Journal of Wildlife Management 73:1062-1071.

Sovic, M. G., B. C. Carstens, and H. L. Gibbs. 2016. Genetic diversity in migratory bats: results from RADseq data for three tree bat species at an Ohio windfarm. PeerJ 4:e1647; DOI 10.7717/peerj.1647.

Stantec. 2014*a*. 2013 post-construction bat study, Wildcat Wind Farm Phase I, Madison and Tipton counties, Indiana. Stantec Consulting Services Inc., Independence, Iowa. 19 December.

Stantec. 2014*b*. 2014 post-construction bat study, Wildcat Wind Farm Phase I, Madison and Tipton counties, Indiana. Stantec Consulting Services Inc., Independence, Iowa. 19 December.

Stantec. 2015. 2015 post-construction bat mortality monitoring report, Wildcat Wind Farm, Madison and Tipton Counties, Indiana. Stantec Consulting Services Inc., Independence, Iowa. 15 December.

Stantec. 2016. Indiana bat, northern long-eared bat, and little brown bat surveys. High Prairie Wind Energy Project, Schuyler County, Missouri. Stantec Consulting Services Inc., Independence, Iowa. 7 November.

Stantec. 2018a. 2018 bat surveys, High Prairie Wind Energy Project, Adair and Schuyler counties, Missouri. Stantec Consulting Services Inc, Independence, Iowa. 14 December.

Stantec. 2018b. Raptor nest survey, High Prairie Wind Energy Project, Adair and Schuyler counties, Missouri. Stantec Consulting Services Inc, Independence, Iowa. 19 April.

Stantec. 2019. Final avian use surveys, High Prairie Wind Energy Project, Adair and Schuyler county, Missouri. Stantec Consulting Services Inc., Independence, Iowa. 27 November.

Thogmartin, W. E., F. P. Howe, F. C. James, D. H. Johnson, E. T. Reed, J. R. Sauer, and F. R. Thompson, III. 2006. A review of the population estimation approach of the North American landbird conservation plan. Auk 123: 892–904.

Thogmartin, W. E., R. A. King, J. A. Szymanski, and L. Pruitt. 2012. Space-time models for a panzootic in bats, with a focus on the endangered Indiana bat. Journal of Wildlife Diseases 48: 876–887.

Thogmartin, W. E., C. A. Sanders-Reed, J. A. Szymanski, P. C. McKAnn, L. A. Pruitt, R. A. King, M. C. Runge, and R. E. Russell. 2013. White-nose syndrome is likely to extirpate the endangered Indiana bat over large parts of its range. Biological Conservation 160: 162–172.

Thogmartin, W. E., C. A. Sanders-Reed, J. A. Szymanski, P. C. McKAnn, L. A. Pruitt, R. A. King, M. C. Runge, and R. E. Russell. 2015. *Erratum to* White-nose syndrome is likely to extirpate the endangered Indiana bat over large parts of its range. Biological Conservation 191: 845.

Tidhar, D., M. Sonnenberg, and D. Young. 2013. Post-construction carcass monitoring study for the Beech Ridge Wind Farm, Greenbrier County, West Virginia, final report, April 1 – October 28, 2012. Western EcoSystems Technology, Inc., Waterbury, Vermont. 18 January.

Turner, G. G., D. M. Reeder, and J. T. Coleman. 2011. A five-year assessment of mortality and geographic spread of white-nose syndrome in North American bats and a look to the future. Bat Research News 52: 13–27.

USDA-FS (U.S. Department of Agriculture-Forest Service). 1995. Description of the ecoregions of the United States. Compiled by R. G. Bailey. Rocky Mountain Research Station, Fort Collins, Colorado. <https://www.fs.fed.us/land/ecosysmgmt/index.html>. Accessed 1 December 2019.

USEIA (U.S. Energy Information Administration).2020. Annual energy outlook 2020 with projections to 2050. Office of Energy Analysis, U.S. Department of Energy, Washington, D.C. 29 January. <https://www.eia.gov/outlooks/aeo/>. Accessed 1 March 2020.

USFWS (U.S. Fish and Wildlife Service). 1967. Endangered species. Federal Register 32: 4001. 11 March.

USFWS. 2002. Migratory bird mortality: many human-caused threats afflict our bird population. Division of Migratory Bird Management, Arlington, Virginia. January. <http://www.fws.gov/birds/mortality-fact-sheet.pdf>. Accessed 12 December 2013.

USFWS. 2007. Indiana bat (*Myotis sodalis*) draft recovery plan: first revision. Region 3, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota.

USFWS. 2008. Birds of conservation concern 2008. U.S. Fish and Wildlife Service, Division of Migratory Bird Management, Arlington, Virginia. <http://www.fws.gov/migratorybirds/>. Accessed 12 December 2013.

USFWS. 2012a. Land-based wind energy guidelines. U.S. Fish and Wildlife Service, Arlington, Virginia. 23 March.

USFWS. 2012b. White-nose syndrome: a devastating disease of North American bats. U.S. Fish and Wildlife Service. August. < http://whitenosesyndrome.org/sites/default/files/resource/white-nose_fact_sheet_9-2012.pdf>. Accessed 16 March 2016.

USFWS. 2013. Eagle conservation plan guidance: module 1 – land-based wind energy, version 2. Division of Migratory Bird Management. April.

USFWS. 2014. Region 3 Indiana bat Resource Equivalency Analysis Model for wind energy projects, version 4. 7 July.

USFWS. 2015. Threatened species status for the northern long-eared bat with 4(d) rule; final rule and interim rule. 2 April. Federal Register 80: 17974-18033.

USFWS. 2016*a*. 4(d) rule for the northern long-eared bat, final rule. Federal Register 81: 1900-1922. 14 January.

USFWS. 2016*b*. Programmatic biological opinion on final 4(d) rule for the northern long-eared bat and activities excepted from take prohibitions. Midwest Regional Office, Bloomington, Minnesota. 5 January.

USFWS. 2016c. Midwest wind energy multi-species habitat conservation plan public review draft. Midwest Region, in collaboration with the states of Iowa, Illinois, Indiana, Michigan, Minnesota, Missouri, and Wisconsin and the AWEA. U.S. Fish and Wildlife Service. April.

USFWS. 2016d. Region 3 Indiana bat resource equivalency analysis model for wind energy projects, version 7. Bloomington Field Office, Bloomington, Indiana. December.

USFWS. 2016e. Region 3 northern long-eared bat resource equivalency analysis model for wind energy projects, version 1. Bloomington Field Office, Bloomington, Indiana. December.

USFWS. 2016f. Region 3 little brown bat resource equivalency analysis model for wind energy projects, version 1. Bloomington Field Office, Bloomington, Indiana. December.

USFWS. 2018. Conservation bank enabling instrument. 11 July.

USFWS. 2019. 2019 Indiana bat (*Myotis sodalis*) population status update. U.S. Fish and Wildlife Service, Indiana Ecological Services Field Office, Bloomington, Indiana. 27 June.

USFWS. 2020a. Bats affected by WNS. <https://www.whitenosesyndrome.org/static-page/bats-affected-by-wns>. Accessed 29 March 2020.

USFWS. 2020b. White-nose syndrome spread map. <https://www.whitenosesyndrome.org/>. Accessed 23 June 2020.

USFWS and NOAA (National Oceanic and Atmospheric Administration) Fisheries. 2016. Habitat conservation planning and incidental take permit processing handbook. 21 December.

Vonhof, M. J., and A. L. Russell. 2015. Genetic approaches to the conservation of migratory bats: a study of the eastern red bat (Lasiurus borealis). PeerJ 3:e983; DOI 10.7717/peerj.983.

Westwood. 2018. Draft wetland delineation report for the High Prairie Wind Energy Center. Westwood Multi-Disciplined Surveying & Engineering, Minnetonka, Minnesota.

Whitaker, J. O., Jr., and L. J. Rissler. 1992. Winter activity of bats at a mine entrance in Vermillion County, Indiana. American Midland Naturalist 127: 52-59.

Whitfield, D. P., and M. Madders. 2006. Deriving collision avoidance rates for red kites *Milvus milvus*. Natural Research Information Note 3. Natural Research Ltd., Banchory, United Kingdom.

Young, D., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-construction monitoring study, Criterion Wind Project, Garrett County, Maryland, April–November 2012. Western EcoSystems Technology, Inc. Cheyenne, Wyoming and Waterbury, Vermont.

APPENDICES

APPENDIX A: BIRD AND BAT CONSERVATION STRATEGY

Bird and Bat Conservation Strategy

High Prairie Wind Energy Facility

Adair and Schuyler Counties, Missouri

November 19, 2020

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1.0 INTRODUCTION

High Prairie Wind Energy Facility (HPWF or Project) is a proposed wind energy project located near Queen City, Missouri, in Adair and Schuyler counties, Missouri (Figure 1). The Project Area is approximately 113,873 acres (ac) in size and is dominated by pastureland, forest, and agricultural fields in row crop production. Both large and small tracts of forest, rural residences, and farmsteads are scattered throughout the Project Area. HPWF is the responsible party for implementing this Bird and Bat Conservation Strategy (BBCS).

1.1 STATEMENT OF PURPOSE

HPWF, as part of its voluntary due diligence process, is developing this BBCS to avoid and minimize impacts to wildlife associated with operations of the Project. This BBCS will also document HPWF's scientific analysis of the Project's impacts to wildlife species and their habitats, and the systematic processes which were used for evaluating these impacts. The BBCS uses the tiered approach described in the U.S. Fish and Wildlife Service's (USFWS) Land Based Wind Energy Guidelines (WEG; USFWS 2012) to assess the impacts to wildlife.

This BBCS will be in effect throughout the life of the Project as a working document. The document may need to be updated from time to time in the future, as laws (or interpretations of laws) change, species are removed from or added to certain regulatory lists, and further evidence is gathered through research as to what are effective methods for protecting birds and bats from wind turbine strikes. The main goals of the HPWF BBCS are to:

- Avoid and minimize bird and bat fatalities and secondary effects on wildlife at the Project;
- Comply with federal and state wildlife regulations (e.g., Migratory Bird Treaty Act [MBTA]);
- Effectively document any bird or bat injuries or fatalities to provide a basis for ongoing development of avian and bat protection procedures;
- Outline and summarize ongoing and past surveys, monitoring, and management efforts to avoid and minimize adverse wildlife impacts throughout the Project;
- Implement adequate training for all personnel and subcontractors;
- Plan for, and commit to, effective and routine coordination between HPWF, the Missouri Department of Conservation (MDC) and the USFWS; and
- Demonstrate HPWF's commitment to implement best management practices, as outlined in the BBCS, to avoid and minimize impacts to wildlife and their habitats to the extent practicable.

This BBCS covers impacts to general bird and bat species. A separate Habitat Conservation Plan (HCP) is being developed for the federally endangered Indiana bat (*Myotis sodalis*), federally threatened northern long-eared bat (*Myotis septentrionalis*), and little brown bat (*Myotis lucifugus*), though they are also discussed briefly in this document as well. A separate Eagle Conservation Plan (ECP) is being developed for

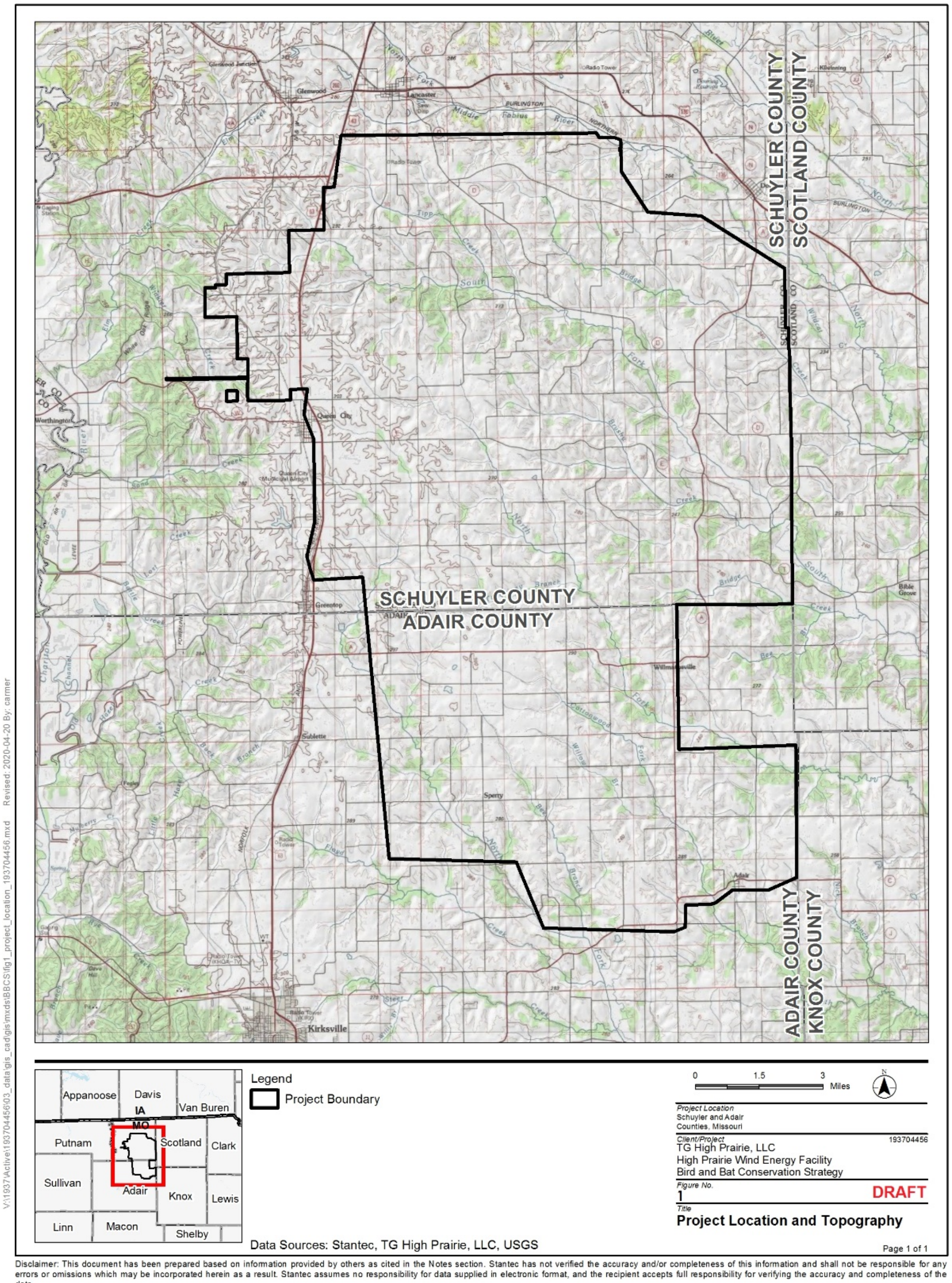

Figure 1. Project Location and Topography

bald eagles (*Haliaeetus leucocephalus*), though they are also discussed briefly in this document as well as in Appendix A (Eagle Conservation Strategy). The HCP and ECP will both outline the avoidance and minimization measures, monitoring, adaptive management, and specific commitments made by HPWF with regards to protected species.

1.1.1 BBCS Terms

This BBCS will be in effect through operation, maintenance, and decommissioning of the Project (Term). This Term will cover the 30-year expected functional life of the turbines and potential extended operations and/or decommissioning of the Project. HPWF will update this BBCS, as needed, through adaptive management (see Section 6.0) throughout the Term. Should the Project be repowered at the end of the Project's expected life, HPWF will re-initiate coordination with the USFWS and Missouri Department of Conservation (MDC). This BBCS's avoidance and minimization measures (Section 4.0), post-construction monitoring plan (Section 5.0) and adaptive management plan (Section 6.0) will remain in effect until the Project is decommissioned, or may be replaced with more stringent measures in the HCP and/or ECP once implemented.

1.1.2 BBCS Project Area

This BBCS applies to all lands owned (substation) and leased (turbines, access roads and adjacent properties) by HPWF for the operation of the Project. These lands include the locations of the 175 turbines and associated facilities.

1.2 REGULATORY FRAMEWORK

1.2.1 Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)

The Migratory Bird Treaty Act of 1918 (MBTA), 16 U.S.C. 703, et seq., prohibits the taking, possession, transportation, importation, exportation, and sale/purchase/barter of migratory birds, their eggs, parts, and nests, except as authorized under a valid permit. Under the MBTA, "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture or collect." The bird species protected by MBTA are listed in 50 CFR §10.13. In total, 1,007 bird species are protected by the MBTA. Incidental take of migratory birds is not prohibited by the MBTA[1].

1.2.2 Bald and Golden Eagle Protection Act (BGEPA)

The Bald and Golden Eagle Protection Act of 1940 (BGEPA; 16 USC 668-668d and 50 CFR 22.26), and its implementing regulations, provides additional protection to bald eagles and golden eagles (*Aquila chrysaetos*) such that it is unlawful to take an eagle.

The USFWS published a final rule (Eagle Permit Rule) on September 11, 2009 under BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles ''for the protection of…other interests in any particular locality'' where the take is compatible with the preservation of the bald eagle and the golden eagle, is associated with and not the purpose of an otherwise lawful activity, and cannot practicably be avoided (74 FR 46836). This rule was

[1] M-Opinion (M-37050) memorandum dated December 22, 2017 determined that the MBTA does not prohibit incidental take. https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf.

revised and finalized on December 16, 2016 (81 FR 91494-91554). Revisions included changes to permit issuance criteria and duration, definitions, compensatory mitigation standards, criteria for eagle nest removal permits, permit application requirements, and fees.

In May 2013, the USFWS announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2 (the ECP Guidance). The ECP Guidance provides a means of compliance with the BGEPA by providing recommendations and in-depth guidance for:

- Conducting early pre-construction assessments to identify important eagle use areas;
- Avoiding, minimizing, and/or compensating for adverse effects to eagles; and
- Monitoring for impacts to eagles during construction and operation.

The ECP Guidance interprets and clarifies the permit requirements in the regulations at 50 CFR 22.26 and 22.27 and does not impose any binding requirements beyond those specified in the regulations. HPWF is preparing an ECP to fully outline the measures taken to minimize and mitigate impacts to bald eagles.

1.2.3 Endangered Species Act (ESA)

The federal Endangered Species Act (ESA) of 1973 (16 U.S.C. §§1531 et seq.) provides for the listing, conservation, and recovery of endangered species. Section 9 of the ESA prohibits the take of any endangered or threatened species of fish or wildlife listed under the ESA. The siting, design, and operation components of the Project incorporate measures to ensure that impacts to ESA-listed species are reduced; these measures are described in this BBCS.

1.2.4 Wildlife Code of Missouri

The Wildlife Code of Missouri (3 CSR 10-4.111), published by the Missouri Secretary of State, extends special protection to endangered wildlife and lists species considered to be threatened with extinction. The Code prohibits the importation, transportation, sale, purchase, taking, possession, or exportation of any state-endangered wildlife or plant species, in whole or in part.

1.3 USFWS LAND-BASED WIND ENERGY GUIDELINES

The USFWS developed the WEG in 2012 to provide a structured, scientific process for addressing wildlife conservation concerns during land-based wind energy development (USFWS 2012). Potential adverse impacts to species of concern and their habitats are addressed via the tiered approach. Tiers 1 and 2 include pre-construction assessments in which developers identify, avoid, and minimize impacts to species of concern. Tier 3 involves field studies aimed at documenting wildlife and habitats, as well as predicting the impact of the project. Tiers 4 and 5 include post-construction assessments to address whether actions taken in earlier tiers were successful at minimizing and avoiding the identified impacts. Following the tiered approach allows developers to abandon or proceed with project development, as well as collect additional information as needed.

2.0 TIERS 1, 2, AND 3 – AVIAN AND BAT RESOURCES

This section covers the preliminary site evaluation (WEG Tier 1), site characterization (WEG Tier 2), and review of field studies to document wildlife and habitat (WEG Tier 3) to give a general overview of the Project's potential impact to birds and bats.

Tier 1 (Preliminary Site Evaluation), as described in the WEG (USFWS 2012), is a landscape-scale screening process using existing information sources to identify blocks of native habitat, ecological communities, and other areas of broad-scale wildlife value. The objective of Tier 1 is to answer the following questions at the landscape level (USFWS 2012):

1. Are there species of concern present on the potential site(s), or is habitat (including designated critical habitat) present for these species?
2. Does the landscape contain areas where development is precluded by law or areas designated as sensitive according to scientifically credible information? 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 categorizations.
3. 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?
4. 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?

Tier 2 (Site Characterization) focuses on site-specific natural resource information and existing information specific to the Project Area to evaluate potential risks to sensitive or protected natural resource features. The objective of Tier 2 is to answer the following questions at the site level (USFWS 2012):

1. Are known species of concern present at the proposed site, or is habitat (including designated critical habitat) present for these species?
2. Does the landscape contain areas where development is precluded by law or designated sensitive according to scientifically credible information? Examples of designated areas include, but are not limited to: federally designated critical habitat; high priority conservation areas for NGOs or other local, state, regional, federal, tribal, or international organizations.
3. Are there plant communities of concern present or likely to be present at the site?
4. Are there known critical areas of congregation of species of concern, 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?

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

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

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

Studies conducted as part of Tier 3 assess the potential risk of the proposed project, further evaluating the site to determine whether the wind energy project should be developed or abandoned. Additionally, the results from these studies can help to design and operate the site in a manner which avoids or minimizes significant adverse impacts, as well as help to determine the level of post-construction monitoring (Tier 4) which needs to be conducted. The objective of Tier 3 is to answer the following questions after conducting site-specific surveys (USFWS 2012):

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

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

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

4. What are the potential risks of adverse impacts of the proposed wind energy project to individuals and local populations of species of concern and their habitats? (In the case of rare or endangered species, what are the possible impacts to such species and their habitats?)

5. How can developers mitigate identified significant adverse impacts?

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

2.1 TIERS 1 AND 2 – SITE EVALUATION AND CHARACTERIZATION

2.1.1 Project and Site Description

TG High Prairie, LLC (High Prairie) is developing the 400-megawatt (MW) High Prairie Wind Energy Facility, located in Adair and Schuyler counties, Missouri, near Queen City (Figure 1). The Project will include 175 wind turbine generators (WTGs; Figure 3), including 163 2.2-MW WTGs and 12 3.45-MW WTGs. The Project Area is approximately 113,873 ac in size. Agricultural lands (i.e., crops, hay, herbaceous grassland), herbaceous wetlands, and open water are the predominant land cover, comprising approximately 76% of the Project Area (86,093 ac). Forest (to include shrub/scrub habitat and woody wetlands) makes up approximately 20% of the Project Area (22,769 ac). Various stages of developed and barren land make up an additional 4% of the Project Area (5,010 ac). A full list of landcover types, acreages, and percentages of the overall Project Area can be found in Table 2-1 and is illustrated in Figure 2. Additionally, North Fork Salt River and Floyd Creek run southeast/northwest through the southwestern third of the Project, North Fork South Fabius River runs southeast/northwest through the middle of the Project, and South Fork Middle Fabius River runs northwest/southeast through the northeastern third of the Project.

Table 2-1. Land cover type and amount within the High Prairie Wind Energy Facility Project Area in Adair and Schuyler counties, Missouri.

Land Cover Type[1]	Total Acres	Percent of Total
Hay/Pasture	71,386.34	63
Deciduous Forest	16,443.15	14
Cultivated Crops	12,560.95	11
Developed, Open Space	4,356.33	4
Shrub/Scrub	3,170.43	3
Mixed Forest	1,945.47	2
Herbaceous	1,797.86	2
Woody Wetlands	1,004.97	1
Developed, Low Intensity	619.64	1
Evergreen Forest	205.42	<1
Open Water	241.92	<1
Emergent Herbaceous Wetlands	106.68	<1
Developed, Medium Intensity	33.98	<1

[1]Land cover types described in U.S. Geological Survey (USGS) LCI National Land Cover Database 92 Land Cover Class Definitions (2012).

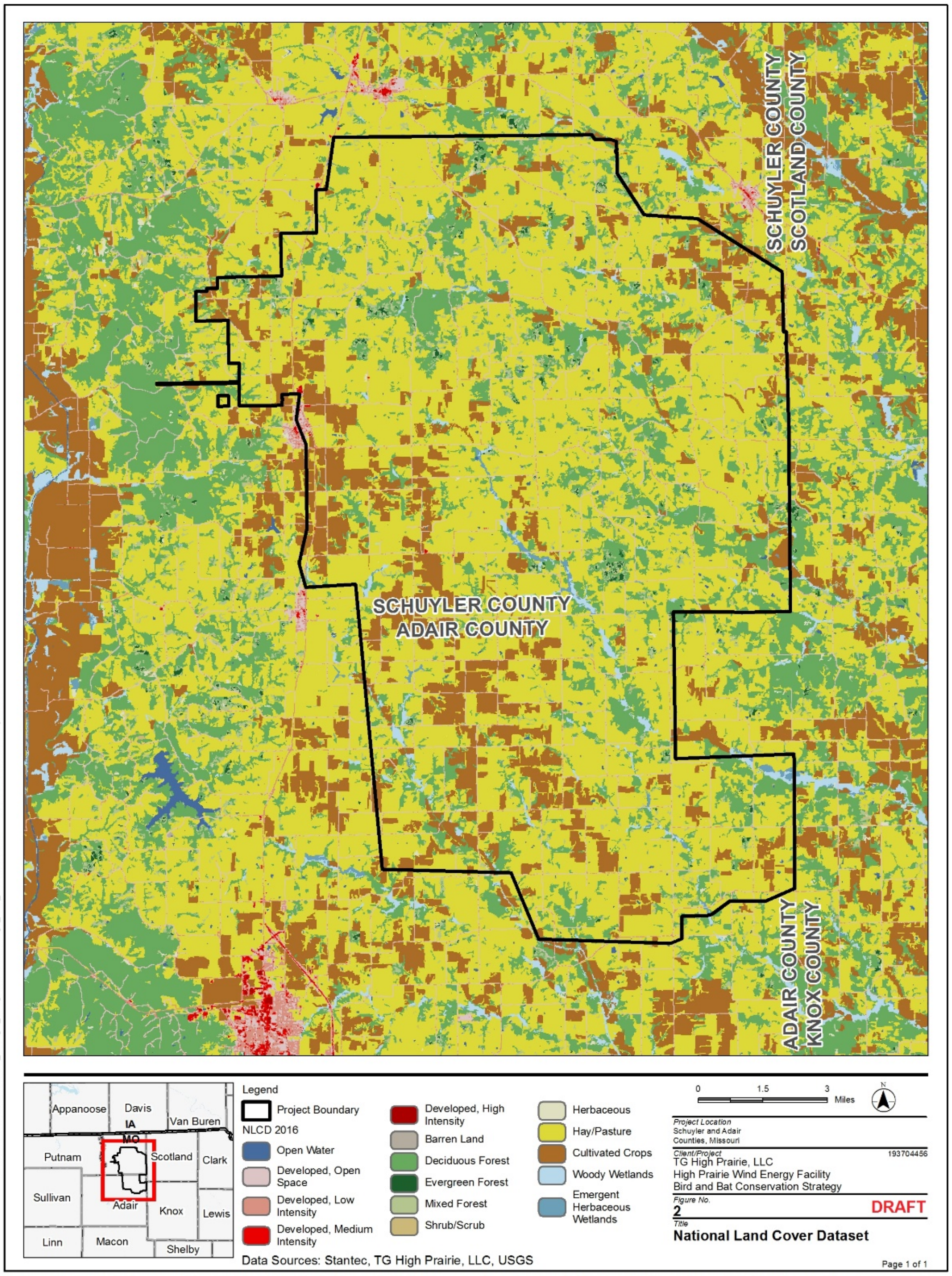

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Figure 2. National Land Cover Dataset

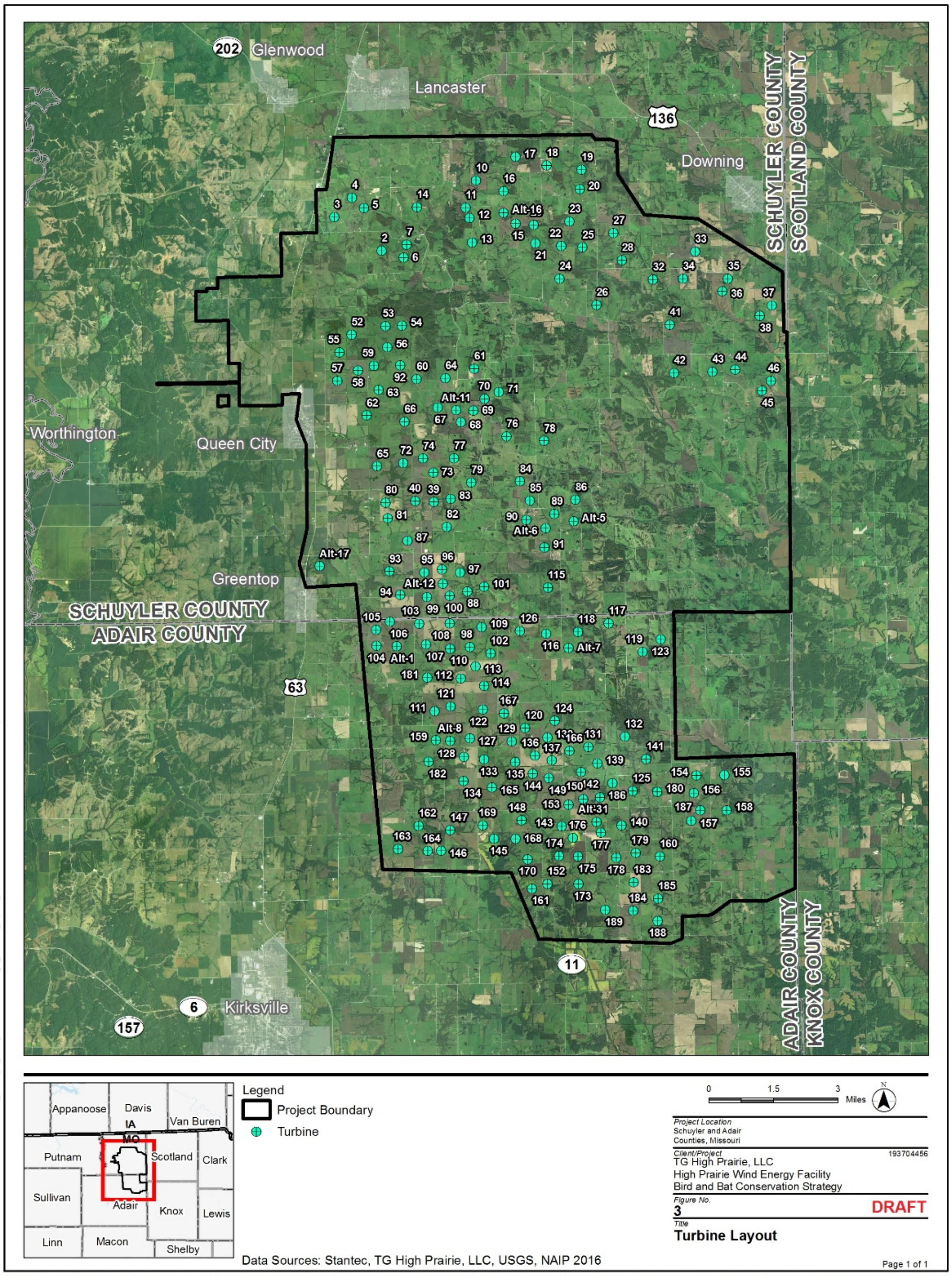

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Figure 3. Turbine Layout

2.1.2 Avian and Bat Resources

Row crops and developed space make up approximately 15% of the Project Area. These areas do not generally provide suitable breeding and migration stopover habitat for migratory bird species. Forests, shrub/scrub, and wetlands make up over 20% of the Project Area and can provide suitable breeding and migration stopover habitat. Over 60% of the Project Area is consists of hay and pasture. Depending on the management regimes of these pasturelands (e.g., mow/harvest schedule, amount of grazing, prescribed burning), they too could provide both breeding and migration stopover habitat. Therefore, it is likely that migratory birds are present within the Project Area during the spring, summer, and fall. A few species may also overwinter in the Project Area. The Missouri Natural Heritage Program (MNHD) notes that bald eagles are known from Adair and Schuyler counties (MDC 2017).

Natural habitat features or resource areas that typically attract bats are common within the Project Area, including both large and small tracts of woodland. Outbuildings associated with farmsteads and rural residences within the Project Area may also provide suitable roosting locations for some bat species. According to Bat Conservation International (BCI), nine bat species have geographic distributions that could include Adair and Schuyler counties, Missouri (BCI 2017) including three species of tree bats (which use trees year-round) and six species of cave bats (which hibernate in caves in winter) which are summarized in Table 2-2.

Table 2-2. Summary of bat species whose range includes the High Prairie Wind Energy Facility, and their summer and winter habitat preferences (Reid 2006).

Species Group	Species	Summer Habitat	Winter Habitat
Tree bats	Eastern red bat	Trees	Trees
	Hoary bat	Trees	Trees
	Silver-haired bat	Trees	Trees, occasionally cave entrances or cliff faces
Cave bats	Evening bat	Trees, structures	Caves
	Big brown bat	Trees, structures, caves, mines	Caves
	Little brown bat	Trees, structures	Caves, structures
	Indiana bat	Trees	Caves, mines
	Northern long-eared bat	Trees	Caves, mines
	Tricolored bat	Trees	Caves, mines

All nine species use woodland habitat for travel, foraging, or roosting at some time during the year. In addition, many species of bats feed along stream corridors or over water. Approximately 23,892 ac (21%) of the Project Area is classified as suitable bat habitat (Figure 4).

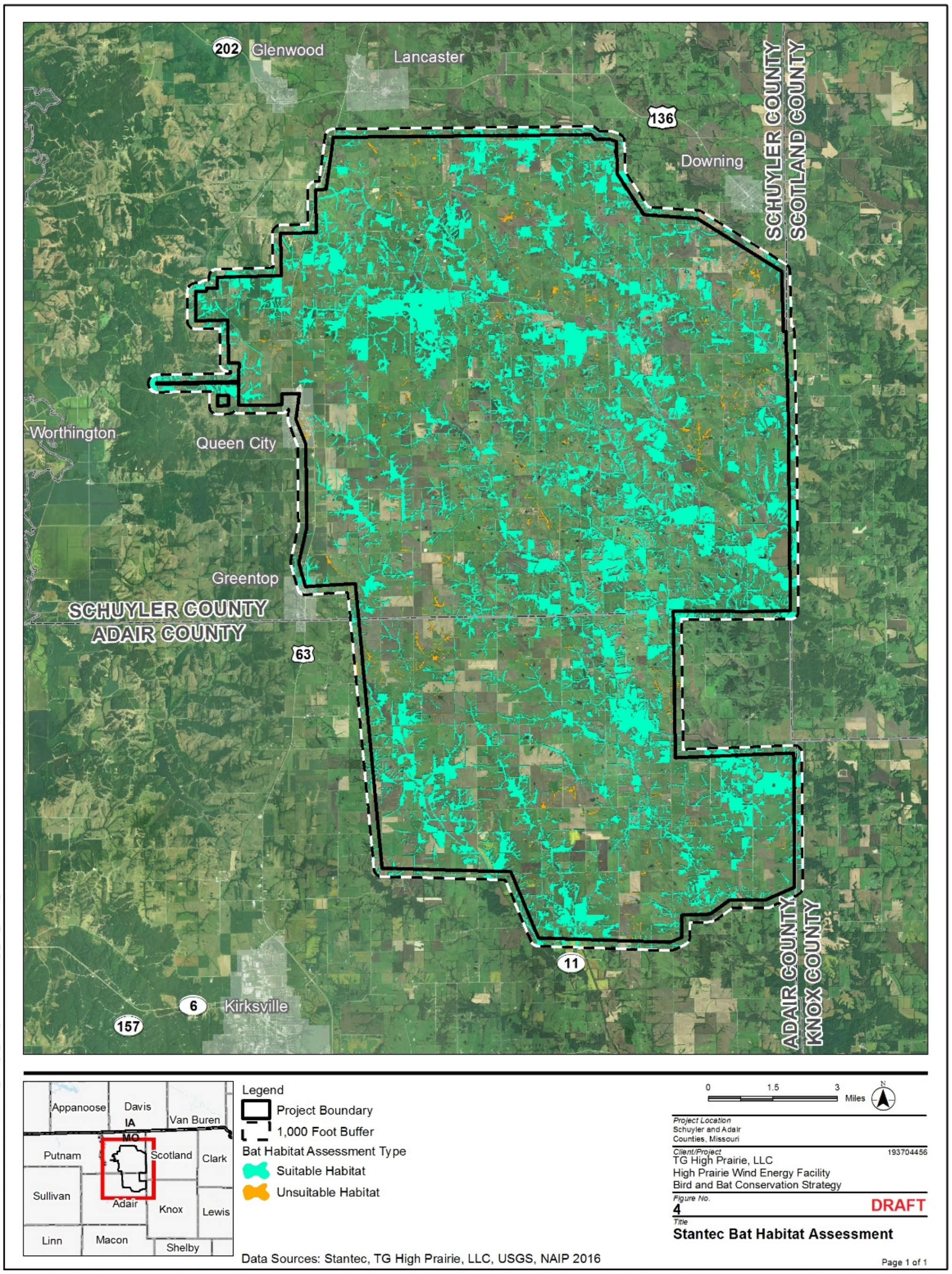

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Figure 4. Stantec Bat Habitat Assessment

2.1.3 Threatened and Endangered Species

2.1.3.1 Federal-Listed Wildlife Species

Per review of the USFWS's Information for Planning and Consultation (IPaC) website, there are no federally listed bird species and three federally listed bat species with a geographic range that includes Adair and/or Schuyler counties (USFWS 2018):

- Gray bat (*Myotis grisescens*) – Endangered
- Indiana bat – Endangered
- Northern long-eared bat – Threatened

The little brown bat is currently not a federally- or state-listed, proposed, or candidate species; however, it is currently under a USFWS Discretionary Status Review on the National Listing Workplan. The tricolored bat is not federally-listed, proposed or a candidate species, but is currently under a status review after being petitioned for listing as a threatened or endangered species under the ESA (CBD and DW 2016). The petition also requests a concurrent designation of critical habitat (CBD and DW 2016). Currently, no Federal critical habitat, conservation plans, or recovery plans exist for this species.

While the gray bat is listed for Adair County (USFWS 2018), given the habitat within the Project Area, this species is not anticipated to occur.

2.1.3.2 State-Listed Wildlife Species

The MDC is responsible for maintaining the Missouri List of Endangered Species (no threatened classification used in Missouri). The MDC (2018) lists three endangered wildlife species with the potential to occur in Adair and/or Schuyler counties:

- Indiana bat
- Northern long-eared bat
- King rail (*Rallus elegans*)

2.2 TIER 3 – FIELD SURVEYS TO DOCUMENT SITE WILDLIFE AND HABITAT AND PREDICT PROJECT IMPACTS

2.2.1 Small Bird Use Survey

Small bird use surveys (defined as smaller than an American Crow [*Corvus brachyrhynchos*]) have been conducted in Schuyler County since 2016, and the Project Area was expanded in late 2017 to include Adair County. The survey began with 42 survey points in May 2016 (located in Schuyler County), which were each was surveyed 10 times between May 2016 and February 2017 (35 hours of survey effort). An additional 51 points were added in November 2017, and the 93 total points were surveyed 5 times between December 2017 and April 2018, for an additional 38.75 hours of survey effort. Points 43-93 (those points added in December 2017) were then surveyed from May 2018 through November 2018 for an additional 29.75 hours of survey effort. A total of 12,542 observations of 115 species have been observed during the surveys (5-minute counts at 100-meter radius plots). The ten most frequently observed small birds have been:

- 2,455 red-winged blackbird (*Agelaius phoeniceus*)
- 1,988 European starling (*Sturnus vulgaris*)
- 634 mourning dove (*Zenaida macroura*)
- 567 blue jay (*Cyanocitta cristata*)
- 518 American goldfinch (*Spinus tristis*)
- 497 American robin (*Turdus migratorius*)
- 392 house sparrow (*Passer domesticus*)
- 382 lapland longspur (*Calcarius lapponicus*)
- 319 dark-eyed junco (*Junco hyemalis*)
- 276 barn swallow (*Hirundo rustica*)

Four species of special concern in Missouri, the pine siskin (*Spinus pinus*), brown creeper (*Certhia americana*), chestnut-sided warbler (*Setophaga pensylvanica*), and loggerhead shrike (*Lanius ludovicianus*), were observed during surveys. Two state endangered species were observed, the northern harrier (*Circus hudsonius*) and peregrine falcon (*Falco peregrinus*), which were both observed incidentally (larger than an American crow, outside of the 100-meter radius plot). Northern harriers are generally considered at a lower risk of fatality from wind farms, as their hunting habits include flying low to the ground and using sight and sound to detect prey. Even at sites with relatively high northern harrier use, fatality has been absent or low (Erickson et al. 2002). Northern harrier sightings during large bird use surveys are discussed in Section 2.2.2 below. Additionally, four large bird species of special concern, the bald eagle (*Haliaeetus leucocephalus*; 67 observations), short eared owl (*Asio flammeus*; 1 observation), sharp-shinned hawk (*Accipiter striatus*; 3 observations), and trumpeter swan (*Cygnus buccinator*; 2 observations), were observed incidental to small bird surveys.

2.2.2 Large Bird Use Survey

Large bird use surveys (defined as American Crow sized or larger) have been conducted in Schuyler County since 2016, and the Project Area was expanded in late 2017 to include Adair County. The survey began with 42 survey points in May 2016 (located in Schuyler County), which were each was surveyed 10 times between May 2016 and February 2017 (420 hours of survey effort). An additional 51 points were added in November 2017, and the 93 total points were surveyed 12 times between November 2017 and October 2018, for an additional 1,116 hours of survey effort. The additional 51 points were surveyed from November 2018 to October 2019 and the original 42 points were surveyed during March and April of 2019 so that each of the 93 points was surveyed 24 times for a total survey effort of 2,232 hours. A total of 19,388 observations of 37 species have been observed during the surveys (1-hour counts at 800-meter radius plots). The ten most frequently observed large birds have been:

- 6,603 turkey vulture (*Cathartes aura*)
- 4,638 snow goose (*Chen caerulescens*)
- 3,244 Canada goose (*Branta canadensis*)
- 2,414 American crow
- 879 red-tailed hawk (*Buteo jamaicensis*)
- 316 northern harrier

- 194 rough-legged hawk (*Buteo lagopus*)
- 187 wild turkey (*Meleagris gallopavo*)
- 155 lesser scaup (*Aythya affinis*)
- 103 Mallard (*Anas platyrhynchos*)

Five species of special concern in Missouri were observed. This included 1 osprey, 2 sandhill cranes (*Grus canadensis*), 25 short-eared owls, 35 sharp-shinned hawks, and 29 trumpeter swans. Two more ospreys, 4 more short-eared owls, and 2 more sharp-shinned hawks were observed incidentally during large bird surveys and 1 loggerhead shrike, another species of special concern in Missouri, was also observed incidental to large bird surveys.Two state endangered species were observed, the northern harrier (n=316) and peregrine falcon (n=1) were observed during surveys. Northern harriers are generally considered at a lower risk of fatality from wind farms, as their hunting habits include flying low to the ground and using sight and sound to detect prey. Even at sites with relatively high northern harrier use, fatality has been absent or low (Erickson et al. 2002). Northern harriers are also discussed in Section 2.2.1 above.

2.2.3 Eagle Use Survey

Eagle use surveys have been conducted concurrent with large bird use surveys in Schuyler County since 2016, and the Project Area was expanded in late 2017 to include Adair County. The survey began with 42 survey points in May 2016 (located in Schuyler County), which were each was surveyed 10 times between May 2016 and February 2017 (420 hours of survey effort). An additional 51 points were added in November 2017, and the 93 total points were surveyed 12 times between November 2017 and October 2018, for an additional 1,116 hours of survey effort. The additional 51 points were surveyed from November 2018 to October 2019 and the original 42 points were surveyed during March and April of 2019 so that each of the 93 points was surveyed 24 times for a total survey effort of 2,232 hours. Both bald and golden eagles were observed during eagle use surveys.

During the 2,232 hours of survey effort, 547 bald eagles were observed, for a total of 1,480 bald eagle flight minutes (minutes bald eagles were flying within the 800-m buffer and below 200-m in height). While all 93 points were surveyed 24 times each, the current project boundary (Figure 1) no longer includes 13 of the survey points (Points 61, 63, 68-69, 73, 80, 86-89, 91-93; Figure 1).

During 1,920 hours of survey effort at the 80 points still within the project boundary, a total of 490 bald eagle observations were recorded, for a total of 1,324 bald eagle flight minutes. These 1,324 bald eagle flight minutes were from 408 bald eagle observations (the remaining 82 bald eagle observations were either perched or outside the 800-m survey plot). Of the 547 bald eagle observations, 427 were adults (78.1%) and 112 were juveniles (i.e., immature; 20.5%), while the remaining observations were of unknown age class. Of the 1,480 bald eagle flight minutes recorded, 1,071 minutes (72.4%) were adult bald eagle observations and 387 minutes (26.2%) were juvenile bald eagle observations.

Bald eagle flight minutes were recorded at 77 of the 80 points still within the project boundary (all points except for Points 20, 59, and 79). Bald eagle observations and minutes were generally spread out across all points. The majority of bald eagle observations occurred from November through March with 1,298 of the 1,480 bald eagle flight minutes (87.7%) recorded during these winter months. Zero bald eagle flight minutes were recorded during the month of June. This pattern of use is typical of Midwestern sites located in agricultural areas away from major water features, which frequently record higher eagle use in the winter months due to migratory and/or overwintering eagles.

During the 2,232 hours of survey effort, 5 golden eagles were observed, for a total of 15 golden eagle flight minutes (minutes golden eagles were flying within the 800-m buffer and below 200-m in height), with 4 of those observations and 11 of the 15 golden eagle minutes occurring at points still within the current project boundary. Golden eagles were observed within four plots, at Points 16, 36, 38, 61 (outside current project boundary), and 65. The golden eagles were observed within the plots during the months of March, April, and December with the majority of observations (3; 60%) occurring during the month of April. Further information on eagles is provided in Appendix A.

2.2.4 Raptor Nest Survey

In support of the Project, Stantec Consulting Services Inc. (Stantec) completed a raptor nest survey, utilizing ground-based and fixed-wing aerial methods, for bald eagle and other raptor nests within the current Project Area and a 10-mile buffer (nest search area), including portions of Adair, Knox, Schuyler, and Scotland counties in Missouri and Appanoose and Davis counties in Iowa (Stantec 2018a).

From February 26 through March 2, 2018, before leaf-out in the spring, a ground-based raptor nest survey was conducted, identifying the locations of any eagle or other raptor nests visible within the nest search area from public roadways. In addition to the ground-based nest survey, a fixed-wing aerial survey was completed from March 7 through March 9 and on March 13, 2018. A total of 22 bald eagle nests were observed during the 2018 raptor nest survey, including 3 within the Project Area (1 occupied), 17 outside of the Project Area but within the 10-mi buffer, and 2 outside of the 10-mi buffer. Fourteen of the nests outside of the Project Area were considered occupied. Nineteen non-eagle raptor nests were observed during the 2018 raptor nest survey (5 within the Project Area, 13 within the 10-mile buffer, and 1 outside the 10-mile buffer; Stantec 2018a).

2.2.5 Bat Surveys

Stantec conducted a habitat assessment and acoustic, mist net, and radio telemetry surveys for the federally endangered Indiana bat, federally threatened northern long-eared bat, and little brown bat at the HPWF Project Area in 2016 within Schuyler County and again in 2018 within Adair County (Stantec 2016, 2018b).

2.2.5.1 Habitat Assessment

There are no winter Indiana bat or northern long-eared bat records or known hibernacula in Adair or Schuyler counties (USFWS 2007; Stantec 2018b). The desktop bat habitat assessment evaluates suitable northern long-eared and Indiana bat habitat within the Project Area based on aerial photographs used to map forested areas, potential individual roost trees, and linear forest features. Unsuitable habitat can include individual trees that are greater than 1,000 ft from other forested areas, pure stands of young trees (<3 inches dbh), and trees within highly developed areas. Based on this assessment, approximately 23,893 ac (21%) of the Project Area consists of suitable northern long-eared and Indiana bat habitat (Table 2-3, Figure 4). Because bats travel some distance, a 1,000-ft buffer around the Project Area was also assessed for suitable northern long-eared and Indiana bat habitat, where an additional 1,827 acres of suitable habitat were found.

Table 2-3. Bat summer habitat assessment for Indiana and northern long-eared bats within the High Prairie Wind Energy Facility Project Area and adjacent 1000-ft buffer, Adair and Schuyler counties, Missouri.

Location	Suitable Summer Bat Habitat (acres)	Unsuitable Summer Bat Habitat (acres)
Within Project Area	23,893	643
Outside Project Area but Within 1,000 ft	1,827	34
Total	**25,720**	**676**

Little brown bats are assumed to use both wooded and non-wooded areas and therefore, 100% of the 113,873.2-acre Permit Area is considered suitable little brown bat habitat.

2.2.5.2 Acoustic Surveys

2010 and 2011 Surveys

A bat study was conducted in 2010 and 2011 by Robbins et al. (2012) for Normandeau Associates, however; the Project Area has significantly changed in shape and size since these surveys occurred. The 2010/2011 study area did not include Adair County or large portions of the current Project Area. Survey methods were based on a standardized protocol in use at that time (USFWS 1999, USFWS 2007, Carroll et al. 2002, Robbins et al. 2008). Ultrasonic detectors were used at each site to document bat species in the area.

Acoustic data was collected and analyzed to species by comparing call structure to known calls using Analook software (Britzke et al. 2002, Murray et al. 1999) and Bat Call Identification (BCID) software (Allen et al. 2008). Surveys were conducted during fall migration in 2010 (Robbins et al. 2010) and during mist-netting surveys in 2011 (Robbins et al. 2012) confirmed presence of the Indiana bat, northern long-eared bat, and little brown bat (Table 2-4).

Table 2-4. Results of acoustic surveys conducted at the proposed HPWF in Schulyer County, Missouri in 2010 (Robbins et al. 2010) and 2011 (Robbins et al. 2012).

Species	2011 Acoustic Results	2010 Acoustic Results
Big brown bat	11.3%	16.1%
Evening bat	16.1%	9.9%
Eastern red bat	24.4%	14.7%
Indiana bat	7.7%	1.4%
Little brown bat	7.6%	4.1%

Species	2011 Acoustic Results	2010 Acoustic Results
Hoary bat	10.9%	11.1%
Silver-haired bat	14.5%	22.0%
Northern long-eared bat	2.0%	0.2%
Tricolored bat	2.9%	11.6%
Unknown	2.5%	8.8%

2016 and 2018 Surveys

Acoustic surveys were conducted in Schuyler County at 70 sites in 2016, and at 65 sites in Adair County in 2018, for a total of 135 sites within the Project Area. These 135 sites were sampled for a minimum of 2 calendar nights with 2 acoustic detectors (4 detector nights) over from June 9 – July 26, 2016 and from May 16 – June 7, 2018.

Sample sites were chosen based on the location of suitable habitat (see Section 2.2.5.1) and land access. Stantec's bat biologists, experienced with detector placement, conducted field investigations at each survey site and made the final selection of the specific detector locations based on a combination of factors, including their proximity to other acoustic sites, presence of key habitat characteristics (e.g., permanent water, mature woodlands), and site access. Detector location was based upon open or high canopy cover, presence of non-obstructed flyways, and forest condition. The actual location and orientation of each acoustic detector was determined in the field prior to conducting surveys. Kaleidoscope Pro (an automated-identification program for acoustic calls approved by the USFWS) identified nine species in both years, summarized in Table 2-5 below (Stantec 2016, 2018b).

Table 2-5. Species composition from acoustic presence-absence surveys conducted within the proposed High Prairie Wind Energy Facility Project Area in 2016 and 2018 (Stantec 2016, 2018).

Species	2016 Acoustic Bat Passes		2018 Acoustic Bat Passes	
	Number files recorded	Percent of total files	Number files recorded	Percent of total files
Eastern red bat	12,550	17.0%	16,062	23.2%
Hoary bat	7,235	9.8%	13,569	19.6%
Silver-haired bat	13,573	18.4%	2,787	4.0%
Big brown bat	18,370	24.8%	17,640	25.1%
Evening bat	3,651	4.9%	8,285	11.9%
Little brown bat	6,337	8.6%	6,495	9.4%
Indiana bat	4,321	5.8%	3,289	4.7%
Northern long-eared bat	1,362	1.8%	1,016	1.5%
Tricolored bat	235	0.3%	220	0.3%
Total	67,634	100.0%	69,363	100.0%

Qualitative identification by a qualified bat biologist was conducted on calls for the three *Myotis* species, and presence was confirmed for the following:

- Indiana bat – 114 sites (84.4%)
- Little brown bat – 102 sites (75.6%)
- Northern long-eared bat – 69 sites (51.1%)

In 2018, qualitative identification was also conducted for the tricolored bat, and no sites were confirmed for summer presence of this species.

2018 MET Tower Acoustic Survey

Acoustic detectors were deployed on five MET towers within the Permit Area from April 26, 2018 through November 7, 2018. At each MET tower, a detector was placed at approximately 10 feet (low detector) and at 164 feet (high detector). A total of 231,174 bat calls were recorded, of which 171,308 were identified to the species level by Kaleidoscope Pro. The remaining 59,866 bat calls (25.96% of all calls) were not of sufficient quality to be identified to a species. It is assumed that these unidentified calls are equally likely to be any of the nine species, and that no particular species is more likely to fall into the unidentified call category. As such, for this analysis, it is assumed that the species composition of the calls identified to the species level is comparable to the species composition of the unidentified calls. All nine species with the potential to occur within the HPWF were identified by Kaleidoscope Pro at a MET tower, with the following overall number of calls and species composition:

- Hoary bat – 52,946 calls (30.9% of all calls identified to the species level)
- Big brown bat - 35,895 calls (21.0%)
- Eastern red bat – 28,381 calls (16.6%)
- Silver-haired bat – 24,497 calls (14.3%)
- Evening bat – 14,749 calls (8.6%)
- Little brown bat – 11,566 calls (6.8%)
- Indiana bat – 1,609 calls (0.9%)
- Tricolored bat – 1,288 calls (0.8%)
- Northern long-eared bat – 377 calls (0.2%)

Breakdown by season and detector height are shown in Table 2-6.

Table 2-6. MET tower species composition based on output from Kaleidoscope Pro (4.2.0). Includes data from spring (April 28 through May 14, 2018), summer (May 15 through August 15, 2018), and fall (August 16 through November 7, 2018). Percent composition (based on calls identified to the species level [i.e., excluding no identifications] within each season for a detector height) provided in parentheses.

Detector Location	Season	Species									
		Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Little brown bat	Northern long-eared bat	Indiana bat	Evening bat	Tricolored bat	No Identification (% of all calls)
High MET Towers	Spring	139 (9.0%)	231 (14.9%)	786 (50.6%)	360 (23.2%)	15 (1.0%)	0 (0.0%)	2 (0.1%)	18 (1.2%)	2 (0.1%)	166 (9.7%)
	Summer	2,961 (13.2%)	4,053 (18.1%)	12,029 (53.6%)	2,619 (11.7%)	135 (0.6%)	0 (0.0%)	3 (<0.1%)	564 (2.5%)	66 (0.3%)	2,324 (9.4%)
	Fall	1,549 (11.4%)	2,492 (18.4%)	4,930 (36.4%)	3,904 (28.8%)	140 (1.0%)	2 (<0.1%)	8 (0.1%)	398 (2.9%)	113 (0.8%)	1,736 (11.4%)
Low MET Towers	Spring	796 (14.4%)	1,047 (18.9%)	2,740 (49.5%)	510 (9.2%)	74 (1.3%)	1 (<0.1%)	18 (0.3%)	316 (5.7%)	31 (0.6%)	1,062 (16.1%)
	Summer	5,763 (26.1%)	3,372 (15.3%)	8,321 (37.7%)	1,947 (8.8%)	497 (2.3%)	12 (0.1%)	68 (0.3%)	1,950 (8.8%)	154 (0.7%)	8,105 (26.8%)
	Fall	1,347 (28.6%)	499 (10.6%)	1,215 (25.8%)	853 (18.1%)	301 (6.4%)	4 (0.1%)	39 (0.8%)	368 (7.8%)	77 (1.6%)	1,317 (21.9%)

Qualitative identification by a qualified bat biologist was conducted on all calls of the three *Myotis* species recorded at a high detector during the summer, to address concerns about impacts to local maternity colonies. Qualitative review confirmed the following:

- 73 of the 135 little brown bat calls had characteristics of *Myotis* or little brown bat calls
- 0 of the 2 northern long-eared bat calls had characteristics of *Myotis* or northern long-eared bat calls
- 7 of the 13 Indiana bat calls had characteristics of *Myotis* of Indiana bat calls. Of these 7 calls, 2 were during the spring migration period, 2 were during the summer maternity season (August 8 and August 9) and 3 were during the fall migration period.

Spatial analysis of bat activity showed that activity was consistently higher at the ground-based detectors when compared to the low or high MET tower detectors. During the summer maternity season, bat activity at the high MET towers averaged 56.5 bat passes/detector night (for all species, including unidentified calls), whereas bat activity in bat habitat at the ground-based detectors averaged almost four times that amount at 217.0 bat passes/detector night. Specifically, for the three *Myotis* species each species recorded significantly higher activity at the ground-based detectors compared to either MET tower detector during summer and fall while spring showed no significant differences for any species. The little brown bat recorded significantly higher activity at the low MET tower compared to the high MET tower during summer and fall. Both Indiana bat and northern long-eared bat recorded <0.1 average call/detector night at the high MET tower across all seasons and northern long-eared bat also recorded <0.1 average call/detector night at the low MET tower across all seasons.

2.2.5.3 Mist Net Surveys

2011 Surveys

Ten sites within the project (though not necessarily within the current project boundary since the project area has changed since 2011) and three off-site locations associated with manmade structures (roosts) were surveyed with mist nets from May 19, 2011 to July 28, 2011 (71 available nights) for a capture total of 460 bats of 7 species during 139 net nights (Robbins et al. 2012). Captures by species were as follows:

- 292 little brown bats (63.5% of all captures)
- 56 big brown bats (12.2%)
- 45 eastern red bats (9.8%)
- 37 Indiana bats (8.0%)
- 18 evening bats (3.9%)
- 9 northern long-eared bats (2.0%)
- 3 hoary bats (0.7%)

The little brown captures were heavily influenced by the capture of 226 little brown bats captured at a barn with a known maternity colony. Another barn had an additional 49 little brown bat captures (Robbins et al. 2012).

2016 and 2018 Surveys

Mist-net surveys were conducted at 33 sites in 2016 in Schuyler County, and at an additional 33 sites in 2018 in Adair County. The number of mist-net sites within the 2016 and 2018 survey area were determined through coordination with USFWS in order to achieve the goals of Phase 3 of the USFWS guidelines, which are to capture and characterize the Indiana bats that are present in the survey area, and to facilitate Phase 4 (radio-telemetry and emergence counts, see Section 2.2.5.4) efforts. Mist-netting was also targeting the northern long-eared bat, little brown bat, and tricolored bat, with the same goals of capturing and characterizing the bats present in the survey area and facilitating Phase 4 efforts with these species as well. Sites were chosen based on the results of the acoustic surveys, with mist-netting efforts focused on sites with acoustic detections of the highest number of target species and/or a large volume of calls.

A total of 431 bats representing 8 species were captured between July 21 and August 5, 2016, and a total of 389 bats representing 7 species were captured between June 18 and August 4, 2018. Results are summarized in Table 2-7 (Stantec 2016, 2018b).

Table 2-7. Species composition from mist-netting surveys conducted within the proposed High Prairie Wind Energy Facility Project Area in 2016 and 2018 (Stantec 2016, 2018).

Species	2016 Mist-Net		2018 Mist-Net	
	Number captured	Percent of total captures	Number Captured	Percent of total captures
Eastern red bat	116	26.9%	73	37.0%
Hoary bat	5	1.2%	4	1.0%

Species	2016 Mist-Net		2018 Mist-Net	
	Number captured	Percent of total captures	Number Captured	Percent of total captures
Silver-haired bat	4	0.9%	1	0.3%
Big brown bat	151	35.0%	144	37.0%
Evening bat	124	28.8%	104	26.7%
Little brown bat	7	1.6%	2	0.5%
Indiana bat	23	5.3%	60	15.4%
Northern long-eared bat	1	0.2%	0	0.0%
Tricolored bat	0	0.0%	0	0.0%
Total	431	100.0%	389[1]	100.0%

[1]One unidentified bat (either an Indiana bat or little brown bat) was captured, but was not able to be identified before its escape.

2.2.5.4 Radio Telemetry

2011 Surveys

During the 2011 mist-net survey, 14 Indiana bats, 4 northern long-eared bats, and 5 little brown bats were part of the radio-telemetry survey. Many of the bats tagged in 2011 were tracked to roosts outside of the current Project Area

Of the 14 tagged Indiana bats, 12 were successfully tracked to 3 estimated colonies ranging in size from 69 to over 180 individuals based on emergence counts (Robbins et al. 2012). Of the 4 tagged northern long-eared bats, all were successfully tracked to a single colony with an estimated size of 10 individuals based on emergence counts (Robbins et al. 2012). All of the 5 tagged little brown bats were successfully tracked, and either roosted along or at 1 of 3 colonies of 80 to over 950 individuals based on emergence counts, though some of these colonies may have included big brown bats within the colony or been a bachelor colony (Robbins et al. 2012).

2016 and 2018 Surveys

Radio-telemetry was conducted on Myotis species that were captured, and a total of 24 bats were tagged over the 2 years of survey.

A total of 12 bats (9 Indiana bats and 3 little brown bats) were radio-tagged and tracked between July 21 and August 5, 2016. No northern long-eared bats were tagged, as the only northern long-eared bats captured escaped the net prior to handling. Bats were tracked to 21 roost locations. Ten additional roosts were either estimated or triangulated due to inaccessibility or poor signal acquisition (Stantec 2016). A total of 65 emergence counts at 42 different roosts (the 21 located during this survey, as well as roosts that had previously been located in 2011) were conducted between July 23 and August 7, 2016. Of the 22 roosts used by bats tracked during this study, 21 roosts recorded bats emerging during the study (95.5%). The highest number of bats recorded at a single roost was 147. This roost was an Indiana bat roost and had the highest average emergence count at 88 bats/night. When all roosts used by bats tracked during this study are considered, the average emergence count was 16.3 bats/night (Stantec 2016).

A total of 12 Indiana bats were radio-tagged and tracked between June 18 and August 6, 2018. No little brown bats were tagged, the adult post-lactating female that was prepped for radio-tagging escaped from the cloth bag prior to gluing on the transmitter. Bats were tracked to 10 roost locations. Two additional roosts were estimated due to inaccessibility (Stantec 2018b). A total of 20 emergence counts at 10 different roosts were conducted between June 26 and August 4, 2018. Of the 10 roosts, all 10 recorded bats emerged during emergence counts during at least one of the two nights surveys were conducted (100.0%). The highest number of bats recorded at a single roost was 48. The highest average emergence count was 36.5 bats/night. When all roosts used by bats tracked during this study are considered, the average emergence count was 13.8 bats/night (Stantec 2018b).

3.0 POTENTIAL IMPACT TO BIRDS AND BATS

3.1 BIRDS

3.1.1 Overview of Potential Impacts

Operational impacts of wind energy facilities on birds include varying degrees of displacement from the wind turbines and surrounding habitat, as well as mortalities resulting from collisions with turbines, transmission lines, and other facility structures (Winegrad 2004).

Wind turbines may displace birds from an area due to the creation of edge habitat, the introduction of vertical structures, and/or disturbances directly associated with turbine operation (e.g., noise, shadow flicker). Disturbance impacts are often complex, involving shifts in abundance, species composition, and behavioral patterns. The magnitudes of these impacts vary across species, habitats, and regions. Concerns have been raised that displacement from habitat may significantly affect certain avian populations (The Ornithological Council 2007). Although most research to date has focused on collision mortality associated with wind energy facilities, the limited data available indicate that avoidance impacts to birds generally extend approximately 246-2,625 feet (75-800 m) from a turbine, depending on the environment and the bird species affected (Strickland 2004). Studies in the western and Midwestern U.S. consistently show small-scale (<328 feet [100 m]) impacts on birds (Strickland 2004).

Direct collisions with the wind turbines can result in bird injury or fatality. A number of factors affect the probability of a bird colliding with a turbine, such as flight height, weather, and turbine avoidance behaviors. The number of avian fatalities at wind energy facilities is generally low when compared to the total number of birds detected at these facilities (Erickson et al. 2002).

AWWI (2014) compiled overall bird fatality rates (number of fatalities/MW/year) from approximately 100 studies across North America that published post-construction fatality data. Based on this compilation, overall bird fatality rates are relatively similar across North America (bird fatality was estimated at 3 to 5 fatalities/MW/year), though fatality rates at sites in the Great Plains appear to be lower than sites in the rest of the U.S. Fatalities in the Pacific region may be significantly higher, but it is unknown to what extent these differences reflect sample bias (AWWI 2014; Loss et al. 2013; Strickland et. al. 2011). Mortality rates at sites in the west and Midwest, particularly agricultural ones, have typically been at the low end of the national range. Publicly available estimates for the Midwest have been found to range from 0.00 to 7.17 birds/MW/year (Barclay et al. 2007; Poulton 2010).

No particular species or family has been identified as incurring greater numbers of fatalities at wind energy facilities. However, likely due to differences in abundance and use of habitat, bird groups have experienced varied impacts from wind turbines. Passerines, both resident and migrant, represent the majority (approximately 75%) of mortalities at wind turbines nation-wide (Erickson et al. 2001; Johnson et al. 2002) and result in spring and fall peaks of bird mortality rates at most wind energy facilities (Johnson et al. 2002). The most current fatality estimate for small birds is approximately 3.96 birds/MW/year (Erickson et al. 2014). Additionally, the USFWS calculated an extrapolated all-bird fatality rate of 5.82 birds/MW/year (USFWS 2016a). Although waterbird (waterfowl, shorebirds, and seabirds) mortality at wind energy facilities has been highly variable, national research has demonstrated that waterbirds rarely collide with inland turbines (Everaert 2003; Kingsley and Whittam 2007). The only sites experiencing regular waterfowl fatalities have been those located on the shores of large, open expanses of water (Erickson et al. 2002). Raptor mortality rates at Midwest sites have been very low; generally, one or two carcasses are found per study (Poulton 2010).

See Appendix A (Eagle Conservation Strategy) for a more in-depth discussion and review of potential impacts to eagles.

3.1.2 Potential Impacts from the Project

The Project is sited among hay/pasture, forested areas, and cultivated cropland. Small bird surveys to date indicate that many bird species utilize the Project Area at some point during the year. Some of the observed species are known to be adversely affected by wind development to some degree.

It is anticipated that the Project may affect individual birds, but based on data collected to-date, it is unlikely to adversely affect local or regional small bird populations. Displacement impacts from the turbines that would greatly alter the composition of the area’s avian community are unlikely. For species or individuals that are displaced, it is unclear if displacement impacts would persist for the life of the Project; certain species may adapt to the presence of the turbines (The Ornithological Council 2007). Studies of displacement impacts to birds from operating turbines are limited; clear and consistent patterns of impacts have yet to be established.

Operating turbines also pose a risk of bird mortalities from collisions. Bird mortality rates at other wind energy facilities in the Midwest have ranged from 0.00 to 7.17 birds/MW/year (Barclay et al. 2007; Poulton 2010). Studies at the Fowler Ridge Wind Farm, located in an agricultural landscape in Indiana, reported moderate mortality rates of 5.26 bird/turbine during the 2009 study for Phase 1 (Johnson et al. 2010). Bird fatality rates at HPWF are likely to peak during the spring and fall migration seasons, as has been observed at most wind energy facilities (Johnson et al. 2002). Passerines, both resident and migrant, represent the majority (75%) of mortalities at wind turbines nationwide (Erickson et al. 2001; Johnson et al. 2002). Night-migrating passerines have accounted for over 50% of avian fatalities at certain sites. However, no particular passerine species or group of species has been identified as incurring greater numbers of fatalities (Erickson et al. 2002). Birds taking off at dusk or landing at dawn or birds traveling in low cloud or fog conditions (which lower the flight altitude of most migrants) are likely at the greatest risk of collision (Kerlinger 1995). Nationally, mortality at wind farms has not been known to result in a significant population level impact to any one species, mainly because the migratory species impacted most by mortality are regionally abundant.

Collision risk is likely to be much lower for other bird groups in the Project Area. Waterfowl use may be increased in the Project Area during the winter months if the croplands within the Project Area attract large flocks of Canada geese (Erickson et al. 2002). National research has demonstrated that waterfowl and shorebirds rarely collide with inland turbines (Everaert 2003; Kingsley and Whittam 2007), perhaps because of the consistently high (500- 5,000 feet [150-1,500 m]) altitudes at which these species migrate over land (Kerlinger 1995).

See Appendix A (Eagle Conservation Strategy) for a more in-depth discussion and review of potential impacts to eagles.

3.2 BATS

3.2.1 Overview of Potential Impacts

Direct mortality at wind turbines is currently the greatest concern for bats at wind facilities (Cryan 2008a); commercial wind facilities have been found to impact many bat species (Arnett et al. 2008). Whether bats are attracted to wind turbines and the exact mechanisms by which wind turbines cause mortality are unclear (reviewed in Kunz et al. 2007a). However, several hypotheses have recently been put forth and tested, including the role of land cover and environmental conditions in attracting bats to wind turbine locations, behavioral factors that might make wind turbines attractive to bats, pressure changes from rotating blades causing “barotrauma”, and direct impact of unsuspecting migrant bats (Baerwald et al. 2008; Horn et al. 2008; Johnson et al. 2004; Kerns et al. 2005; reviewed in Kunz et al. 2007a).

The influence of landcover on bat mortality at wind turbine sites is unclear (Arnett et al. 2008). Johnson et al. (2004), for example, found no significant relationship between bat fatalities and landcover type within 328 feet (100 m) of wind turbines. They also found no significant relationship between bat mortality and distance to wetlands or woodlands (Johnson et al. 2004). Weather conditions, such as wind speed, rainfall, and temperature, have been found to have a significant impact on bat mortalities (Arnett et al. 2008). Bat mortality and insect activity are both high on nights with low wind speed when wind turbines are adjusted to rotate near their maximum revolutions per minute (Kerns et al. 2005). Bat fatalities decrease with increases in wind speed and precipitation intensity (Kerns et al. 2005; Arnett et al. 2009; Baerwald et al. 2009).

The primary bat species affected by wind facilities are believed to be migratory tree-roosting species that mostly emit low frequency calls (Johnson et al. 2004; reviewed by Kunz et al. 2007a). Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the United States and Canada and found that mortality has been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, nearly 75 percent were the migratory, foliage-roosting hoary bat, eastern red bat, and silver-haired bat (Kunz et al. 2007b).

Some researchers have suggested that bats that roost in foliage of trees for most of the year may be attracted to wind turbines because of their migratory and mating behavior patterns (e.g. Kunz et al. 2007a, Cryan 2008b). At dawn, these tree bats may mistake wind turbines for roost trees, thereby increasing the risk of mortality (Kunz et al. 2007a). Cryan (2008b) suggested that male tree bats may be using tall trees as lekking sites, calling from these sites to passing females. If this is the case, then tree bats may be more attracted to wind turbine sites after the turbines are erected. Migrating tree bats are also thought to depend on sight for navigation rather than echolocation, possibly resulting in the bats being unaware of the presence of wind turbines during migration (Cryan and Brown 2007). As further support for these hypotheses, the majority of bat fatalities occur mid-summer through fall, during approximately the same time frame as southward migration of tree bats (Arnett et al. 2008). Tree bats tend to be larger species that emit low frequency calls. Bats that use low frequency calls may be more inclined to forage above tree tops where there are few obstructions. Migratory bats may also fly higher to maximize efficiency. Thus, tree bats may be more likely to fly in the rotor-swept area of wind turbines when compared to smaller bat species that have different foraging and migration strategies.

Although the number of bat fatalities recorded at wind energy facilities varies regionally, reports of mortality have been highest along forested ridge tops in the eastern U.S. and lowest in open landscapes of Midwestern and western states (Kunz et al. 2007a). However, it is difficult to make direct comparisons among projects due to differences in study length, metrics used for searches, and calculations for compensating for study biases (Arnett et al. 2008). Fatality rates ranged from 0.00 bats/turbine/year to 28.5 bats/MW/year and averaged 7.12 bats/turbine/year (which is roughly 7.66 bats/MW/year based on an average turbine size of 0.93 MW) in 21 studies conducted at wind energy facilities across North America (Barclay et al. 2007). In the Midwestern U.S., bat fatalities range from 0.2 to 30.4 bats killed/MW/year, but higher fatality rates (up to 38.7 bats/MW/year) have been reported in the eastern U.S. (Poulton 2010; Arnett et al. 2008). Estimates from the Fowler Ridge Wind Farm in Indiana averaged 30.17 bats/turbine/year (17.85 bats/MW/year) at uncurtailed turbines, based on two years of intensive monitoring (Good et al. 2011, 2012).

The final Biological Opinion (BO) for the final 4(d) rule under the ESA regarding the northern long-eared bat reported that bat fatalities from wind energy within the species' range averaged 17.55 bats/MW/year, ranging from 1.42 bats/MW/year to 38.25 bats/MW/year (USFWS 2016b). The draft Midwest Wind Multi-Species Habitat Conservation Plan (MSHCP) used similar data to determine that, within the range of the Indiana bat in the Midwest, fatalities average 18.13 bats/MW/year, ranging from 12.16 bats/MW/year to 38.22 bats/MW/year (USFWS 2016a).

See the HPWF HCP for additional details on potential impacts to Indiana bats, northern long-eared bats, and little brown bats.

3.2.2 Potential Impacts from the Project

Pre-construction bat surveys are summarized in Section 2.2.5 above. They included pre-construction acoustic, mist net, and radio telemetry surveys, as well as a habitat assessment and emergence counts. Details pertaining to take estimations for the Covered Species are described in the HPWF HCP. The pre-construction surveys were used to assess the risk potential to all bat species at the Project.

The Project turbines present a risk of bat mortality due to collisions or barotrauma. Due to the location of the Project Area and amount of suitable bat habitat, it is anticipated that overall impacts resulting from the Project will likely be higher than other wind farms located in highly agricultural areas in the Midwest. Bat mortalities in the Midwest have mostly occurred in the swarming and migration seasons, typically between mid-July and mid-September (e.g., Kerlinger et al. 2007, Johnson et al. 2003, Howe et al. 2002). Based on data from the Midwestern United States, 6.5% of bat fatalities typically occur in the spring, 25.5% in the summer, and 68.0% in the fall (USFWS 2016a).

Migratory tree bat species have comprised the majority of fatalities in the Midwest and nationally (Erickson et al. 2002; Kunz et al. 2007a). Additionally, certain weather conditions, including low wind speeds and warmer temperatures, are likely to increase the risk of bat mortality at the Project Area, as these conditions have been demonstrated to coincide with nights of high bat mortality at wind energy facilities (Good et al. 2011; Gruver et al. 2009; Kunz et al. 2007a).

The turbines have been sited to avoid high-quality bat habitat, but the presence of the turbines, even in open, non-forested areas, poses some risk of bat mortality, and all species have foraging distances that could put them at risk of collision with wind turbines while foraging (Table 3-1), though individual species may be less likely to forage over open areas.

Table 3-1.Bat species potentially present within the proposed High Prairie Wind Energy Facility and documented foraging distances from publicly-available literature.

Species	Documented foraging distance	Captured during mist-net surveys?	Number of proposed turbines within foraging distance of capture location(s)[1]
Eastern red bat	Up to 4.6 mi (Hutchinson and Lacki 1991, as cited in Maxell 2015)	Yes	185
Hoary bat	Up to 12.4 mi (Barclay 1989, as cited in Maxell 2015)	Yes	185
Silver-haired bat	Up to 2.1 mi (Campbell et al. 1996)	Yes	62
Big brown bat	Up to 1.1 mi (Brigham 1991)	Yes	137
Evening bat	1.5 to 2.5 mi (Duchamp et al. 2004)	Yes	158-179
Little brown bat	Up to 3.9 mi (Randall et al. 2014)	Yes	139
Indiana bat	2.5 to 5.0 mi (USFWS 2018)	Yes	156-181
Northern long-eared bat	1.5 to 3.0 mi (USFWS 2014)	Yes	13-29
Tricolored bat	Up to 2.7 mi (Veilleux et al. 2003)	No	N/A

[1]This includes 10 alternative sites (185 total turbines), so the actual number within each boundary may be lower for some species since only 175 turbines will be built.

Bat mortality has been documented at Midwestern wind energy facilities in agricultural areas during the migration season, demonstrating that some migrating bats will fly over open land (Good et al. 2011; Kerlinger et al. 2007; Johnson et al. 2003; Howe et al. 2002). Bat migration patterns and behaviors, and subsequently, indicators of bat fatality risk at wind energy sites, are not well understood (Poulton 2010). However, High Prairie has used the best science available to incorporate avoidance and minimization strategies, including a turbine curtailment strategy, into the siting, design, and operation strategies for this Project (described in Section 4.0) in an attempt to reduce bat risk at the Project Area to the best of our current understanding. The operational strategies are intended to minimize take of all bat species at the Project.

See the HPWF HCP for additional details on potential impacts to Indiana bats, northern long-eared bats, and little brown bats.

4.0 AVOIDANCE AND MINIMIZATION MEASURES

4.1 CONSERVATION MEASURES IMPLEMENTED DURING SITE SELECTION AND PROJECT DESIGN

The Project's approach to siting was designed to avoid or reduce potential impacts to birds and bats. Pre-construction surveys were conducted to assess potential impacts to avian and bat resources and to assist in developing measures to avoid and minimize the identified potential impacts. These studies are summarized above in Section 2.2. The Project siting process incorporated considerations to avoid and minimize impacts to birds and bats, including bald eagles, Indiana bats, norther long-eared bats, and little brown bats.

General project design and siting measures to avoid or minimize risk to all avian and bat species include the following:

- Using the existing road network where possible to reduce the need for road construction.
- All permanent MET towers installed at the Project will be un-guyed.
- All electrical collection lines will be buried underground.
- The Project has been sited within close proximity to the Mark Twain Transmission line, minimizing the length of the generation-tie line needed to interconnect with the grid.
- Lighting at substations and other operations and maintenance facilities will be at a minimum required for safety and security needs (i.e., directional, hooded and/or shielded, low-intensity, low-sodium lights equipped with motion sensors). All internal turbine nacelle and tower lighting will be extinguished when unoccupied.
- The project will maximize power generation per turbine in order to reduce the number of turbines needed to achieve maximum energy production.
- All above ground power lines will be constructed in accordance with the most current Avian Power Line Interaction Committee (APLIC) Suggested Practices (APLIC 2012) to protect birds from electrocution and collision.
- Turbines have been sited as far from woodlands as feasible, with a goal of 1,000 ft where possible.
- Certain woodlands within the Project Area were designated "exclusion areas" and turbines are set-back a minimum of 1,000 ft from these areas. See the HPWF HCP for additional details on this measure.

4.2 CONSERVATION MEASURES TO BE IMPLEMENTED DURING CONSTRUCTION

Conservation measures to be implemented during construction that will avoid or minimize impacts to avian and bat species include the following:

- Vehicle speeds will be limited to the existing speed limits on public roads, and to 15 miles-per-hour on access roads to avoid wildlife collisions. Construction and O&M vehicles will be restricted to pre-designated access routes. Following construction activities, roads not needed for operations and maintenance will be restored to native vegetation.

- To the extent feasible, the area required for Project construction and operation will be minimized. The Project owner will develop a Habitat Restoration and Revegetation Plan for restoring all areas of temporary disturbance to their previous condition.

- Appropriate erosion control methods, as specified in the Project-specific Stormwater Pollution Prevention Plan (SWPPP) will be used during construction to eliminate or minimize runoff and avoid impacts to hydrology.

- Rocks unearthed during excavation will be used during construction or removed from the site rather than left in piles near the turbines. Such rock piles create habitat for small mammals which serve as prey for many raptor species. Additionally, parts and equipment which may be used as cover for prey will not be stored at the base of wind turbines while a turbine is operational and spinning.

- The Project owner will retain a biological firm as an on-call service provider throughout construction of the Project. This firm will be on-call to identify species either by photograph or via a site-visit if needed.

- Sensitive resources (e.g., nests) identified during pre-construction surveys will be flagged and all site personnel will be notified of their presence and necessary setbacks.

- If an injured or dead threatened, endangered, or species of conservation concern species is encountered during construction, all work within the immediate vicinity will stop and the appropriate agencies as well as the on-call biologist will be notified before construction is allowed to proceed.

- No unleashed dogs belonging to construction or operations personnel will be allowed on the Project site during construction or operations.

- All trash will be covered in containers and work sites will be cleared daily of any garbage and debris related to food.

- All employees and contractors working on the Project will be required to participate in the Worker Education and Awareness Program (WEAP). The WEAP will include training for identifying and responding to encounters with sensitive biological resources, including but not limited to bald eagle, Indiana bat, northern long-eared bat, and little brown bat.

- The project will not clear known bat maternity trees as stipulated by the Public Services Commission (PSC)

- The project will not clear known active or inactive eagle nest trees as stipulated by the PSC

Removal of suitable summer bat habitat for the construction of the Project will be minimized to the extent practicable. High Prairie will limit the timing of tree clearing to time periods when the bats are not present (1 November – 31 March). Should tree clearing be required outside of these dates, High Prairie will confer with the USFWS and contract with a qualified bat biologist to evaluate the suitability of trees to serve as maternity roosts and conduct emergence counts, if necessary, at any suitable roost tree to determine if the tree is occupied by bats. Therefore, the removal of habitat for Project construction or maintenance will not result in direct take; however, removal of habitat could indirectly affect the bats if it causes them to exert additional energy to locate suitable roosts or foraging areas upon their return to the area. The magnitude of the impact of tree removal varies depending on the scale of the roost loss, including how many roosts are lost and how much alternative habitat is available in the immediate vicinity (Kurta 2005). Therefore, if tree clearing is limited, and if suitable habitat exists in relatively close proximity to the removed habitat, bats can shift their roosting activity to minimize the impacts of habitat loss during the summer maternity season. Likewise, given the large amount of suitable habitat present within the Project Area, foraging by migrating bats is not anticipated to be impacted by the removal of small amounts of suitable habitat.

While tree removal has the potential to limit habitat availability if habitat is limiting in an area, given the large amount of suitable habitat present within the Project Area, and the documented presence of bat species throughout the Project Area, it is not anticipated that the loss of habitat related to tree removal for construction would result in the loss of any species.

All construction personnel will receive guidance on the importance of disclosing the presence of birds, particularly dead birds, nests or colonies. Training will generally cover issues pertaining to the environmental constraints and issues specific to the site, including sensitive habitats to be avoided (such as buffers around raptor nests or habitat of sensitive species) and how they are marked in the field; practices to minimize impacts to wildlife (such as project-specific speed limits); and procedures for reporting injured or dead birds and other wildlife. Materials to support this training will be provided by Environmental Managers or other appropriate personnel and will include photos of species of concern, maps showing sensitive areas to be avoided, and forms for reporting mortality and injury

4.3 CONSERVATION MEASURES TO BE IMPLEMENTED DURING OPERATIONS

Conservation measures to be implemented during operations that will avoid or minimize impacts to avian and bat species include many of the measures described above in Section 4.2 (e.g., lighting, training of staff).

Cut-in speed adjustments will be implemented as a minimization measure (below the cut-in speed, turbine blades will be feathered so that they do not spin). All curtailment studies to-date show a generally consistent inverse relationship between cut-in speeds and bat mortality. Curtailment actions effective at reducing risk of collision for all bat species are assumed to also be effective for the Indiana bat, northern long-eared bat, and little brown bat.

A cut-in speed of 5.0 m/s is proposed for the Project from sunset to sunrise from April 1 – October 31 when the air temperature is above 50ºF, which is expected to yield an average mortality reduction of 62% for all bat species. This reduction is likely even higher for *Myotis* species, which are adapted for foraging over water or near vegetation, rather than the open-air aerial hawking used by migratory tree bats (Norberg and Rayner 1987). Curtailment above even 4.0 m/s has been shown to reduce *Myotis* fatalities by over 90% (Gruver and Bishop-Boros 2015), and it is assumed that curtailment at 5.0 m/s would be even more protective.

All staff such as managers, supervisors, line crews, operations and maintenance staff, engineering, dispatch etc. will receive training on this BBCS. Training will include a general orientation to local, state and Federal laws and procedures for reporting dead or injured birds, and the operational mortality monitoring and reporting. Materials to support this training will include a power point presentation; copies of the BBCS; and short courses on how dead or injured birds and bats should be handled. Posters of project-specific species of interests will be present at the site. New materials and updates will be provided on an as-needed basis. New hires will receive training within the first 30 days of duty. Refresher courses on procedures will be held on a yearly basis.

5.0 TIER 4 – POST-CONSTRUCTION MONITORING

The objective of post-construction monitoring is to estimate the avian and bat mortality at the Project. It is then possible to compare mortality at the Project to other regional projects and to the estimated mortality predicted during the assessments completed for Tiers 1-3. Chapter 5 of the WEG identifies the following questions that will be addressed through performing post-construction studies:

1. What are the bird and bat fatality rates for the project?
2. What are the fatality rates of species of concern?
3. How do the estimated fatality rates compare to the predicted fatality rates?
4. Do bird and bat fatalities vary within the project site in relation to site characteristics?
5. How do the fatality rates compare to the fatality rates from existing projects in similar landscapes with similar species composition and use?
6. What is the composition of fatalities in relation to migrating and resident birds and bats at the site?
7. Do fatality data suggest the need for measures to reduce impacts?

5.1 POST-CONSTRUCTION MONITORING PLAN

The HPWF post-construction monitoring plan is described in the HPWF HCP, but will address all bird and bat fatalities observed within the Project Area. Post-construction monitoring is the method by which High Prairie will evaluate the effectiveness of the minimization measures and ensure that take of the Covered Species does not exceed the take limits set forth in the ITP. Because fatalities are expected to occur during the entire bat active season (April 1 – October 31), the post-construction monitoring will occur during this entire period as well.

Robust post-construction monitoring will occur for the first 6 years of operation to ensure initial permit compliance. Twice-weekly searches will be conducted with 60% of the turbines being searched on the roads and pads and 40% of the turbines having 60-meter circular cleared plots searched. This protocol may change over the 6 years; however, an overall detection probability of 0.2 over the 6-year permit term will be the goal (see HCP Section 7.3 for details).High Prairie used the USFWS Evidence of Absence (EofA) Software "Design Tradeoffs" tool (Dalthorp et al. 2017) to evaluate post-construction monitoring protocols for the Project.

5.1.1 Permits and Wildlife Handling Procedures

All necessary wildlife salvage/collection permits will be obtained from MDC and the USFWS to facilitate legal transport of injured animals and/or carcasses.

All bat carcasses found will be labeled with a unique number, individually bagged, and retained in a freezer at the O&M building. A copy of the original data sheet for each carcass will be placed in the bag with each frozen carcass. The carcasses may be used in searcher efficiency and carcass removal trials; however, mice purchased through a commercial source may be used as a surrogate. If a carcass of a bald eagle or an ESA- or state-listed species is found, High Prairie will arrange to submit the carcass, tissue sample, or the photograph (in the case of birds) to the appropriate authorities (USFWS for federally-listed species, MDC for state-listed species). Notification will occur within 48 hours of carcass discovery and species identification. If an injured bird or bat is found, the animal will be sent to a local wildlife rehabilitator, when possible. All bird carcasses will be identified in the field, if possible, and left in place. Digital photographs and location information of all bird carcasses will be taken and used for confirming identification when necessary.

5.1.2 Standardized Carcass Searches

Under HCP monitoring, a total of 70 full plots and 105 road and pad plots will be established. Monitoring may also be conducted under a Technical Assistance Letter (TAL), and will follow these same general protocols, but with 10% full plots and 90% roads and pads. Turbines will be randomly assigned to the full plot or road and pad group; however, preference will be given for full plots to be placed in fields where crops are not currently grown (e.g., pasture). Observers will walk at a rate of approximately 2 miles-per-hour, scanning the ground for carcasses within 10 ft of each transect. The observer will start at one side of the circular plot and systematically search in a north/south or east/west direction, switching the search pattern on a weekly basis. At road/pad turbines, the observer will walk the access road starting at 262.5 ft from the turbine and walk towards the turbine, around the turbine, and back towards their vehicle, searching out 10 ft on each side until the entire road/access pad is searched. These plots will be described in detail in the HPWF HCP.

Carcass searches will be conducted by qualified biologists, operating under applicable permits and experienced in conducting fatality search methods, including proper handling and reporting of carcasses. Searchers will be familiar with and able to accurately identify bird and bat species likely to be found in the Project Area. Any unknown bats or suspected Indiana or northern long-eared bats discovered during fatality searches will be sent to a qualified USFWS-approved bat expert for positive identification, or may be sent for genetic testing to determine species and/or sex. Mortality of any federally-listed species, including eagles, will be reported to the USFWS Columbia, Missouri Ecological Services Office within 48 hours of identification. Bird carcasses will be identified in the field. Digital photographs and location information of all bird carcasses will be taken and used for confirming identification when necessary. Carcasses will be photographed from several angles to provide the best chance of photographic identifications, and photos will be verified by a bird expert for positive identification when possible.

For all carcasses found, data recorded will include:

- Date and time,
- Initial species identification,
- Sex, age, and reproductive condition (when possible),
- Global Positioning System (GPS) location,
- Distance and bearing to turbine,
- Substrate/ground cover conditions,
- Condition (intact, scavenged),

- Any notes on presumed cause of death, and
- Wind speeds and direction and general weather conditions for nights preceding search.

A digital picture of each detected carcass will be taken before the carcass is handled and removed. Bird carcasses will be documented in place and not removed. As previously mentioned, all bat carcasses will be labeled with a unique number, bagged, and stored frozen as needed for future studies (with a copy of the original data sheet) at the O&M building. TG High Prairie will also collect a tissue sample from each bat carcass for submission to the USFWS and/or MDC. Carcasses will be retained for a minimum of one year.

Bird and bat carcasses found in non-search areas will be coded as "incidental finds" and documented as much as possible in a similar fashion to those found during standard searches. Maintenance personnel will be informed of the timing of standardized searches, and in the event that maintenance personnel find a carcass or injured animal, these personnel will be trained on the collision event reporting protocol. Any carcasses found by maintenance personnel will also be considered incidental finds. Incidental finds will be included in survey summary totals but will not be included in the mortality estimates because the lack of standardized search effort and search area, as well as the lack of searcher efficiency and carcass removal trials prohibits calculations to account for bias and extrapolate incidental carcasses found to estimated fatalities.

5.1.3 Searcher Efficiency and Carcass Removal Trials

To assess carcass persistence, approximately 40 bat carcasses will be randomly placed within survey plots at varying times during the search seasons (spring, summer, fall). High Prairie's contractors will rely on contacts with veterinary labs that can provide bat carcasses and/or use of bat carcasses collected onsite during monitoring studies; however, in the event that 40 are not available, brown mice or small black rats will be used as surrogates for bat carcasses. The carcasses will be placed at least once during each season, thereby spreading the trials throughout the survey period to incorporate the effects of varying weather, climatic and vegetation conditions, and scavenger types and densities. Carcasses will be dropped from waist high or higher and allowed to land in a random posture. Each trial carcass will be discreetly marked (with tape or thread) prior to placement so that it can be identified as a study carcass if it is found by observers or wind facility personnel or moved by a scavenger.

Observers conducting carcass searches will monitor the trial bats over a 30-day period according to the following schedule as closely as possible. Carcasses will be checked every day for the first week, and then on days 10, 14, 21, and 30. This schedule may vary slightly depending on weather and coordination with the other survey work. At each visit, the observer will note the condition of the carcass (e.g., intact, scavenged, complete). Trial carcasses will be left at the location until the end of the 30-day trial or until the carcass is removed entirely by scavengers. After 30 days, any remaining evidence of the carcasses will be removed.

Searcher efficiency trials will be completed concurrent with scavenger trials using the same test subjects as used in carcass persistence trials. Searchers will be unaware of the placement of the test subjects done on the morning of turbine searches. Test subjects will be checked after searcher efficiency trials to ensure the subjects were present at the time of the trial. These carcass removal and searcher efficiency trials will be used to adjust estimates of bat fatalities using contemporary equations for estimating fatality.

5.1.4 Statistical Methods for Estimating Bias Correction Factors and Overall Bat Fatality Rate

The method for estimating overall bird and bat fatality rates will make use of contemporary, peer-reviewed equations, such as the estimator proposed by Erickson et al. (2003) as modified by Young et al. (2009), the empirical estimator presented in Good et al. (2011), the estimator proposed by Huso (2010), or the U.S. Geological Survey's Generalized Estimator[2].

6.0 ADAPTIVE MANAGEMENT

This BBCS represents a process through which High Prairie plans to reduce impacts to birds and bats at the Project while still maintaining optimal Project operation and generating electricity from renewable, emissions-free wind. High Prairie has sited the Project and incorporated measures to avoid and minimize impacts to birds and bats, including sensitive and listed species (based on consultations with MDC and USFWS). Adaptive management is a process that will allow High Prairie to adjust the avoidance measures outlined in this BBCS to reflect new information or changing conditions in order to reach a goal – in this case minimization of impacts to all bird and bat species, while minimizing effects on the operation of the Project. Changes to the Project's avoidance and minimization plan may be triggered by certain events; High Prairie will coordinate with both USFWS and MDC prior to implementing such changes. The adaptive management plan will apply throughout the life of the Project; on-going evaluation and adaptation of the Project will provide effective measures for avoiding and reducing impacts to birds and bats. Adaptive management specific to the Indiana bat, northern long-eared bat, and little brown bat is included in the HPWEF HCP.

Examples of specific events which will trigger adaptive management measures, in coordination with USFWS and MDC, include:

- Discovery of a mass avian or bat mortality event (> 50 individuals in one day);
- Take of an ESA-listed species (excluding the northern long-eared bat while the current 4(d) rule is in effect and excluding any species that take coverage has been received for);
- Take of a state-listed species; and
- ESA listing of a new bird or bat species known to occur or which has the potential to occur in the Project Area that is not already covered through an Incidental Take Permit (ITP).

Additional adaptive management measures will be designed to resolve any issues that arise on a case-by-case basis. Some examples of adaptive management include:

- Using sound or scent deterrents to deter wildlife from colliding with turbines;
- Installing a "smart curtailment" system that could shut turbines off or increase the cut-in speed when bat activity is high or when certain species are near the rotor swept zone;
- Modification of wind turbine operations; and
- Additional training of wind farm staff.

[2] https://code.usgs.gov/ecosystems/GenEst/tags/1.0.0

7.0 LIST OF PREPARERS

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8.0 REFERENCES

Allen, C.R., J.R. Flinn, J.T. Layne, and L.W. Robbins. 2008. Efficient repeatable approach to quantitative call identification. North American Symposium on Bat Research. Scranton, PA.

American Wind Wildlife Institute (AWWI). 2014. Wind Turbine Interactions with Wildlife and their Habitats: A Summary of Research Results and Priority Questions. Washington, D.C. Available from: http://awwi.org/wp-content/uploads/2014/05/AWWI-Wind-Wildlife-Interactions-Factsheet-05-27-14.pdf.

Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Tankersley. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management 72(1):61-78.

Arnett, E.B., M. Schirmacher, M.M.P. Huso, and J.P. Hayes. 2009. Effectiveness of changing wind turbine cut-in speed to reduce bat fatalities at wind facilities. An annual report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas.

Baerwald, E.F., G.H. D'Amours, B.J. Klug and R.M.R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology 18(16):R695-R696.

Baerwald, E.F., J. Edworthy, M. Holder, and R.M. Barclay. 2009. A Larger-Scale Mitigation Experiment to Reduce Bat Fatalities at Wind Energy Facilities. Journal of Wildlife Management 73(7):1077-1081.

Barclay, R.M.R., E.F. Baerwald, and J.C. Gruver. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotor size and tower height. Canadian Journal of Zoology 85:381-387.

Bat Conservation International, Inc. (BCI). 2017. Species Profiles: Missouri. http://www.batcon.org/resources/media-education/species-profiles. Accessed December 4, 2017.

Britzke, E. R., K. L. Murray, J. E. Heywood, and L. W. Robbins. 2002. Acoustic Identification. *In* The Indiana Bat: Biology and Management of an Endangered Species (A. Kurta and J. Kennedy, eds) Bat Conservation International, Austin, TX.

Carroll, S. K., T. C. Carter, and G. A. Feldhamer. 2002. Placement of nets for bats: Effects on perceived fauna. Southeastern Naturalist, 1:193-198.Clawson, R. 1986. An investigation of the summer distribution and status of the Indiana bats in Missouri. Final report. Federal Aid Project ;W-13-R, Fish and Wildlife Res. Cen., Columbia, Missouri. 4pp.

Center for Biological Diversity (CDB) and Defenders of Wildlife (DW). 2016. Petition to List the Tricolored Bat *perimyotis subflavus* as Threatened or Endangered Under the Endangered Species Act. June 14, 2016.

Cryan, P. 2008a. Overview of Issues Related to Bats and Wind Energy. Web Version of Presentation to the Wind Turbine Guidelines Advisory Committee Technical Workshop & Federal Advisory Committee Meeting, Washington, D.C., 26 February, 2008: U.S. Geological Survey General Information Product. 71pp.

Cryan, P. 2008b. Mating behavior as a possible cause of bat fatalities at wind turbines. Journal of Wildlife Management 72:845-849.

Cryan, P. M., and A. C. Brown. 2007. Migration of bats past a remote island offers clues toward the problem of bat fatalities at wind turbines. Biological Conservation 139:1–11.

Dalthorp, D., M. Huso, and D. Dail. 2017. Evidence of absence (v2.0) software user guide: U.S. Geological Survey Data Series 1055, 122 p., https://pubs.usgs.gov/ds/1055/ds1055.pdf

Erickson, W.P., G. D. Johnson, M. D. Strickland, D. P. Young Jr., K. Sernka, and R. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Avian Collision Mortality in the United States. Washington, DC: Resolve, Inc.

Erickson, W.P., G.D. Johnson, D.P. Young, M.D. Strickland, R.E. Good, M. Bourassa, K. Bay and K.J. Sterna. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. Final report prepared for Bonneville Power Administration, Portland OR. WEST, Inc., Cheyenne, WY. 124 pp.

Erickson, W.P., Gritski, B., and K. Kronner. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report, August 2003. Technical report submitted to energy Northwest and the Nine Canyon Technical Advisory Committee.

Erickson, W.P, M.M. Wolfe, K.J. Bay, D.H. Johnson, and J.L. Gehring. 2014. A Comprehensive Analysis of Small-Passerine Fatalities from Collision with Turbines at Wind Energy Facilities. PLoS One 9(9):e107491.

Everaert, J. 2003. Wind turbines and birds in Flanders: preliminary study results and recommendations. Natuur. Oriolus. 69:145-155.

Good, R.E., W. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat Monitoring Studies at the Fowler Ridge Wind Energy Facility Benton County, Indiana, April 13 – October 15, 2010. Prepared for: Fowler Ridge Wind Farm. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming. January 28, 2011.

Good. R. E., A. Merrill, S. Simon, K. L. Murray, and K. Bay. 2012. Bat Monitoring Studies at the Fowler Ridge Wind Farm, Benton County, Indiana. Final Report: April 1 – October 31, 2011. Prepared for Fowler Ridge Wind Farm, Fowler, Indiana. Prepared by Western EcoSystems Technology, Inc. (WEST, Inc.), Bloomington, Indiana.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin. July 21, 2008-October 31, 2008, and March 15, 2009-June 4, 2009. Western EcoSystems Technology, Inc., Cheyenne, Wyoming. 104 pp.

Gruver, J. and L. Bishop-Boros. 2015. Summary and Synthesis of Myotis Fatalities at Wind Facilities with a Focus on Northeastern North America. Prepared for EDP Renewables. Prepared by Western EcoSystems Technology, Inc. April 13, 2015.

Horn, J.W., E.B. Arnett and T. H. Kunz. 2008. Behaviorial responses of bats to operating wind turbines. Journal of Wildlife Management 72(1):123-132.

Howe, R.W., W. Evans, and A.T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Wisconsin Public Service Corporation, Madison, Wisconsin.

Huso, M.M.P. 2010. An estimator of wildlife fatality from observed carcasses. Environmetrics, n/a. doi: 10.1002/env.1052.

Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, D. A. Shepherd, and S. A. Sarappo. 2002. Collision mortality of local and migrant birds at a large-scale wind-power development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin. 30:879-887.

Johnson, G., M. Perlik, W. Erickson, M. Strickland, D. Shepherd, and P. Sutherland, Jr. 2003. Bat Interactions with Wind Turbines at the Buffalo Ridge, Minnesota Wind Resource Area: An Assessment of Bat Activity, Species Composition, and Collision Mortality. Prepared for EPRI, Palo Alto, California, and Xcel Energy, Minneapolis, Minnesota: 2003. 1009178.

Johnson, G.D., M.K. Perlik, W.P. Erickson, and M.D. Strickland. 2004. Bat Activity, Composition and Collision Mortality at a Large Wind Plant in Minnesota. Wildlife Society Bulletin 32(4):1278-1288.

Johnson, G.D., M. Ritzert, S. Nomani, and K. Bay. 2010. Bird and Bat Fatality Studies, Fowler Ridge III Wind-Energy Facility, Benton County, Indiana. April 2 - June 10, 2009. Prepared for BP Wind Energy North America. Prepared by Western EcoSystems Technology, Inc. (WEST, Inc.), Cheyenne, Wyoming.

Kerlinger, P. 1995. How Birds Migrate. Stackpole Books. Mechanicsburg, Pennsylvania.

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory Bird and Bat Monitoring Study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005 - August 2006. Final Draft. May 2007. Prepared for Orrick Herrington & Sutcliffe, LLP. Washington, D.C. 41 pp.

Kerns, J, W. P. Erickson, and E. B. Arnett. 2005. Bat and bird fatality at wind energy facilities in Pennsylvania and West Virginia. Pages 24–95 in E. B. Arnett, editor. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas, USA.

Kingsley, A., and B. Whittam. 2007. Wind Turbines and Birds: A Background Review for Environmental Assessment. Prepared by Bird Studies Canada Prepared for Environment Canada / Canadian Wildlife Service.

Kunz, T.H., E.B. Arnett, W.P. Erickson, A.R. Hoar, G.D. Johnson, R.P. Larkin, M.D. Strickland, R.W. Thresher, and M.D. Tuttle. 2007a. Ecological impacts of wind energy development on bats: questions, research needs and hypotheses. Frontiers in Ecology and the Environment 5:315-324.

Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak. 2007b. Assessing impacts of wind-energy development on nocturnally active birds and bats: a guidance document. Journal of Wildlife Management 71:2449-2486.

Kurta, A. 2005. Roosting Ecology and Behavior of Indiana Bats (Myotis sodalis) in Summer. Pp. 29-42 in K.C. Vories and A. Harrington (eds.), Proceedings of the Indiana Bat and Coal Mining: A Technical Interactive Forum. Office of Surface Mining, U.S. Department of the Interior, Alton, IL.

Loss, S.R., T. Will, and P.P. Marra. 2013. Estimates of Bird Collision Mortality at Wind Facilities In The Contiguous United States. Biological Conservation 168:201-209.

Missouri Department of Conservation (MDC). 2015. Missouri State Wildlife Action Plan. Conserving healthy fish, forests, and wildlife. Columbia, Missouri. 253 pp.

Missouri Department of Conservation (MDC). 2018. List of endangered species. Available at: https://mdc.mo.gov/property/greener-communities/heritage-program/results/county/Schuyler and Adair. Accessed on October 16, 2018.

Murray, K.L., E.R. Britzke, B.M. Hadley, and L.W. Robbins. 1999. Surveying bat communities: a comparison between mist nets and the Anabat II bat detector system. Acta Chiropterologica, 1: 105-112.

Norberg, U.M., and J.M.V. Rayner. 1987. Ecological morphology and flight in bats (Mammalia; Chiroptera): wing adaptations, flight performance, foraging strategy and echolocation. Philosophical Transactions of the Royal Society B 316:335-427. September 16, 1987.

Ornithological Council, The. 2007. Critical Literature Review: Impact of Wind Energy and Related Human Activities on Grassland and Shrub-steppe Birds. Prepared for the National Wind Consulting Council. Literature Review by Sarah Mabey and Ellen Paul. October 2007.

Poulton, V. 2010. Summary of Post-Construction Monitoring at Wind Projects Relevant to Minnesota, Identification of Data Gaps, and Recommendations for Further Research Regarding Wind-Energy Development in Minnesota. Prepared for the State of Minnesota Department of Commerce. Prepared by Western EcoSystems Technology, Inc., Cheyenne, Wyoming.

Reid, F. A. 2006. A Field Guide to Mammals of North America North of Mexico (Volume 4). Houghton Mifflin Harcourt.

Robbins, L. W., K. L. Murray, and P. McKenzie. 2008. Evaluating the Effectiveness of the Standard Mist Netting Protocol for the Endangered Indiana Bat *(Myotis sodalis).* Northeastern Naturalist, 15:275-282.

Robbins, L.W., C.R. Allen, B.T. Hale, J. Bowcock, J.R. Lemen and S. Romeling. 2010. Bat Activity during the fall migratory period at the proposed wind power facility in Schuyler County, Missouri (Final Report). Prepared for Ecology and Environment, Inc. December 14, 2010.

Robbins, L.W, B.T. Hale, S. Romeling, and J.R. Lemen. 2012. Evaluation of Myotis Activity: Capture, Telemetry, and Acoustic Analyses of Potential Interactions at a Wind Energy Facility. Missouri State University. Springfield, MO. 30 pp. March 7, 2012.

Stantec Consulting Services Inc. (Stantec). 2016. Indiana Bat, Northern Long-eared Bat and Little Brown Bat Surveys, High Prairie Wind Energy Facility, Schuyler County, Missouri. November 7, 2016.

Stantec. 2018a. Raptor Nest Survey, High Prairie Wind Energy Facility, Adair and Schuyler Counties, Missouri.

Stantec. 2018b. Indiana Bat, Northern Long-eared Bat and Little Brown Bat Surveys, High Prairie Wind Energy Facility, Adair and Schuyler Counties, Missouri.

Strickland, D. 2004. Overview of Non-Collision Related Impacts from Wind Projects. Resolve, Inc., Washington, D.C.:34 – 38.

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.

U.S. Fish and Wildlife Service. 1999. Agency Draft Indiana Bat *(Mvotis sodalis)* Revised Recovery Plan. Region 3, US Fish and Wildlife Service, Fort Snelling, MN.

United States Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Region 3, U.S. Fish and Wildlife Service, Fort Snelling, Minnesota.

USFWS. 2012. Land-based Wind Energy Guidelines. U.S. Fish and Wildlife Service. 71 pp. March 23, 2012.

USFWS. 2016a. Midwest Wind Energy Multi-Species Habitat Conservation Plan, Draft Environmental Impact Statement. U.S. Fish and Wildlife Service, Midwest Region. April 2016.

USFWS. 2016b . Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions. U.S. Fish and Wildlife Service Regions 2, 3, 4, 5, and 6. Prepared by U.S. Fish and Wildlife Service Midwest Regional Office, Bloomington, MN. January 5, 2016.

USFWS. 2018. Information for Planning and Consultation (IPaC). https://ecos.fws.gov/ipac/. Accessed October 16, 2018.

U.S. Geological Survey (USGS). Land Cover Institute (LCI). 2012. National Land Cover Database 92 Land Cover Class Definitions. http://landcover.usgs.gov/classes.php. Last modified December 2012. Website accessed December 5, 2017.

Veilleus, J.P., J.O. Whitaker, and S.L. Veilleux. 2003. Tree-roosting ecology of reproductive female eastern pipistrelles, Pipistrellus subflavus, in Indiana. Journal of Mammalogy, 84(3): 1068-1075.

Winegrad, G. 2004. Wind Turbines and Birds. In Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts. Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., Susan Savitt Schwartz, ed. September 2004.

Young, D.P., Erickson, W.P., Bay, K., Nomani, S., and W. Tidbar. 2009. Mount Storm Wind Energy Facility, Phase 1 Post-Construction Avian and Bat Monitoring. July-October 2008. Prepared for NedPower Mount Storm, LLC. 54 pp.

APPENDIX A: EAGLE CONSERVATION STRATEGY

APPENDIX A

Eagle Conservation Strategy

High Prairie Wind Energy Facility

Adair and Schuyler Counties, Missouri

April 21, 2020

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1.0 INTRODUCTION

High Prairie Wind Energy Facility (HPWF or Project) is a proposed wind energy project located near Queen City, Missouri, in Adair and Schuyler counties, Missouri (Figure 1). The project area is approximately 113,974 acres (ac) in size and is dominated by pastureland, forest, and agricultural fields in row crop production. Both large and small tracts of forest, rural residences, and farmsteads are scattered throughout the project area. HPWF is the responsible party for implementing this Eagle Conservation Strategy (ECS).

1.1 STATEMENT OF PURPOSE

HPWF, as part of its voluntary due diligence process, is developing this ECS as part of the BBCS to avoid and minimize impacts to eagles associated with operations of the Project prior to development of the Eagle Conservation Plan (ECP) and application for an Eagle Take Permit (ETP) once data collection is complete. This ECS will also document HPWF's scientific analysis of the Project's impacts to eagles and their habitats and the systematic processes which were used for evaluating these impacts. The ECS uses the tiered approach described in the U.S. Fish and Wildlife Service's (USFWS) Land Based Wind Energy Guidelines (WEG; USFWS 2012) and Eagle Conservation Plan Guidance (ECP Guidance; USFWS 2013) to assess the impacts to eagles.

This ECS will be in effect throughout the life of the Project as an appendix to the BBCS. The document may need to be updated from time to time in the future, as laws (or interpretations of laws) change and further evidence is gathered through research as to what are effective methods for protecting eagles from wind turbine strikes, and after development and implementation of the ECP for the Project (i.e., the measures in the ECP will take precedence, and potentially replace some measures currently in this ECS). The main goals of the HPWF ECS are to:

- Act as a guideline for the HPWF ECP;
- Avoid and minimize eagle fatalities or disturbance at the Project;
- Comply with federal and state wildlife regulations (e.g., Bald and Golden Eagle Protection Act [BGEPA]);
- Effectively document any eagle injuries or fatalities to provide a basis for ongoing development of eagle protection procedures;
- Outline and summarize ongoing and past surveys, monitoring, and management efforts to avoid and minimize adverse eagle impacts throughout the Project;
- Implement adequate training for all personnel and subcontractors;
- Plan for, and commit to, effective and routine coordination between HPWF and the USFWS and Missouri Department of Conservation (MDC); and
- Demonstrate HPWF's commitment to implement best management practices, as outlined in the ECS, to avoid and minimize impacts to eagles and their habitats to the extent practicable.

This ECS outlines the avoidance and minimization measures, monitoring, adaptive management, and eagle-specific commitments made by HPWF.

1.1.1 ECS Terms

This ECS is part of the HPWF BBCS and will be in effect through the duration of the BBCS (see Section 1.1.1 of the BBCS), though it may be updated occasionally (e.g. when the ECP for the Project is developed, as those measures will take precedence). It will also be updated as needed through adaptive management (see Section 6.0). This preliminary ECS's avoidance and minimization measures (Section 4.0), post-construction monitoring plan (Section 5.0), and adaptive management plan (Section 6.0) will act as a guide for HPWF as it goes through the process of developing an ECP and obtaining an ETP.

1.1.2 ECS Project Area

This ECS applies to all lands owned (substation and O&M Facility) and leased (turbines, access roads, underground electrical collection systems and transmission lines) by HPWF for the operation of the Project. These lands include the locations of the 175 turbines and associated facilities, as well as a surrounding buffer (based on site-specific eagle data and will be explained at length in the final HPWF ECP).

1.2 REGULATORY FRAMEWORK

1.2.1 Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)

The Migratory Bird Treaty Act of 1918 (MBTA), 16 U.S.C. 703, et seq., prohibits the taking, possession, transportation, importation, exportation, and sale/purchase/barter of migratory birds, their eggs, parts, and nests, except as authorized under a valid permit. Under the MBTA, "take" is defined as "to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture or collect." The bird species protected by MBTA are listed in 50 CFR §10.13. In total, 1,007 bird species, including bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), are protected by the MBTA. Incidental take of migratory birds is not prohibited by the MBTA[1].

1.2.2 Bald and Golden Eagle Protection Act (BGEPA)

The Bald and Golden Eagle Protection Act of 1940 (16 USC 668-668d and 50 CFR 22.26), and its implementing regulations, provides additional protection to bald eagles and golden eagles such that it is unlawful to take an eagle.

The USFWS published a final rule (Eagle Permit Rule) on September 11, 2009, under BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles ''for the protection of…other interests in any particular locality'' where the take is compatible with the preservation of the bald eagle and the golden eagle, is associated with and not the purpose of an otherwise lawful activity, and cannot practicably be avoided (74 FR 46836). This rule was revised and finalized on December 16, 2016 (81 FR 91494-91554). Revisions included changes to permit issuance

[1] M-Opinion (M-37050) memorandum dated December 22, 2017, determined that the MBTA does not prohibit incidental take. Available at: https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf.

criteria and duration, definitions, compensatory mitigation standards, criteria for eagle nest removal permits, permit application requirements, and fees.

1.2.3 Wildlife Code of Missouri

The Wildlife Code of Missouri (3 CSR 10-4.111), published by the Missouri Secretary of State, extends special protection to endangered wildlife and listed species considered to be threatened with extinction. The Code prohibits the importation, transportation, sale, purchase, taking, possession, or exportation of any state-endangered wildlife or plant species, in whole or in part.

1.3 USFWS EAGLE CONSERVATION PLAN GUIDANCE (ECP GUIDANCE)

In May 2013, the USFWS announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2 (USFWS 2013). The ECP Guidance provides a means of compliance with the BGEPA by providing recommendations and in-depth guidance for:

- Conducting early pre-construction assessments to identify important eagle use areas;
- Avoiding, minimizing, and/or compensating for adverse effects to eagles; and
- Monitoring for impacts to eagles during construction and operation.

The ECP Guidance interprets and clarifies the permit requirements in the regulations at 50 CFR 22.26 and 22.27 and does not impose any binding requirements beyond those specified in the regulations. HPWF is preparing an ECP to fully outline the measures taken to minimize and mitigate impacts to bald eagles.

The ECPG Guidance provides a staged approach to address eagle concerns during wind energy development (USFWS 2013).

2.0 STAGES 1 AND 2 – EAGLE RESOURCES

This section covers Stage 1 of the ECP Guidance, which is a broad, landscape-scale evaluation of technical literature, agency files, on-line biological databases, data from nearby projects, industry reports, geodatabases, and species experts. This corresponds with the preliminary site evaluation (WEG Tier 1; see Section 2 of the BBCS), and site characterization (WEG Tier 2; see Section 2 of the BBCS). The objective of this stage is to identify, at the landscape level, potential wind facility locations with manageable risk to eagles.

In addition, this section covers Stage 2 of the ECP Guidance, which includes site-specific surveys and intensive observation to determine eagle exposure rate and distribution of use in the project area, plus locations of occupied eagle nests, migration corridors, stopover sites, foraging and concentration areas, and communal roosts in the project area. This corresponds with the review of field studies to document wildlife and habitat (WEG Tier 3; see Section 2 of the BBCS) to give a general overview of the Project's potential impact to eagles. The objective of this stage is to obtain site-specific data to predict eagle fatality rates and disturbance take at the Project and to investigate other aspects of eagle use, such as the distribution of occupied nests, areas of seasonal concentration, and intensity of use throughout the project area.

2.1 STAGE 1 – LANDSCAPE-SCALE EVALUATION

2.1.1 Project and Site Description

TG High Prairie, LLC (High Prairie) is developing the 400-megawatt (MW) High Prairie Wind Energy Facility, located in Adair and Schuyler counties, Missouri, near Queen City (BBCS Figure 1). The Project will comprise 12 V112 3.45-MW and 163 V120 2.2-MW wind turbine generators (WTGs; BBCS Figure 3) which will connect to one of the two substations. The northern and southern substations will connect via an 8.9-mile 345 kV transmission line. The northern substation will also connect to the Mark Twain Transmission Line via a 10.2-mile 345 kV transmission line.

The project area is approximately 113,873 ac in size. Agricultural lands (i.e., crops, hay, herbaceous grassland), herbaceous wetlands, and open water are the predominant land cover types, comprising approximately 76% of the project area (86,093 ac). Forest (to include shrub/scrub habitat and woody wetlands) makes up approximately 20% of the project area (22,769 ac). Various stages of developed and barren land make up an additional 4% of the project area (5,010 ac). A full list of landcover types, acreages, and percentages of the overall project area can be found in the BBCS (Section 2.1.1; Figure 2). Additionally, the North Fork Salt River and Floyd Creek run southeast/northwest through the southwestern third of the Project, the North Fork South Fabius River runs southeast/northwest through the middle of the Project, and the South Fork Middle Fabius River runs northwest/southeast through the northeastern third of the Project.

2.1.2 Eagle Resources

Row crops, hay and pasture, and developed space make up over 75% of the project area. These areas do not generally provide suitable breeding, foraging, or migration stopover habitat for eagles. Forests, shrub/scrub, open water, and wetlands make up over 20% of the project area and can provide suitable breeding and migration stopover habitat.

The Missouri Natural Heritage Program (MNHP) notes that bald eagles are known from Adair and Schuyler counties, and the bald eagle is a species of conservation concern in those counties (MDC 2018a). The golden eagle is primarily a western species, which wanders into Missouri in small numbers during the winter (MDC 2012).

2.1.3 Bald and Golden Eagles

2.1.3.1 Bald Eagle

The bald eagle was listed as an endangered species in 1966 under the Endangered Species Preservation Act. It was delisted in 2007 when recovery objectives were met (USFWS 2009). The bald eagle is still protected under the BGEPA.

Northern breeding populations return to their breeding grounds between January and March (Buehler 2000). Bald eagles typically nest along forested coasts, rivers, streams, reservoirs, or large lakes (Buehler 2000; USFWS 2009). Nests are often constructed in mature or old-growth trees and snags within 1.24 miles of food resources (Buehler

2000; USFWS 2009) and less commonly on cliffs, rocky outcrops, and human-made structures (USFWS 2009). Bald eagles typically choose the largest nest tree available having a limb structure that supports their heavy nests and provides good visibility and easy access (Buehler 2000). Eagles also tend to select nest trees that, on average, are more than 547 yards from human development (Buehler 2000), although some will build within 109 yards of development. Nest tree diameter ranges from 20 to 75 inches, and nest height ranges from 22 to 66 yards (Stalmaster 1987). Nests generally are built against or near the tree trunk and just below the crown of the tree (Buehler 2000).

Bald eagle home range size varies based upon location, time of year, breeding status, and food availability (Buehler 2000). Bald eagles defend territories, often using the same territory each year (USFWS 2009). Territory size ranges from 0.19 to 1.5 square miles (Hodges and Robards 1982; Stalmaster 1987; Gerrard et al. 1992; Buehler 2000). Egg laying may occur as early as February or as late as April, depending on the region. The incubation period is usually around 35 days (Buehler 2000), and fledging is typically between June and August. Eagles can be sensitive to disturbance and may abandon nest sites in response to human activities (USFWS 2009).

Bald eagles primarily hunt from perches or by soaring over foraging areas. Bald eagles usually soar above areas of open water while hunting, although they may at times soar over land (Buehler 2000). The typical diet of a bald eagle consists primarily of fish, but it will also eat birds, mammals, and reptiles (Buehler 2000). While most prey is captured while flying, eagles opportunistically feed on carrion.

Bald eagles have been noted to occur across much of the state of Missouri, particularly during the winter. The Missouri bald eagle population continues to increase, with 166 nesting pairs recorded in 2011 (MDC 2012); however, the species remains a species of conservation concern in the state, with a state rank of S3 (vulnerable; MDC 2018a). The main nesting locations for bald eagles in Missouri are in the center of the state, but there have historically been one to two nests observed in Adair and Schuyler counties (see Section 2.2.2 for the results of eagle nest surveys conducted for the Project in 2018). Missouri is more commonly used as an overwintering ground for bald eagles, with 2,656 eagles recorded during the 2012 annual winter count, mainly arriving in December and leaving in February (MDC 2012). They can generally be found along waterways (MDC 2012, 2018b); within the project area, those watersheds include the Salt River and the South and Middle Fabius Rivers (MDC 2018b).

2.1.3.2 Golden Eagle

Golden eagles are not federally-listed or state-listed in Missouri, but they are protected under the BGEPA. They are mainly a western species that have never been common in the eastern U.S. and are not currently known to occur in Missouri except as occasional transient visitors. Golden eagles may be observed in Missouri in small numbers during the winter; five were recorded during the 2012 annual winter count, though none were observed to be nesting (MDC 2012). Golden eagles will occupy a wide variety of plant communities within open habitats for hunting but prefer cliffs and large trees with large horizontal branches for roosting, perching, and nesting (Tesky 1994). They may occasionally be seen in the project area.

2.2 STAGE 2 – SITE-SPECIFIC SURVEYS

It is important to note that the project area has significantly changed in shape and size (nearly doubled) since some of the surveys described below were conducted and now includes portions of Adair County. No part of Adair County was within the survey area of the surveys described below. Eagle/large bird use surveys are on-going, and the survey area does now include Adair County as shown in Figure 1 of the BBCS.

2.2.1 Eagle Use Survey

Eagle use surveys for bald and golden eagles have been conducted within the project area since May 2016, and document all eagles observed flying within 60-minute periods at 800-meter (2,624-ft) radius plots with a height of 200-meters (656-ft). The number of survey points was selected to achieve a 30% sample covered for the eagle use surveys as recommended by the ECP Guidance (USFWS 2013), and all points will be surveyed for a total of 2 years. Survey points are located on publicly accessible roads and situated in a manner to ensure safety for the surveyor and allow maximum visibility during the surveys. In May 2016, 42 points were established within the project area, and 51 additional points were added in November 2017 after the project area expanded. These locations are depicted as "Original Survey" (42 original points) and "New Location" (51 points added in November 2017) on Figure 1.

During the 2016 survey season, 10 survey events (1 survey event = 60 minutes/point/month) were completed at points 1 through 42 between May 2016 and February 2017, resulting in 420 hours of survey effort at the HPWF. The only eagle species observed during the surveys was the bald eagle. A total of 308 eagle flight minutes were recorded during the 10 months of survey. Bald eagles were observed at 28 of the 42 points (67%) during 4 months of the survey (November through February). There were no bald eagles observed during the remaining months of the survey (May through October).

During the 2018 survey season to-date, 12 survey events (1 survey event = 60 minutes/point/month) were completed at points 1 through 93 between November 2017 and October 2018, resulting in 1,116 hours of survey effort at the HPWF. Both the bald eagle and the golden eagle were observed during the surveys. A total of 723 bald eagle flight minutes, 9 golden eagle flight minutes, and 6 additional potential eagle minutes from unknown observations were recorded during the 12 months of survey. Bald eagles were observed at 80 of the 93 points (86%), and the majority of flight minutes were again observed during the November through February time frame (545 of the 723 minutes, or 75.4%), and no eagle minutes were recorded in May or June.

During the 2019 survey season, 12 survey events (1 survey event = 60 minutes/point/month) were completed at points 43 through 93 between November 2018 and October 2019. Additionally, points 1 through 42 were surveyed in March and April 2019, resulting in 696 hours of survey effort at the HPWF during the 2019 survey season. Both the bald eagle and the golden eagle were observed during the surveys. A total of 76 bald eagle flight minutes and 2 golden eagle flight minutes were recorded at points 1 through 42 during March and April 2019. Bald eagle were observed at 17 of the 42 points (40%). A total of 373 bald eagle flight minutes and 4 golden eagle flight minutes were recorded at points 43 through 93 during the 12 months of survey. Bald eagles were observed at 41 of the 51 points (80%) surveyed. The majority of flight minutes were again observed during the November through February time frame (293 of the 373 minutes, or 78.6%), and no eagle minutes were recorded in June, July, or August. A summary of the bald eagle observations from the 2016-2019 eagle surveys can be found in Appendix A.

A total of 5 golden eagles have been observed in the project area, totaling 15 golden eagle minutes. These observations included:

- 2 immature golden eagles observed in April 2018
    - 4 eagle minutes at Point 36

    - 1 eagle minute at Point 65
- 1 adult golden eagle observed in December 2017
    - 4 eagle minutes at Point 16
- 1 immature golden eagle observed during March 2019
    - 2 eagle minutes at point 38
- 1 immature golden eagle observed during April 2019
    - 4 eagle minutes at point 61

In addition, four observations have occurred of raptors that were unable to be identified to the species level but may have been eagles. These include an unknown bird observed circling with the golden eagle at Point 65 in April 2018 for one minute, a possible eagle observed for 2 minutes at Point 2 in November 2017, and 2 possible eagles observed for 3 minutes at points 32 and 27 (1 eagle for 1 minute at point 32 and 1 eagle for 2 minutes at point 37) in October 2018.

The pattern of use at this site is typical of Midwestern sites located in agricultural areas away from major water features, which frequently record higher eagle use in the winter months due to migratory and/or overwintering eagles.

2.2.2 Eagle Nest Survey

In support of the Project, Stantec Consulting Services Inc. (Stantec) completed a raptor nest survey, utilizing ground-based and fixed-wing aerial methods, for bald eagle nests within the project area and a 10-mile buffer (nest search area), including portions of Adair, Knox, Schuyler, and Scotland counties in Missouri and Appanoose and Davis counties in Iowa (Figure 2; Stantec 2018).

From February 26 through March 2, 2018, before leaf-out in the spring, a ground-based nest survey was conducted, identifying the locations of any eagle or other raptor nests visible within the nest search area from public roadways. In addition to the ground-based nest survey, a fixed-wing aerial survey was completed from March 7 through March 9 and on March 13, 2018. A total of 22 bald eagle nests were observed during the 2018 raptor nest survey, including 3 within the project area (1 occupied), 17 outside of the project area but within the 10-mile buffer, and 2 outside of the 10-mile buffer. Fourteen of the nests outside of the project area were considered occupied (Figure 2; Stantec 2018).

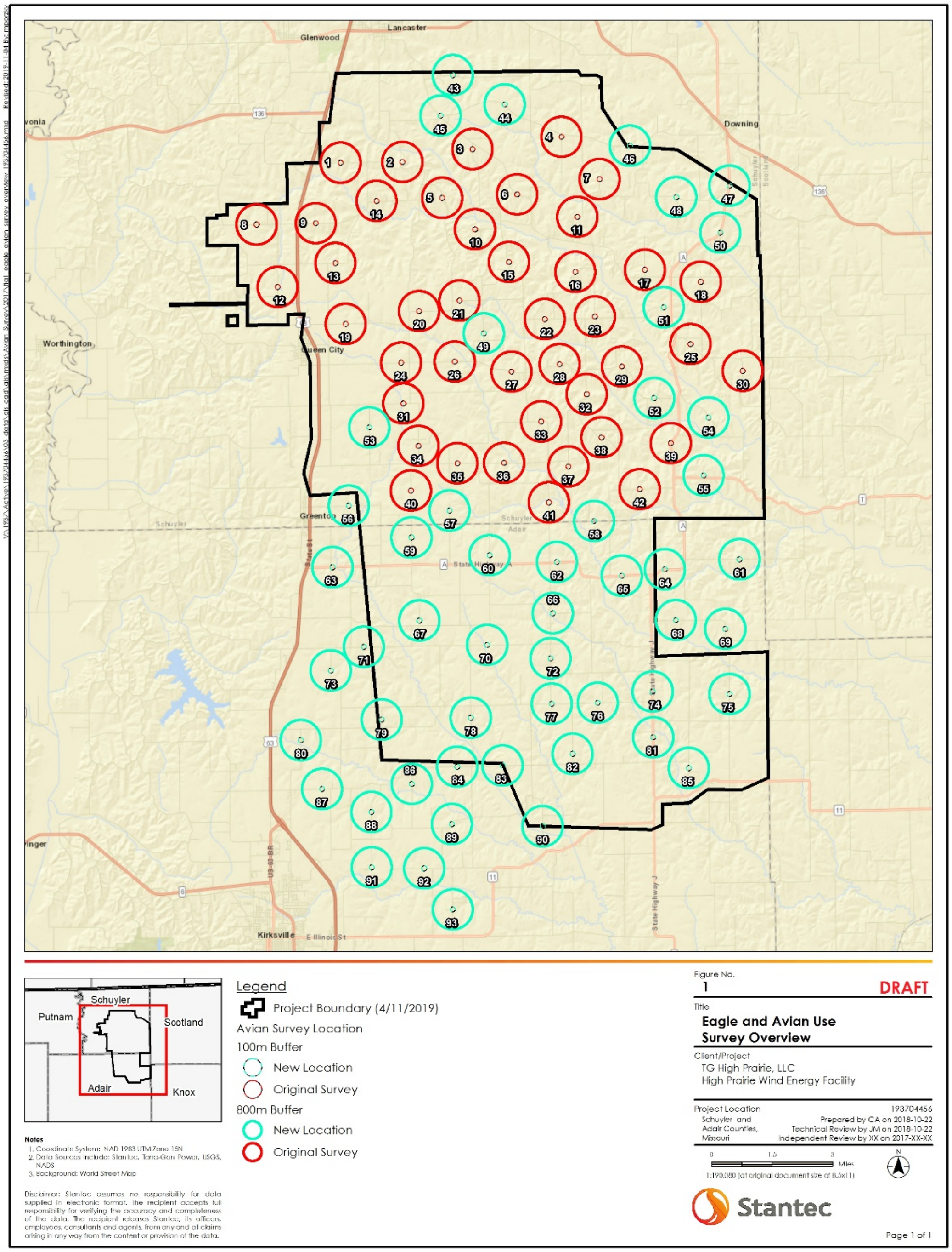

Figure 1. Eagle and Avian Use Survey Overview

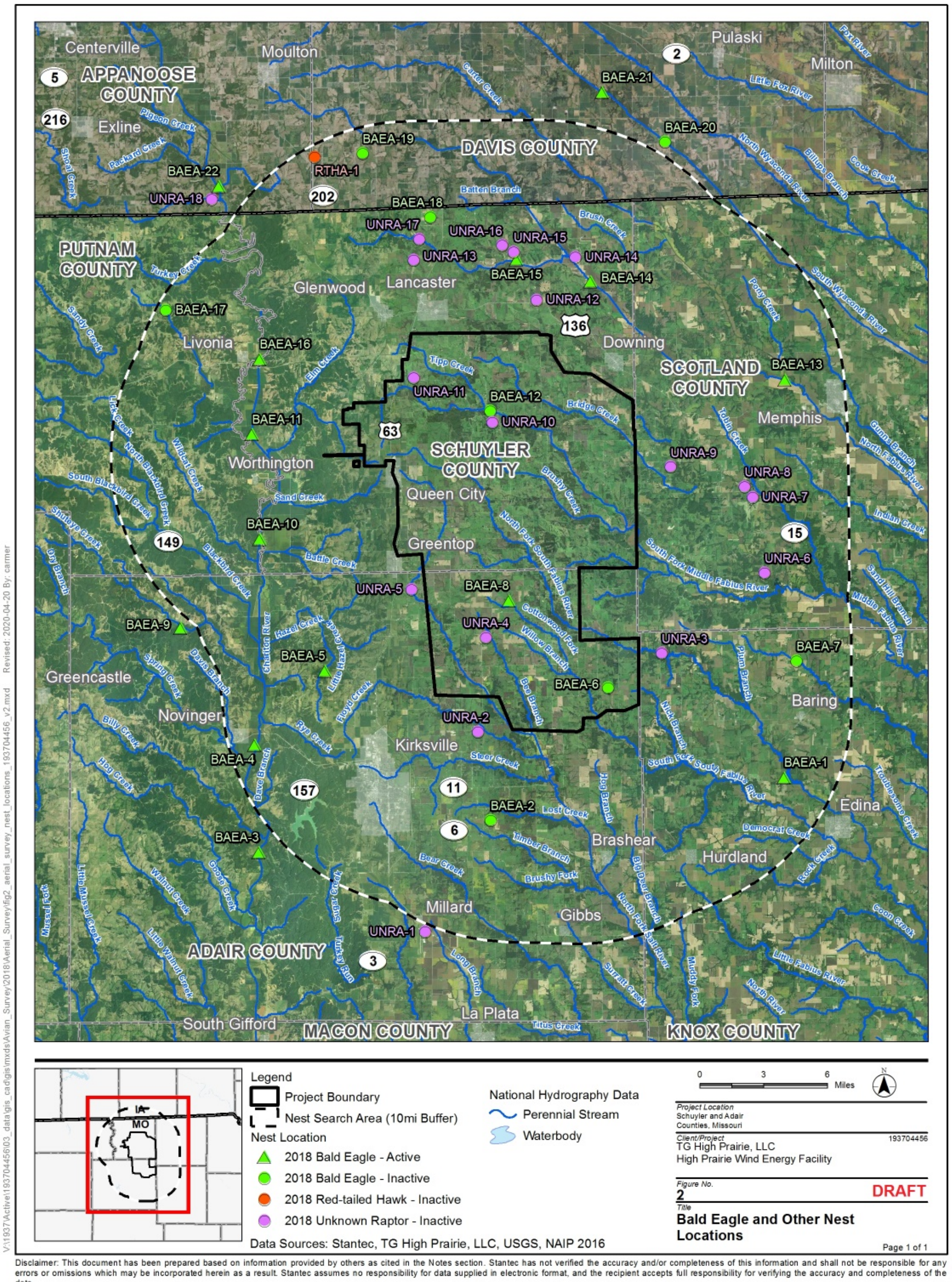

Figure 2. Bald Eagle and Other Nest Locations

3.0 STAGE 3 - POTENTIAL IMPACT TO EAGLES

Stage 3 of the ECP Guidance uses the data collected during Stage 2 to predict eagle risk at the Project in terms of a predicted fatality rate (the average number of fatalities per year).

Two different types of take are analyzed in the Stage 3 Risk Analysis:

1. Disturbance take: estimated loss of production in the local-area bald eagle population[2] attributable to the Project, estimated using data from the Stage 2 surveys.

2. Direct take: estimated number of fatalities/injuries per year utilizing data from Stage 2 surveys and approved models from the USFWS.

Disturbance includes any level of agitation to a degree which causes, or is likely to cause, injury, a decrease in productivity, or nest abandonment (USFWS 2013).

The ECP Guidance outlines three different categories of risk based on this analysis:

- Category 1: high risk to eagles, potential to avoid or mitigate impacts is low.

- Category 2: high or moderate risk to eagles, opportunity to mitigate impacts.

- Category 3: minimal risk to eagles

The category is determined by the location of important eagle use site areas or migration concentration sites, the estimated annual eagle fatality rate, and the impact of the estimated fatality rate on the cumulative annual take of the local-area population.

This analysis will be conducted after conclusion of the eagle use surveys in October 2019, but this section provides a general overview of potential impacts (including fatalities, as well as disturbance).

3.1 OVERVIEW OF POTENTIAL IMPACTS

Operational impacts of wind energy facilities on birds, including eagles, include varying degrees of displacement from the surrounding habitat, as well as mortalities resulting from collisions with turbines, transmission lines, and other facility structures (Winegrad 2004).

3.1.1 Bald Eagles

Regions of the United States that are ideal for wind energy development often overlap bald eagle habitat (Buehler 2000). The golden eagle appears to be particularly vulnerable to collisions with wind turbines, and the limited records for bald eagles may indicate that the species is less vulnerable (Pagel et al. 2013). As of June 2012, a total of six bald eagle fatalities had been publicly reported, including three in Iowa, one in Maryland, and two in Wyoming. There are

[2] The local-area population is defined as the eagle population within a distance from the project footprint equal to the species' median natal-dispersal distance (defined as 86 mi for bald eagles)

also two known fatalities from Ontario (Allison 2012). An additional six bald eagle fatalities (all in the state of Iowa) were recently published with MidAmerican's application for an Incidental Take Permit (USFWS 2018). Data indicates that modern wind facilities are responsible for less than one percent of human-caused golden eagle fatalities (AWEA 2011), and presumably an even smaller percentage of bald eagle mortalities, given the scarce data.

Bald eagles have been known to actively avoid operating wind turbines (Sharp et al. 2011); however, there is also evidence that bald eagles can nest near and fly through large numbers of wind turbines without mortality (Kerlinger and Guarnaccia 2011). Additionally, at the Erie Shores Wind Project, bald eagles have successfully nested within 0.5 mile of wind turbines, raising two eaglets without any documented mortality (Kerlinger and Guarnaccia 2011).

3.1.2 Golden Eagles

A study of golden eagles in the Rocky Mountains showed decreased flight use of the rotor-swept zone post-construction compared to pre-construction when wind speeds were high enough for the blades to be spinning, suggesting detection and avoidance of turbines during eagle migration (Johnston et al. 2014).

Pagel et al. (2013) published a report of 79 substantiated golden eagle fatalities or injuries from 28 wind energy facilities within the U.S.: 29 in Wyoming, 27 in California, 6 in Oregon, 5 in Colorado, 5 in New Mexico, 5 in Washington, 1 in Texas, and 1 in Utah. No golden eagle fatalities have been reported east of the Mississippi River.

3.2 POTENTIAL IMPACTS FROM THE PROJECT

Operating turbines will pose a risk of eagle mortalities from collisions, and construction and/or operation activities could cause disturbance at any occupied nests within the project area. These impacts will be fully analyzed in the ECP, but conservation measures to avoid and minimize these potential impacts are described in Section 4.0 below. At this time, based on data collected to-date (see Section 2.2), impacts are anticipated to be primarily to the bald eagle, as golden eagle observations within the project area have been rare, and they do not nest in the area.

Once the predicted eagle fatality rate has been determined in the ECP, it will be analyzed against various populations to determine whether the take will cause impacts at the population-level. The Project is within the USFWS's Mississippi River Eagle Management Unit (EMU). Within this unit, the predicted population size in 2009 was 31,706 bald eagles (USFWS 2016). The "local area" for the Project is 28,228 square miles (18,065,920 ac; based on an 86-mile radius around the project boundary). With a bald eagle density of 0.0395 bald eagle/square mile in the Mississippi flyway, the local area population is estimated to be 1,115 bald eagles, which sets the local area 5% benchmark at approximately 56 bald eagles per year (USFWS 2016). A 5% benchmark for allowable take for a region has been set based on research identifying that annual take levels of 5% of annual production are sustainable for a range of healthy raptor populations (Millsap and Allen 2006).

4.0 STAGE 4 - AVIODANCE AND MINIMIZATION MEASURES

Stage 4 of the ECP Guidance involves determining potential conservation measures to avoid or minimize risk at the site. Avoidance and minimization measures are defined as "conservation actions targeted to remove or reduce specific risk factors" and can include activities such as avoiding important bald eagle use areas, placing turbines away from ridgelines, or avoiding migration concentration areas (USFWS 2013). These measures will continue to be developed in coordination with the USFWS and MDC during the development of the ECP; however, several example conservation measures are included in this section. The final ECP may include, but is not limited or subject to, the following avoidance and minimization measures outlined in Sections 4.1 through 4.3.

4.1 CONSERVATION MEASURES IMPLEMENTED DURING SITE SELECTION AND PROJECT DESIGN

The Project's approach to siting was designed to avoid or reduce potential impacts to eagles. Pre-construction surveys are being conducted to assess potential impacts to avian resources and to assist in developing measures to avoid and minimize the identified potential impacts. These studies are described in Section 2.2. The Project siting process incorporated considerations to avoid and minimize impacts to bald eagles.

The planning and development stages of the Project incorporated industry best practices and measures based on the best available scientific data to reduce risk to eagles. General project design and siting measures to avoid or minimize risk to eagle include the following:

- **Reduce Perching Opportunities:** WTGs will be constructed with tubular steel towers; lattice structures will not be used to avoid creating perches for eagles.
- **Reduce Collision Risk with MET Towers:** The MET towers are self-supporting, unguyed, lattice steel structures. All permanent MET towers installed will be unguyed.
- **Reduce Collision Risk with Transmission Lines:** The Project has been sited within close proximity to the Mark Twain Transmission line, minimizing the length of the generation-tie line needed to interconnect with the grid.
- **Avoid Collision Risk with Collector Lines:** The power collection system will be buried underground in all areas where interference with other features would not preclude it.
- **Minimize Impacts to Habitat:** No substantial tree clearing will be conducted during project construction, and construction staging areas will be sited to avoid sensitive features, including surface waters.
- **Reduce Electrocution and Collision Risk at Overhead Wires:** All above ground power lines will be constructed in accordance with the most current Avian Power Line Interaction Committee (APLIC) Suggested Practices (APLIC 2012) to protect birds from electrocution and collision.

The avoidance and minimization measures incorporated during project siting and design, described above, will be the initial methods of reducing potential eagle impacts at the Project.

4.2 CONSERVATION MEASURES TO BE IMPLEMENTED DURING CONSTRUCTION

- **Provide training for project personnel:** a qualified biologist will present an education session at the Project to inform personnel on BGEPA, the procedure for reporting incidents involving bald eagles, and the importance of following all site regulations. A Wildlife Incident Reporting System (WIRS) will be created, and personnel will be trained on its use. Personnel will be informed that they are not authorized to handle or otherwise move any bald eagles or listed species they may encounter. HPWF will maintain appropriate records to ensure that personnel have attended the education program prior to working in the project area.

- **Reduce vehicular collisions with wildlife:** Vehicle speeds will be limited to the existing speed limits on public roads, and to 15 miles-per-hour on access roads to avoid wildlife collisions.
- **Reduce Prey Availability:** Rocks unearthed during excavation will be used during construction or removed from the site rather than left in piles near the turbines. Such rock piles create habitat for small mammals which serve as prey for many raptor species. Additionally, parts and equipment which may be used as cover for prey will not be stored at the base of wind turbines while a turbine is operational and spinning.

4.3 CONSERVATION MEASURES TO BE IMPLEMENTED DURING OPERATIONS

- **Landowner Education:** may include holding a landowner meeting, as well as annual mailings, to educate landowners in the area on the proper disposal of carcasses to avoid attracting bald eagles to the area. HPWF will commit to sending out an educational letter each November, at the start of the time period with the highest bald eagle risk.
- **Carcass Removal:** will include sweeps of the project area on private windfarm easements and adjacent public roads for carcasses, including roadkill, and removal of these and any other potential bald eagle food sources.

5.0 STAGE 5 – POST-CONSTRUCTION MONITORING

This section provides an overview of Stage 5 of the ECP Guidance, which would include:

- Conduct fatality monitoring in the project footprint;
- Monitor activity of eagles that may be disturbed at nest sites, communal roosts, and/or major foraging sites;
- Monitor eagle use post-construction.

The objective of post-construction monitoring is to estimate the eagle mortality at the Project. It is then possible to compare mortality at the Project to other regional projects and to the estimated mortality predicted after collection of eagle use data pre-construction. The HPWF ECP will outline the post-construction monitoring plan necessary to ensure permit compliance, but post-construction monitoring will, at a minimum, be conducted for at least 2 years and be targeted after that period to assess the effectiveness of any conservation measures implemented.

5.1 POST-CONSTRUCTION MONITORING PLAN

Post-construction monitoring is the method by which High Prairie will evaluate the effectiveness of the minimization measures and ensure compliance with the take limits set forth in the ETP.

5.1.1 Standardized Searches

Standardized searches will be conducted by a third-party contractor who will report directly to the USFWS, per the regulations. Searches will be conducted by independent, qualified biologists operating under applicable permits and experienced in fatality searches.

During searches, the searcher will visit each turbine and scan the surrounding landscape with the aid of binoculars or a spotting scope, out into the field and systematically searching within 55 yards of the turbine base, scanning out beyond that distance to increase the search area. All 175 turbines will be monitored for bald eagle fatalities and searches will be conducted approximately every 31 days between November and March to target the time period of highest risk at the Project. Additionally, TG High Prairie will conduct visual scans during twice weekly searches for bat carcasses from April 1 through October 31, scanning the surrounding landscape with the aid of binoculars or a spotting scope for potential eagle carcasses.

For each search, the following data will be recorded:

- Date
- Start time
- End time
- Interval since last search
- Observer
- Turbine Identifier
- Weather data
- GPS track of the search path

If a bald eagle is found, the following information will be recorded:

- Date
- Species
- Age and sex (when possible)
- Band number and notation, if wearing a radio-transmitter or auxiliary marker
- Observer
- Turbine or location
- Distance of carcass from turbine
- Azimuth of carcass from the turbine
- UTM coordinates of the turbine and the carcass
- Habitat description surrounding carcass
- Condition of carcass
- Rough estimate of time since death and how this was estimated
- A digital photograph of the carcass

- Information on carcass disposition

5.1.2 Searcher Efficiency and Carcass Persistence Trials

Searcher efficiency trials will be used to estimate the percentage of all bald eagle fatalities that are detected during the standardized searches. Similarly, carcass persistence trials will be used to estimate the average length of time a bald eagle carcass remains on the landscape (i.e., are available to find) before being scavenged or decaying. When considered together, the results of these trials will represent the likelihood that the bald eagle fatality that falls within the search area will be found.

Trials will be conducted each year throughout the risk season. It is assumed that only one searcher will be responsible for monitoring at the site; if more than one searcher is used, then multiple searcher efficiency trials will be needed to determine each searcher's unique searcher efficiency rate. A surrogate bald eagle carcass will be used (e.g., red-tailed hawk carcass) to test both searcher efficiency and carcass persistence.

Searcher efficiency trials will be conducted blindly; the searcher(s) will not know when the trials are occurring, at which search turbines surrogate carcasses are placed, or where the surrogate carcasses are located within the plots. The trials will consist of placing a surrogate carcass at a predetermined distance and bearing from a specific turbine in the morning prior to a scheduled search. Placements will occur within each type of habitat (gravel, snow, and harvested field) during the risk period. The distance and bearing of surrogate carcasses from turbines will be determined using a random number table. In the event of ground-covering snow, the carcasses will be thrown from the gravel pad so as not to reveal that a trial is being conducted by the evidence of footprints. The number of carcasses found compared to the number of carcasses available to be found will be used as the measure of searcher efficiency. A minimum of four carcasses will be used to test searcher efficiency.

Carcass persistence trials will be conducted immediately following the searcher efficiency trials using the same surrogate carcasses. Carcasses will be left in place by the searchers and monitored until they are removed by scavengers, decay completely, or the end of the search period, whichever occurs first.

The condition of each carcass will be recorded during each check, defined as follows:

- Intact – complete carcass with no body parts missing
- Scavenged – carcass with some evidence or signs of scavenging
- Feather spot – no carcass, but 10 or more feathers remaining
- Missing – no carcass and fewer than 10 feathers remaining

Any carcasses remaining at the end of the search period will be removed from the field.

5.1.3 Fatality Estimation

High Prairie will use the USFWS Evidence of Absence (EofA) Software (Dalthorp et al. 2017) to estimate the annual rate of take, as well as the cumulative fatality estimate for the Project and to evaluate post-construction monitoring protocols.

6.0 ADAPTIVE MANAGEMENT

This ECS represents a process through which High Prairie plans to reduce impacts to eagles at the Project while still maintaining optimal project operation and generating electricity from renewable, emissions-free wind. High Prairie has sited the Project and incorporated measures to avoid and minimize impacts to eagles. Adaptive management is a process that will allow High Prairie to adjust the avoidance measures outlined in this ECS to reflect new information or changing conditions in order to reach a goal – in this case, avoidance and minimization of impacts to eagles, while minimizing effects on the operation of the Project. Changes to the Project's avoidance and minimization plan may be triggered by certain events; High Prairie will coordinate with both the USFWS and MDC prior to implementing such changes. The adaptive management plan will apply throughout the life of the Project; on-going evaluation and adaptation of the Project will provide effective measures for avoiding and reducing impacts to eagles.

Examples of specific events which will trigger adaptive management measures, in coordination with the USFWS and MDC, are listed in Section 6.0 of the BBCS. The ECP will also outline a specific adaptive management plan related to eagles.

7.0 LIST OF PREPARERS

Company	**Key Preparers**
TG High Prairie LLC	
Stantec Consulting Services Inc.	Sydney Edwards, Molly Stephenson

8.0 REFERENCES

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

American Wind Energy Association (AWEA). 2011. Re: Comments of the American Wind Energy Association on Draft Eagle Conservation Plan Guidance. Letter submitted via e-mail to windenergy@fws.gov. May 19, 2011.

Avian Power Line Interaction Committee (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 The Birds of North America, No. 564 (A. Poole and F. Gill, eds.). The Birds of North America Online, Ithaca, New York.

Dalthorp, D., M. Huso, and D. Dail. 2017. Evidence of absence (v2.0) software user guide: U.S. Geological Survey Data Series 1055, 122 p., Available at: https://pubs.usgs.gov/ds/1055/ds1055.pdf.

Gerrard, J.M., P.N. Gerrard, G.R. Bortolotti, and E.H. Dzus. 1992. A 24-Year Study of Bald Eagles on Besnard Lake, Saskatchewan. J. Raptor Res. 26:159-166.

Hodges, J.I., and F.C. Robards. 1982. Observations of 3,850 Bald Eagle Nests in Southeast Alaska. Pp. 37-46 in A Symposium and Workshop on Raptor Management and Biology in Alaska and Western Canada. (Ladd, W. N. and P. F. Schempf, Eds.) U.S. Fish and Wildlife Service. Anchorage, Alaska.

Kerlinger, P., and J. Guarnaccia. 2011. Comprehensive Avian Risk Assessment for the Garden Peninsula Wind Energy Project, Delta County, Michigan. Prepared for Zimmerman, Kuhn, Darling, Boyd and Quandt, PLC. September 2011.

Missouri Department of Conservation (MDC). 2012. *The Bald Eagle in Missouri* (pp. 4). Jefferson City, MO. Retrieved from https://nature.mdc.mo.gov/sites/default/files/downloads/baldeaglemo2012.pdf Accessed 25 September 2018.

MDC. 2015. Missouri State Wildlife Action Plan. Conserving healthy fish, forests, and wildlife. Columbia, Missouri. 253 pp.

MDC. 2018a. Missouri Natural Heritage Program. Missouri Department of Conservation. Retrieved from https://mdc.mo.gov/property/responsible-construction/missouri-natural-heritage-program.

MDC. 2018b. *Bald Eagle Species Report*. Missouri Fish and Wildlife Information System. Retrieved from http://mdc7.mdc.mo.gov/applications/mofwis/Mofwis_Detail.aspx?id=0400056 Accessed September 25, 2018.

Millsap, B.A., and G.T. Allen. 2006. Effects of falconry harvest on wild raptor populations in the United States: theoretical considerations and management recommendations. Wildlife Society Bulletin 34(5), 1392-1400.

Pagel, J., K. Kritz, B. Millsap, R. Murphy, E. Kershner, and S. Covington. 2013. Bald Eagle and Golden Eagle Mortalities at Wind Energy Facilities in the Contiguous United States. Journal of Raptor Research, 47(3):311-315. doi: 10.3356/jrr-12-00019.1

Sharp, L., R. Friedel, K. Kosciuch, C. Herrmann, T. Allison, and R. MacIntosh. 2011. Pre- and post-construction monitoring of bald eagle use at the Pillar Mountain Wind Project, Kodiak, Alaska, 2007–2011. Oral presentation at NWCC Research Webinar. October 31, 2011.

Stalmaster, M.V. 1987. The Bald Eagle. Universe Books, New York.

Stantec. 2018. Raptor Nest Survey, High Prairie Wind Energy Facility, Adair and Schuyler Counties, Missouri. April 19, 2018.

Tesky, J.L. 1994. *Aquilea chrysaetos*. In: Fire Effects Information System, [online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fires Sciences Laboratory (Producer). Retrieved from https://www.fs.fed.us/database/feis/animals/bird/aqch/all.html#DISTRIBUTION%20AND%20OCCURRENCE Accessed September 25, 2018.

U.S. Fish and Wildlife Service (USFWS). 2009. Final Environmental Assessment, Proposal to Permit Take as Provided Under the Bald and Golden Eagle Protection Act. Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Washington, D.C. April 2009.

USFWS. 2012. Land-based Wind Energy Guidelines. U.S. Fish and Wildlife Service. 71 pp. March 23, 2012.

USFWS. 2013. Eagle Conservation Plan Guidance – Module 1 – Land-based Wind Energy. Division of Migratory Bird Management. April 2013.

USFWS. 2016. Bald and Golden Eagles – Population demographics and estimation of sustainable take in the United States, 2016 update. USFWS Division of Migratory Bird Management. April 26, 2016.

USFWS. 2018. Draft Environmental Impact Statement for Proposed Habitat Conservation Plan and Incidental Take Permit – MidAmerican Energy Company Wind Energy Portfolio Iowa. August 22, 2018. Retrieved from https://www.fws.gov/midwest/endangered/permits/hcp/pdf/MidAmericanDraftEIS22Aug2018.pdf.

Winegrad, G. 2004. Wind Turbines and Birds. In Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts. Washington, DC. May 18-19, 2004. Prepared by RESOLVE, Inc., Washington, D.C., Susan Savitt Schwartz, ed. September 2004

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APPENDIX A—BALD EAGLE SUMMARY TABLE

Table 1. Total number of bald eagle flight minutes observed within the 800-meter survey point, and number of eagle observations (in parenthesis) at each of the survey locations by month and year at the High Prairie Wind Energy Project, Adair and Schuyler counties, Missouri.

Survey Point	2016								2017*				2018												2019										Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	
1	0	0	0	0	0	0	0	0	4 (1)	0	0	0	0	0	0	0	0	0	0	7 (1)	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**11 (2)**
2	0	0	0	0	0	0	0	3 (1)	0	0	3 (1)	0	2 (1)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	3 (1)	3 (1)	N/A	N/A	N/A	N/A	N/A	N/A	**14 (5)**
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3 (1)	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**3 (1)**
4	0	0	0	0	0	0	0	0	0	0	10 (2)	3 (1)	0	4 (1)	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	2 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**19 (5)**
5	0	0	0	0	0	0	0	0	11 (3)	2 (1)	0	2 (2)	0	0	4 (2)	0	0	0	0	0	0	2 (1)	N/A	N/A	N/A	N/A	1 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**22 (10)**
6	0	0	0	0	0	0	0	8 (2)	2 (1)	6 (1)	0	1 (1)	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**17 (5)**
7	0	0	0	0	0	0	0	0	0	0	6 (2)	0	0	5 (2)	1 (1)	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	1 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**13 (6)**
8	0	0	0	0	0	0	0	0	10 (3)	0	0	0	12 (6)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	3 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**25 (10)**
9	0	0	0	0	0	0	0	0	0	10 (2)	0	2 (1)	7 (1)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	5 (2)	0	N/A	N/A	N/A	N/A	N/A	N/A	**24 (6)**
10	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**1 (1)**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10 (2)	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**10 (2)**
12	0	0	0	0	0	0	2 (1)	4 (1)	0	0	0	0	0	0	24 (8)	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**30 (10)**
13	0	0	0	0	0	0	14 (2)	0	0	0	0	0	10 (3)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**24 (5)**
14	0	0	0	0	0	0	0	0	22 (4)	18 (2)	0	3 (1)	6 (1)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**49 (8)**
15	0	0	0	0	0	0	0	0	4 (1)	0	0	0	4 (1)	0	4 (1)	0	0	0	7 (2)	0	0	0	N/A	N/A	N/A	N/A	9 (2)	0	N/A	N/A	N/A	N/A	N/A	N/A	**28 (7)**
16	0	0	0	0	0	0	0	2 (1)	7 (2)	24 (2)	1 (1)	0	3 (1)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	2 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**39 (8)**
17	0	0	0	0	0	0	3 (1)	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	0	2 (1)	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**7 (3)**

Survey Point	2016								2017*				2018												2019										Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	
18	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	2 (1)	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**3 (2)**
19	0	0	0	0	0	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	N/A	N/A	N/A	N/A	5 (3)	0	N/A	N/A	N/A	N/A	N/A	N/A	**8 (5)**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**0**
21	0	0	0	0	0	0	0	0	25 (3)	0	0	0	2 (1)	1 (1)	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	6 (3)	0	N/A	N/A	N/A	N/A	N/A	N/A	**34 (8)**
22	0	0	0	0	0	0	0	0	0	0	1 (1)	4 (1)	0	0	0	0	0	0	0	0	0	8 (1)	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**13 (3)**
23	0	0	0	0	0	0	0	0	0	0	1 (1)	0	0	4 (1)	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**5 (2)**
24	0	0	0	0	0	0	0	0	0	5 (3)	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**5 (3)**
25	0	0	0	0	0	0	0	0	0	4 (1)	0	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**4 (1)**
26	0	0	0	0	0	0	0	0	3 (1)	0	0	0	1 (1)	0	3 (1)	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**7 (3)**
27	0	0	0	0	0	0	0	0	0	0	0	2 (1)	8 (2)	5 (2)	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	9 (1)	2 (1)	N/A	N/A	N/A	N/A	N/A	N/A	**26 (7)**
28	0	0	0	0	0	0	0	0	0	0	0	4 (1)	8 (2)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	1 (1)	N/A	N/A	N/A	N/A	N/A	N/A	**13 (4)**
29	0	0	0	0	0	0	0	0	2 (1)	0	1 (1)	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**3 (2)**
30	0	0	0	0	0	0	0	3 (2)	6 (3)	3 (1)	3 (1)	0	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	2 (2)	0	N/A	N/A	N/A	N/A	N/A	N/A	**17 (9)**
31	0	0	0	0	0	0	1 (1)	0	0	0	2 (1)	19 (4)	2 (1)	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**24 (7)**
32	0	0	0	0	0	0	0	0	10 (1)	0	0	0	0	5 (2)	0	0	0	0	0	0	0	2 (2)	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**17 (5)**
33	0	0	0	0	0	0	0	0	0	0	3 (2)	7 (2)	0	1 (1)	0	0	0	0	0	0	8 (1)	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**19 (6)**
34	0	0	0	0	0	0	0	0	0	0	0	1 (1)	0	0	0	0	0	0	0	0	0	4 (1)	N/A	N/A	N/A	N/A	17 (3)	0	N/A	N/A	N/A	N/A	N/A	N/A	**22 (5)**
35	0	0	0	0	0	0	0	5 (1)	0	0	0	0	0	6 (1)	0	0	0	0	2 (1)	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**13 (3)**

Survey Point	2016								2017*				2018												2019										Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	
36	0	0	0	0	0	0	0	0	0	0	0	1 (1)	2 (1)	0	2 (2)	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**5 (4)**
37	0	0	0	0	0	0	0	0	1 (1)	5 (2)	0	0	0	0	0	0	0	0	0	0	14 (1)	3 (2)	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**23 (6)**
38	0	0	0	0	0	0	0	0	4 (1)	7 (1)	0	2 (1)	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	2 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**15 (4)**
39	0	0	0	0	0	0	0	11 (2)	0	0	1 (1)	0	0	2 (1)	2 (2)	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	2 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**18 (7)**
40	0	0	0	0	0	0	1 (1)	0	0	0	4 (1)	8 (1)	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**13 (3)**
41	0	0	0	0	0	0	0	4 (2)	4 (1)	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	0	0	N/A	N/A	N/A	N/A	N/A	N/A	**10 (4)**
42	0	0	0	0	0	0	0	44 (4)	0	0	0	0	0	2 (1)	0	0	0	0	0	0	0	0	N/A	N/A	N/A	N/A	1 (1)	0	N/A	N/A	N/A	N/A	N/A	N/A	**47 (6)**
43	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 (1)	4 (1)	5 (2)	0	0	6 (1)	0	0	0	0	0	0	0	0	0	0	2 (1)	0	0	0	0	0	0	0	**22 (6)**
44	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	2 (1)	0	0	0	0	0	0	3 (1)	**6 (3)**
45	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	6 (1)	0	0	0	0	0	0	0	0	0	0	1 (1)	0	0	2 (1)	0	0	0	0	0	0	0	2 (1)	**11 (4)**
46	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	5 (1)	2 (1)	5 (1)	0	0	0	0	0	2 (1)	0	0	0	0	13 (5)	0	0	0	0	0	0	0	0	**27 (9)**
47	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4 (3)	1 (1)	17 (3)	2 (1)	0	0	0	0	0	0	0	0	0	2 (1)	0	1 (1)	0	0	0	0	0	0	0	0	**27 (10)**
48	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	6 (1)	0	0	0	0	2 (1)	0	0	0	0	0	0	0	0	**8 (2)**
49	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	4 (1)	0	3 (2)	12 (3)	0	0	0	0	0	0	0	**21 (7)**
50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7 (3)	0	2 (1)	0	0	0	0	0	0	0	0	4 (3)	2 (1)	2 (1)	0	0	0	0	0	0	0	0	0	0	**17 (9)**
51	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	2 (1)	5 (1)	0	0	0	0	0	0	0	0	16 (4)	0	0	0	0	1 (1)	0	0	0	0	0	0	**24 (7)**
52	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 (1)	0	0	20 (5)	0	0	0	0	0	0	0	0	0	0	0		8 (2)	0	0	0	0	0	0	0	**30 (8)**

Survey Point	2016								2017*				2018												2019										Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	
53	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	6 (1)	0	1 (1)	0	0	0	2 (1)	2 (1)	0	0	0	0	0	0	0	0	**11 (4)**
54	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	18 (7)	0	4 (2)	0	0	0	0	0	0	1 (1)	0	5 (2)	7 (2)	0	1 (1)	2 (1)	0	0	0	0	0	0	0	**38 (16)**
55	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 (2)	0	0	0	0	0	0	0	0	2 (1)	0	0		3 (1)	0	0	0	0	0	0	0	0	0	0	**10 (4)**
56	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	2 (1)	0	0	0	0	0	0	0	0	1 (1)	6 (1)	7 (2)	2 (1)	0	0	2 (1)	0	0	0	0	0	**20 (7)**
57	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6 (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	11 (2)	0	0	0	0	0	0	0	4 (1)	0	**21 (5)**
58	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	2 (1)	0	4 (1)	0	0	0	0	0	0	0	0	0	0	2 (1)	2 (1)	2 (1)	0	0	0	0	0	0	0	**12 (5)**
59	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
60	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	0	0	2 (1)	8 (2)	0	0	0	0	0	0	**12 (4)**
61	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 (1)	30 (6)	0	0	0	0	0	0	0	0	0	0	0	3 (1)	0	0	0	0	0	0	0	0	0	0	**35 (8)**
62	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	0	0	0	0	0	0	0	0	0	0	0	**1 (1)**
63	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	8 (1)	0	5 (1)	0	0	0	0	0	0	0	0	0	0	0	**13 (2)**
64	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10 (2)	0	2 (1)	4 (1)	0	0	0	0	0	0	0	0	0	0	18 (3)	0	0	0	0	0	0	0	0	0	**34 (7)**
65	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1 (1)	0	0	15 (8)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**16 (9)**
66	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	9 (2)	0	0	0	0	0	0	0	0	0	0	1 (1)	2 (1)	0	9 (3)	0	0	2 (1)	0	0	0	0	0	**23 (8)**
67	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	15 (2)	0	0	0	0	0	0	0	0	0	0	0	0	0		2 (1)	0	0	0	0	0	0	0	**17 (3)**
68	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	24 (5)	4 (2)	0	2 (1)	0	0	0	0	0	0	0	0	0	3 (1)	0	4 (2)	0	3 (1)	0	0	0	0	0	0	**40 (12)**
69	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 (1)	0	4 (1)	0	2 (1)	0	0	0	5 (1)	0	0	0	8 (4)	0	0	0	0	0	0	0	0	0	0	0	**21 (8)**
70	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	29 (8)	0	0	12 (2)	0	0	0	0	0	0	0	0	**41 (10)**

Survey Point	2016								2017*				2018												2019										Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	
71	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	5 (2)	0	1 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6 (3)**
72	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	1 (1)	6 (1)	0	0	0	0	0	0	0	0	0	0	**7 (2)**
73	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	2 (1)	0	3 (2)	0	0	0	0	0	0	0	0	8 (3)	0	0	1 (1)	0	0	0	0	0	0	0	0	**14 (7)**
74	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	8 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**8 (1)**
75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 (1)	0	1 (1)	2 (1)	0	0	0	0	0	0	0	0	13 (1)	4 (1)	0	0	0	0	0	0	0	0	0	0	**25 (5)**
76	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	**2 (1)**
77	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	7 (3)	0	0	0	0	0	0	0	14 (1)	0	0	1 (1)	0	6 (1)	0	0	0	0	0	0	0	12 (3)	**40 (9)**
78	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6 (1)	2 (1)	1 (1)	0	0	0	0	0	0	0	0	0	0	0	2 (1)	0	0	0	0	0	0	0	0	0	**11 (4)**
79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
81	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	5 (2)	0	6 (3)	0	0	0	0	0	0	0	0	0	0	3 (1)	0	0	0	0	0	0	0	0	1 (1)	**15 (7)**
82	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	7 (2)	0	0	0	0	0	0	0	0	0	0	2 (1)	4 (1)	0	0	0	0	0	0	0	8 (2)	**21 (6)**
83	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5 (3)	4 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	5 (2)	0	0	0	0	0	0	0	0	**14 (6)**
84	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	1 (1)	0	0	0	0	0	0	0	0	0	0	0	0	2 (2)	0	0	0	0	0	0	0	0	**3 (3)**
85	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	2 (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	17 (6)	0	2 (1)	0	0	0	0	0	0	**21 (9)**
86	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	1 (1)	0	0	0	0	0	0	0	0	0	0	1 (1)	0	4 (1)	0	0	0	0	0	0	0	0	**6 (3)**
87	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	1 (1)	0	0	0	0	0	0	0	0	0	0	6 (2)	0	0	0	0	0	0	0	0	0	0	**7 (3)**

Survey Point	2016								2017*				2018												2019										Total
	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	
88	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	4 (1)	1 (1)	4 (1)	0	0	0	0	0	0	0	0	0	**9 (3)**
89	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2 (1)	0	0	4 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**6 (2)**
90	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	2 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**2 (1)**
91	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
92	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	1 (1)	0	0	0	0	0	0	0	0	0	0	1 (1)	0	0	0	0	0	0	0	0	0	0	**2 (2)**
93	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	3 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**3 (1)**
Survey Effort (hours)	**42**	**42**	**42**	**42**	**42**	**42**	**42**	**42**	**42**	**42**	**93**	**93**	**93**	**93**	**93**	**93**	**93**	**93**	**93**	**93**	**93**	**93**	**51**	**51**	**51**	**51**	**93**	**93**	**51**	**51**	**51**	**51**	**51**	**51**	**2,232 hours**
Grand Total	**0**	**0**	**0**	**0**	**0**	**0**	**21 (6)**	**86 (17)**	**115 (27)**	**86 (17)**	**122 (43)**	**165 (50)**	**133 (46)**	**125 (48)**	**50 (21)**	**6 (1)**	**0**	**0**	**23 (6)**	**9 (2)**	**64 (10)**	**26 (12)**	**95 (30)**	**54 (19)**	**51 (13)**	**93 (36)**	**102 (36)**	**20 (8)**	**4 (2)**	**0**	**0**	**0**	**4 (1)**	**26 (8)**	**1,480 (459)**

*Surveys were suspended from March 2017 through October 2017, resuming in November of 2017

APPENDIX B: REPORTS FROM PRE-CONSTRUCTION BIRD STUDIES CONDUCTED AT THE HIGH PRAIRIE RENEWABLE ENERGY CENTER

FINAL Avian Use Surveys

High Prairie Wind Energy Project

Adair and Schuyler County, Missouri

November 27, 2019

Prepared for:

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1.0 INTRODUCTION

Stantec Consulting Services Inc. (Stantec), on behalf of TG High Prairie, LLC (High Prairie), performed pre-construction avian use surveys within the project boundary of the proposed High Prairie Wind Energy Project (Project) in accordance with U.S. Fish and Wildlife Service (USFWS) recommendations outlined in the USFWS Land-based Wind Energy Guidelines (LWEG; USFWS 2012) and the USFWS Eagle Conservation Plan Guidance (ECPG; USFWS 2013).

The Project is located in Adair and Schuyler counties, east of Queen City, south of Lancaster, and northwest of Kirksville, Missouri (Figure 1). The current project area includes approximately 113,873 acres, the majority of which are agricultural fields and woodlands. Major transportation routes that intersect the project area include U.S. Route 63, U.S. Route 136, and State Highways D, A, and E. The Project will consist of 175 turbines and associated roads and infrastructure.

1.1 PURPOSE AND OBJECTIVES

The purpose of the surveys was to collect avian use data to support siting decisions and assess potential for migratory and other bird species, including sensitive species, such as eagles, to occur in the project area.

Specific objectives were to:

1. Document species composition and richness in the project area;
2. Examine the spatial and temporal extent of bird observations;
3. Estimate mean avian use;
4. Determine relative abundance by species, species groups, and frequency of observations;
5. Document flight height by species and species groups;
6. Record eagle flight minutes and spatial and temporal distribution of activity; and,
7. Document the spatial and temporal extent of rare bird species observations.

FINAL AVIAN USE SURVEYS

Introduction

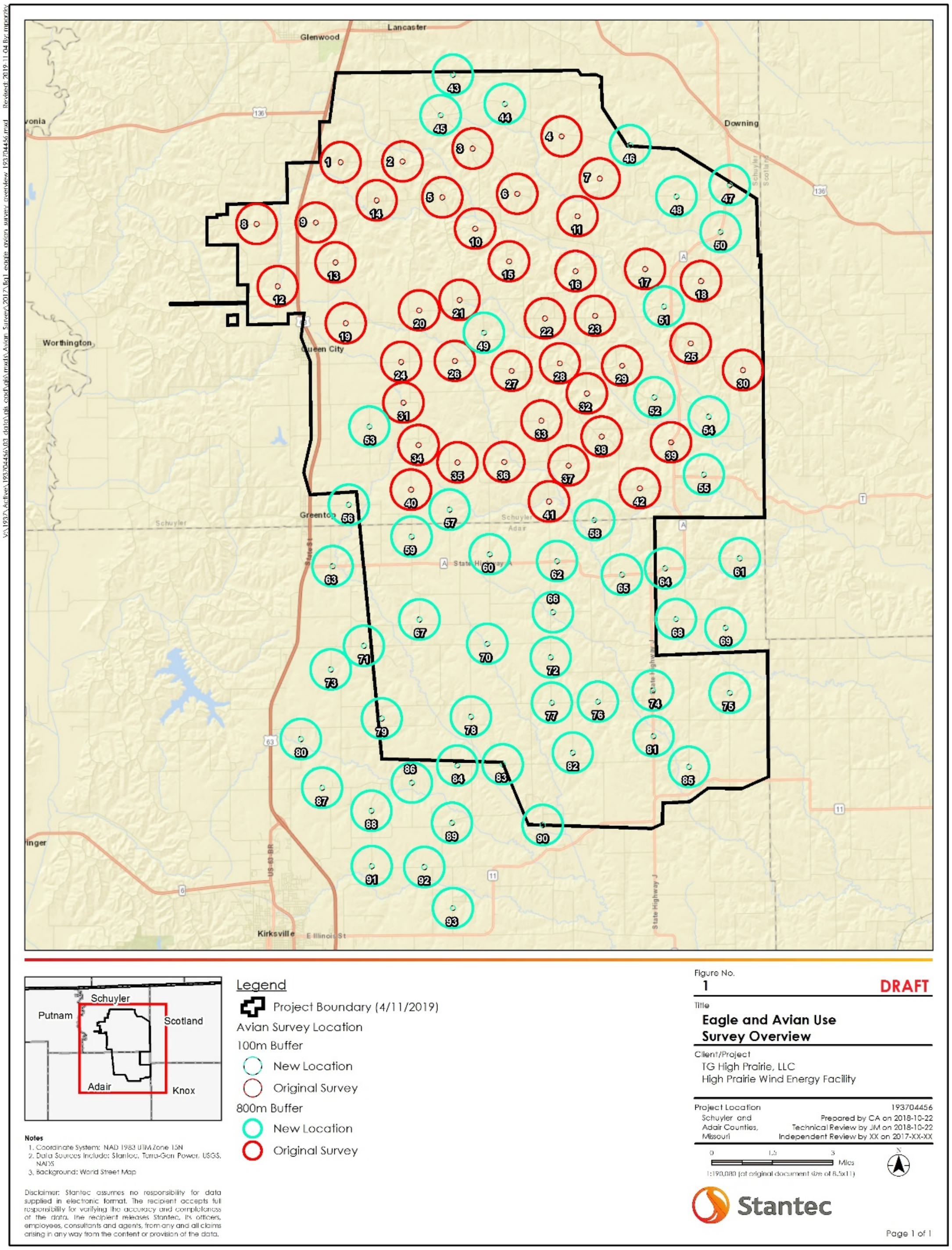


Figure 1. Eagle and Avian Survey Overview

2.0 METHODS

A total of 93 randomly located survey points were established within the project area (Figure 1). The same 93 survey points were used for the small bird, large bird, and eagle use surveys. The number of survey points was selected to achieve at least 30% sample coverage of the study area as recommended by the USFWS ECPG (USFWS 2013). Survey points were located on publicly accessible roads and situated in a manner to allow maximum visibility and allow surveys to be completed in a safe manner. The order of survey points (i.e., beginning and ending points) was alternated each site visit so that point count locations were surveyed during different periods of the day. Birds observed beyond the point count survey radius (beyond 100 meters [m] for small bird use surveys or beyond 800 m for large bird and eagle use surveys), survey height (200 m), or between points were coded as incidentals and were not included in any analysis, though the species were recorded. Rare bird species were defined as federally or state-listed species. Each survey event began in the morning and continued until all points scheduled for that day were sampled or until the weather was unsuitable for the survey to continue that day.

The initial 42 points (Points 1-42; Figure 1) were first surveyed for small bird, large bird, and eagles in May 2016, and an additional 51 points (Points 43-93) were added in November 2017 when the project area expanded. Each point was visited 12 to 15 times for small bird use surveys, including at least one visit in each calendar month. Each point was visit 24 times for large bird and eagle use surveys, including 2 visits in each calendar month. A total of 22 small bird use survey events occurred (1 small bird survey event = one month of visiting each point within the project area for a 5 minute survey) and 24 large bird/eagle use survey events (1 large bird/eagle survey event = one month of visiting each point within the project area for a 60-minute surveys).

The project boundary was further refined in April of 2019 after which 13 points (Points 61, 63, 68-69, 73, 80, 86-89, and 91-93; Figure 1) were no longer inside the project boundary. These points were still surveyed through October 2019 and are included in the analysis due to their proximity to the project area.

2.1 SMALL BIRD USE SURVEY

Small bird use surveys were conducted at each of the 93 survey points by documenting all small birds (any bird smaller than an American crow [*Corvus brachyrhynchos*]) identified by sight or sound during a 5-minute period within a 100-m radius plot (Figure 1). Birds were identified to species when possible and all observations were recorded on datasheets.

To assess avian use in the study area, information recorded for each bird observation included the following:

1. Species and number of individuals
2. Distance from observer (center of point count location)
3. Flight height, if the bird was flying, as described below

Methods

Approximate flight height was recorded for all flying observations during the surveys as follows:

- 0–44 m (below rotor-swept zone)
- 45–155 m (rotor-swept zone)
- Above 155 m (above rotor-swept zone)

Known landmarks and features on the landscape, such as barns, silos, meteorological towers, communication towers, transmission line structures, and trees, were used to calibrate height estimates. Although the design of the proposed turbines had not yet been specified at the time surveys began, for the purposes of these surveys, it was assumed that the rotor-swept zone would extend from a minimum of 45 m above ground level to a maximum of 155 m above ground level. The actual rotor-swept zone for turbines at the Project is slightly lower, ranging from 32 or 38 m to 150 to 152 m, depending on turbine type.

Metrics collected and reported include the following:

- Small bird use (number of small bird observations/5-minutes/100-m plot)
- Flight height analysis (percent of flying observation below, within, and above the rotor-swept zone, overall and within species)
- Species composition, species richness and abundance (list of species observed and number of observations of each)
- Relative abundance (percent of total observations attributed to each species)
- Frequency of occurrence (percent of survey events each species or guild was observed)

2.2 LARGE BIRD USE SURVEY

Large bird surveys were conducted at each of the 93 survey points documenting all large birds (any bird American crow size or larger) identified by sight or sound during a 60-minute period within an 800-m radius by 200-m height plot (Figure 1). All observations were recorded on datasheets. The information recorded, including flight height, followed the methods described for small birds in Section 2.1.

Metrics collected and reported include the following:

- Large bird use (number of large bird observations/60-minutes/800-m plot; overall, species, guild)
- Flight height analysis (percent of flying observation below, within and above the rotor-swept zone, overall and within species)
- Species composition, species richness and abundance (list of species observed and number of observations of each)
- Relative abundance (percent of total observations attributed to each species)
- Frequency of occurrence (percent of survey events each species or guild was observed)

2.3 EAGLE USE SURVEY

Eagle use surveys for bald (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) were conducted at each of the 93 avian survey points by documenting all eagles observed during a 60-minute period within an 800-m radius and 200-m height plot (Figure 1). Eagles observed were recorded based on the number of minutes an eagle was perched or in flight within and outside the plot during the 60-minute survey.

Eagle activity was recorded in one-minute intervals (i.e., eagle minutes) in one of the four following categories:

- Flying within the plot
- Not flying but still within the plot (i.e., perched)
- Flying outside the plot
- Not flying outside of the plot

Collision risk for eagle observations, as per the ECPG (USFWS 2013) is defined as the number of minutes eagles are observed flying within the plot (i.e., "eagle flight minutes"), and measured as the rate of eagle minutes observed per hour of survey effort. These eagle flight minutes were analyzed separately for the points which still fall within the project boundary (Figure 1).

3.0 RESULTS

3.1 SMALL BIRD USE SURVEY

The 93 survey points were each surveyed 12 to 15 times between May 2016 and November 2018 (Table 1). Points 1-42 were surveyed 15 times each while Points 43-93 were each surveyed 12 times. Table 1 shows the schedule of small bird use surveys.

Table 1. Month and year(s) of small bird use surveys at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Month	Points 1 - 42	Points 43 - 93
January	2017, 2018	2018
February	2017, 2018	2018
March	2018	2018
April	2018	2018
May	2016	2018
June	2016	2018
July	2016	2018
August	2016	2018
September	2016	2018
October	2016	2018
November	2016	2018
December	2016, 2017	2017

Overall, 22 survey events occurred, with each survey event surveying 42 to 93 points (Table 2).

Table 2. Small bird use survey events at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Month, Year and Number of Points Surveyed
1	May 2016 (42 points)
2	June 2016 (42 points)
3	July 2016 (42 points)
4	August 2016 (42 points)
5	September 2016 (42 points)
6	October 2016 (42 points)
7	November 2016 (42 points)
8	December 2016 (42 points)
9	January 2017 (42 points)
10	February 2018 (42 points)
11	December 2017 (93 points)
12	January 2018 (93 points)
13	February 2018 (93 points)
14	March 2018 (93 points)
15	April 2018 (93 points)
16	May 2018 (51 points)
17	June 2018 (51 points)
18	July 2018 (51 points)
19	August 2018 (51 points)
20	September 2018 (51 points)
21	October 2018 (51 points)
22	November 2018 (51 points)

During the small bird surveys, a total of 12,542 small bird observations, representing 115 species, were observed. The five most commonly observed small bird species, number of observed birds, and the percentage of the total observations were:

- Red-winged Blackbird (*Agelaius phoeniceus*) – 2,455 (19.6% of all observations)
- European Starling (*Sturnus vulgaris*) – 1,998 (15.9% of all observations)
- Mourning Dove (*Zenaida macroura*) – 634 (5.1% of all observations)
- Blue Jay (*Cyanocitta cristata*) – 567 (4.5% of all observations)
- American Goldfinch (*Spinus tristis*) – 518 (4.1% of all observations)

Although 115 species were identified, taken together the 5 most frequently observed species accounted for 49.2% of all small bird observations, and the most common species (red-winged blackbird) accounted for 19.6%. An average of 3.3 small bird species were observed per survey point. Overall mean small bird use was 10.1 birds/5-minutes/100-m plot (Appendix A, Table A-1). Small bird use for the five most common species and their frequency of occurrence, was (see Appendix A, Table A-1):

- Red-winged Blackbird – 1.98 birds/5-minutes/100-m plot (detected in 17 of 22 survey events; 77.3%)
- European Starling – 1.61 bird/5-minutes/100-m plot (detected in 19 of 22 survey events; 86.4%)
- Mourning Dove – 0.51 bird/5-minutes/100-m plot (detected in 19 of 22 survey events; 86.4%)
- Blue Jay – 0.46 bird/5-minutes/100-m plot (detected in 21 of 22 survey events; 95.5%)
- American Goldfinch – 0.42 bird/5-minutes/100-m plot (detected in 12 of 22 survey events; 54.5%)

Overall, perching birds made up 87.9% of all small bird observations (Appendix A, Table A-1). No species was observed during 100% of the 22 survey events, although blue jays were documented in 21 (95.5%) of the survey events.

3.1.1 Spatial Species Richness

Point 89 had the highest average number of species (7.00 species/event), followed by Point 56 (6.42 species/event). Point 25 had the lowest average number of species (1.13 species/event), followed by Points 16 and 14 (1.20 and 1.27 species/event) (Figures 1 and 2).

Results

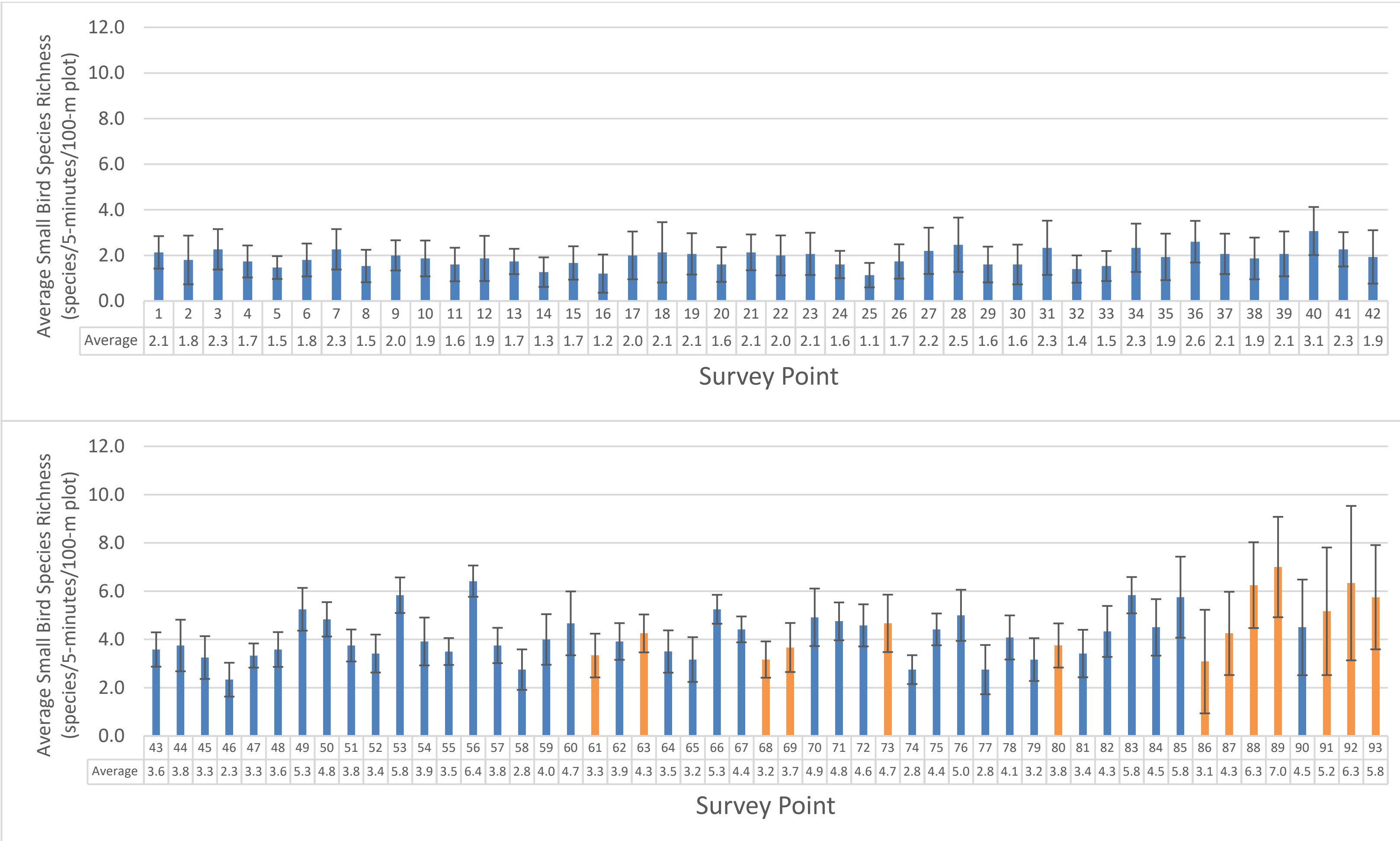


Figure 2. Average number of small bird species per survey point at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri with 95% confidence intervals. Points outside the current boundary (see Figure 1) are shown in orange.

3.1.2 Temporal Species Richness

Small bird use surveys were conducted during each calendar month, with varying levels of survey effort (see Table 1). To analyze temporal species richness, the average number of species observed per point was calculated for each survey event (see Table 2), and then averaged across survey events for any given calendar month (e.g., the species richness from survey event 9 and the species richness from survey event 12 were averaged to calculate the average species richness for the month of January). Species richness by month is shown in Figure 3.

Species richness was highest in August, with an average of eight species per point, and lowest in January with an average of less than one species per point. In general, species richness was lowest during the winter months, slowly rising during spring migration, becoming relatively stable during the summer breeding season, and then peaking during fall migration (Figure 3).

Results

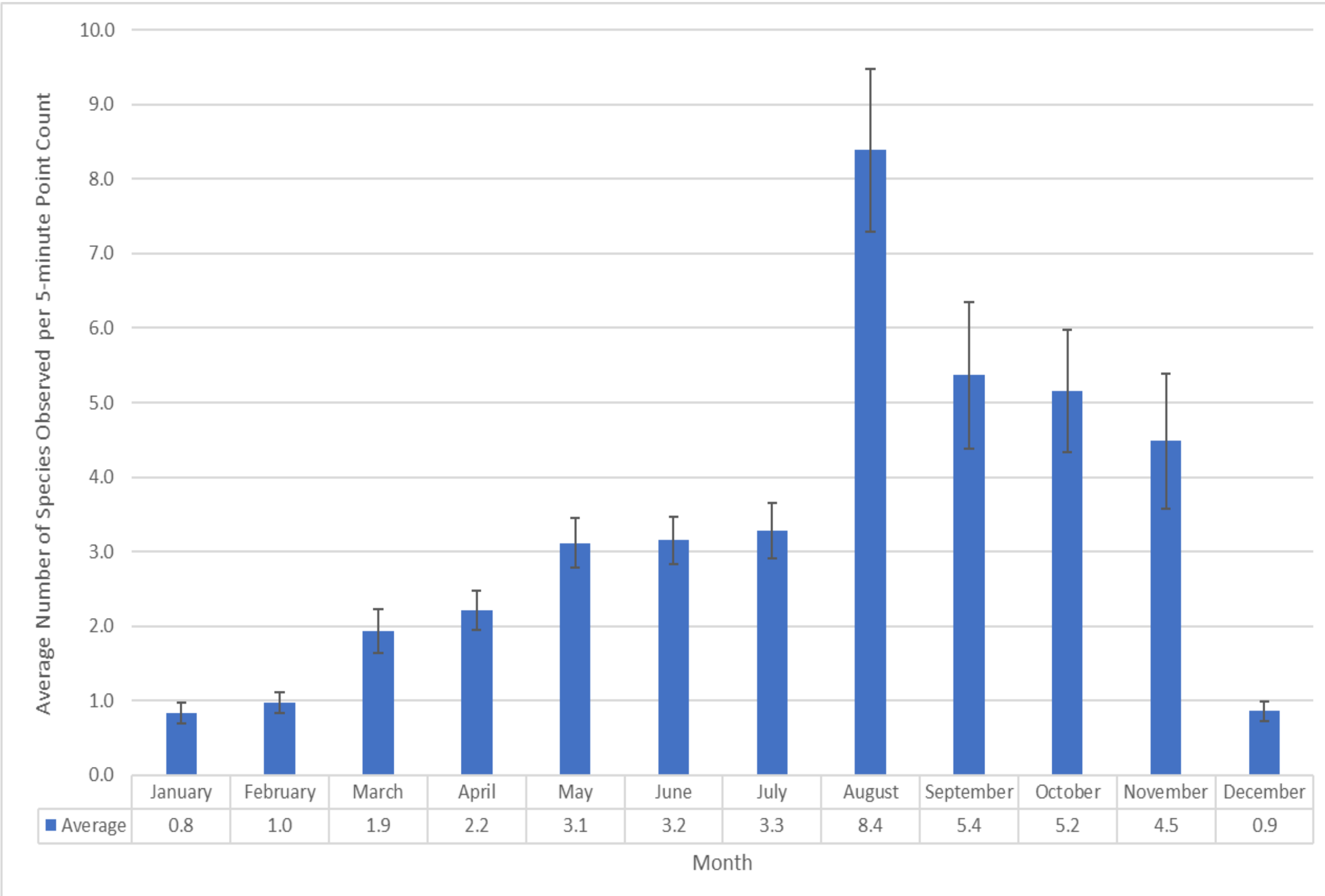
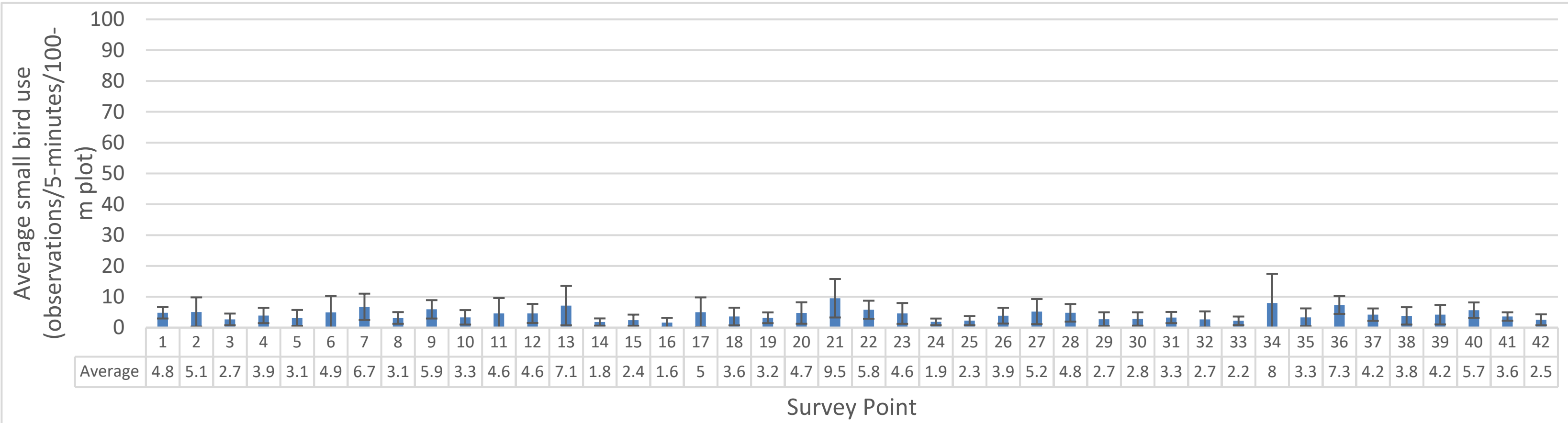


Figure 3. Average number of small bird species per point by month at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri with 95% confidence intervals.

3.1.3 Spatial Bird Use

The average number of observations fluctuated by survey point with the highest average use at Point 88 (72.5 birds/5-minutes/100-m plot). Average use at Point 88 was so high due to a flock of 700 European starlings observed during survey event 22 (November 2018). The next largest flock observed at Point 88 was a flock of 20 house sparrows (*Passer domesticus*). The next highest average use was observed at Point 56 with 43.7 birds/5-minutes/100-m plot, followed by Point 47 with 39.5 birds/5-minutes/100-m plot. Both points had large flocks (200 individuals or more) of red-winged blackbirds observed during surveys. The lowest average bird use was 1.6 birds/5-minutes/100-m plot at Point 16, followed by Point 14 with 1.8 birds/5-minutes/100-m plot (Figures 1 and 4).

Results



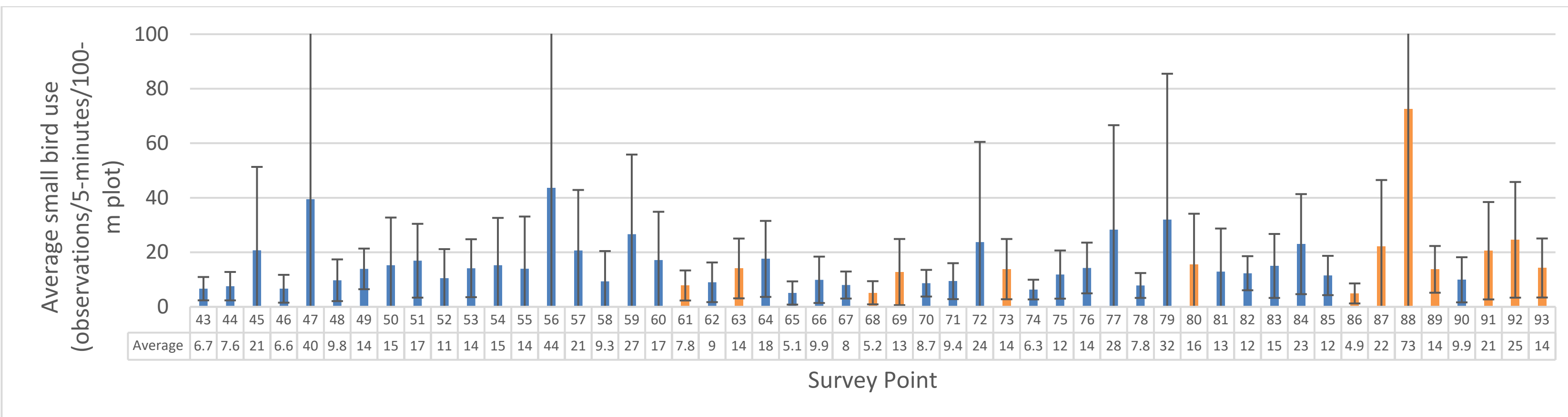


Figure 4. Small bird use per survey point with 95% confidence intervals at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri. Points outside the current boundary (see Figure 1) are shown in orange.

3.1.4 Temporal Bird Use

The highest average number of small birds observed per 5-minute point count occurred during the fall, with an average of 36.1 observations per 5-minutes per 100-m plot in October, followed by November at 27.9 observations per 5-minutes per 100-m plot (Figure 5). October and November bird use were both highly driven by large flocks, including 1,025 red-winged blackbirds observed in October 2018 from 4 separate flocks, and a flock of 700 European starling observed in November 2018. The lowest average number of small birds observed per 5-minute point count occurred in January, with an average of 2.6 observations per 5-minutes per 100-m plot, followed by December with an average of 2.8 observations pe r5-minutes per 100-m plot (Figure 5).

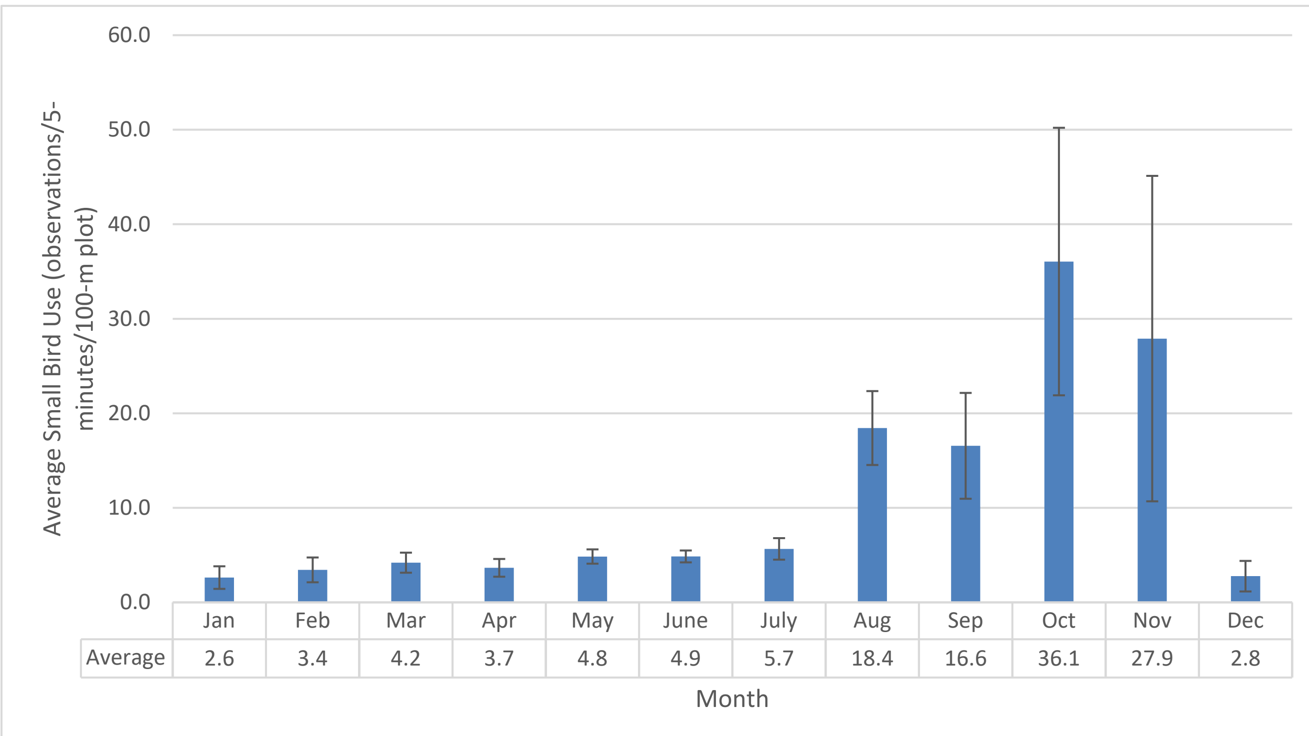


Figure 5. Average number of small bird observations per survey point by month with 95% confidence intervals at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

3.1.5 Rare Bird Species

No federally listed species were observed during small bird surveys. Four species of special concern in Missouri, the pine siskin (*Spinus pinus*), brown creeper (*Certhia americana*), chestnut-sided warbler (*Setophaga pensylvanica*), and loggerhead shrike (*Lanius ludovicianus*), were observed (Table 3).

Table 3. Special concern bird species observed during small bird use surveys at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Species	Number Observed	Month(s) Observed	Point(s) Observed
Pine Siskin	4	October November	85 75 80
Brown Creeper	2	November	66 90
Chestnut-sided Warbler	1	September	85
Loggerhead Shrike	1	December	89[1]

[1]Point located outside of current project area, see Figure 1.

Incidental observations (birds larger than an American crow or outside of the 100-m plot) included two state-listed species, the state endangered northern harrier (*Circus hudsonius*) and the state endangered peregrine falcon (*Falco peregrinus*). Thirty-four northern harriers were observed on 33 occasions. Northern harriers are generally considered at a lower risk of fatality from wind farms, as their hunting habits include flying low to the ground and using sight and sound to detect prey. Even at sites with relatively high northern harrier use, fatality has been absent or low (Erickson et al. 2002). All northern harriers observed during small bird surveys were observed flying at a flight height of 0-44 m. One peregrine falcon was observed at Point 70 on December 15, 2017 flying between 0-44 m above the ground. Additionally, four large bird species of special concern, the bald eagle (*Haliaeetus leucocephalus*; 67 observations), short eared owl (*Asio flammeus*; 1 observation), sharp-shinned hawk (*Accipiter striatus*; 3 observations), and trumpeter swan (*Cygnus buccinator*; 2 observations), were observed incidental to small bird surveys.

3.1.6 Incidental Species

Small bird species only observed incidentally (outside of 100-m plot or large birds not observed during large bird surveys) include the least flycatcher (*Empidonax minimus*) and solitary sandpiper (*Tringa solitaria*).

3.2 LARGE BIRD USE SURVEY

The 93 survey points were each surveyed 24 times between May 2016 and October 2019 (Table 4).

Table 4. Month and years of large bird and eagle use completed at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Month	Points 1 - 42	Points 43 - 93
January	2017, 2018	2018, 2019
February	2017, 2018	2018, 2019
March	2018, 2019	2018, 2019

FINAL AVIAN USE SURVEYS

Results

Month	Points 1 - 42	Points 43 - 93
April	2018, 2019	2018, 2019
May	2016, 2018	2018, 2019
June	2016, 2018	2018, 2019
July	2016, 2018	2018, 2019
August	2016, 2018	2018, 2019
September	2016, 2018	2018, 2019
October	2016, 2018	2018, 2019
November	2016, 2017	2017, 2018
December	2016, 2017	2017, 2018

Overall, 34 survey events occurred, with each survey event surveying 42 to 93 points (Table 5).

Table 5. Large bird and eagle use survey events at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Year and Points
1	May 2016 (42 points)
2	June 2016 (42 points)
3	July 2016 (42 points)
4	August 2016 (42 points)
5	September 2016 (42 points)
6	October 2016 (42 points)
7	November 2016 (42 points)
8	December 2016 (42 points)
9	January 2017 (42 points)
10	February 2017 (42 points)
11	November 2017 (93 points)
12	December 2017 (93 points)
13	January 2018 (93 points)
14	February 2018 (93 points)
15	March 2018 (93 points)
16	April 2018 (93 points)
17	May 2018 (93 points)
18	June 2018 (93 points)
19	July 2018 (93 points)
20	August 2018 (93 points)
21	September 2018 (93 points)
22	October 2018 (93 points)
23	November 2018 (51 points)

Results

Survey Event	Year and Points
24	December 2018 (51 points)
25	January 2019 (51 points)
26	February 2019 (51 points)
27	March 2019 (93 points)
28	April 2019 (93 points)
29	May 2019 (51 points)
30	June 2019 (51 points)
31	July 2019 (51 points)
32	August 2019 (51 points)
33	September 2019 (51 points)
34	October 2019 (51 points)

During the large bird surveys, a total of 19,388 large bird observations, representing 37 species were observed (Appendix A, Table A-2). The five most commonly observed large bird species, number of observed birds, and the percentage of the total observations were:

- Turkey vulture (*Cathartes aura*) – 6,603 (34.1% of all observations)
- Snow Goose (*Anser caerulescens*) – 4,638 (23.9% of all observations)
- Canada goose (*Branta canadensis*) – 3,244 (16.7% of all observations)
- American crow – 2,414 (12.5% of all observations)
- Red-tailed Hawk (*Buteo jamaicensis*) – 879 (4.5% of all observations)

Although 37 species were observed, taken together the 5 most common species accounted for 91.7% of all large bird observations, and the most common species (turkey vulture) accounted for 34.1% (Appendix A, Table A-2). An average of 1.3 species were observed per 60-minute large bird point survey. Overall mean large bird use was 8.7 birds/60-minutes/800-m plot. Large bird use for the five most observed species, and their frequency of occurrence, was:

- Turkey Vulture – 2.96 birds/60-minutes/800-m plot (detected in 20 of 34 survey events; 58.8%)
- Snow Goose – 2.08 birds/60-minutes/800-m plot (detected in 5 of 34 survey events; 14.7%)
- Canada Goose – 1.45 bird/60-minutes/800-m plot (detected in 26 of 34 survey events; 76.5%)
- American Crow – 1.08 bird/60-minutes/800-m plot (detected in 31 of 34 survey events; 91.2%)
- Red-tailed Hawk – 0.39 bird/60-minutes/800-m plot (detected in 34 of 34 survey events; 100%)

Overall, ducks, geese, and swans made up 42.6% of all large bird observations (Appendix A, Table A-2). The red-tailed hawk was the only species observed during all 34 survey events.

3.2.1 Spatial Species Richness

Because all survey points had an equal level of survey effort (each point was visited 24 times, twice in each calendar month over two years of survey), the comparison of species richness can be done without accounting for survey effort. Species richness ranged from 4 species observed at Point 17 to 13 species observed at Point 76 (Figure 1 and Figure 6).

Results

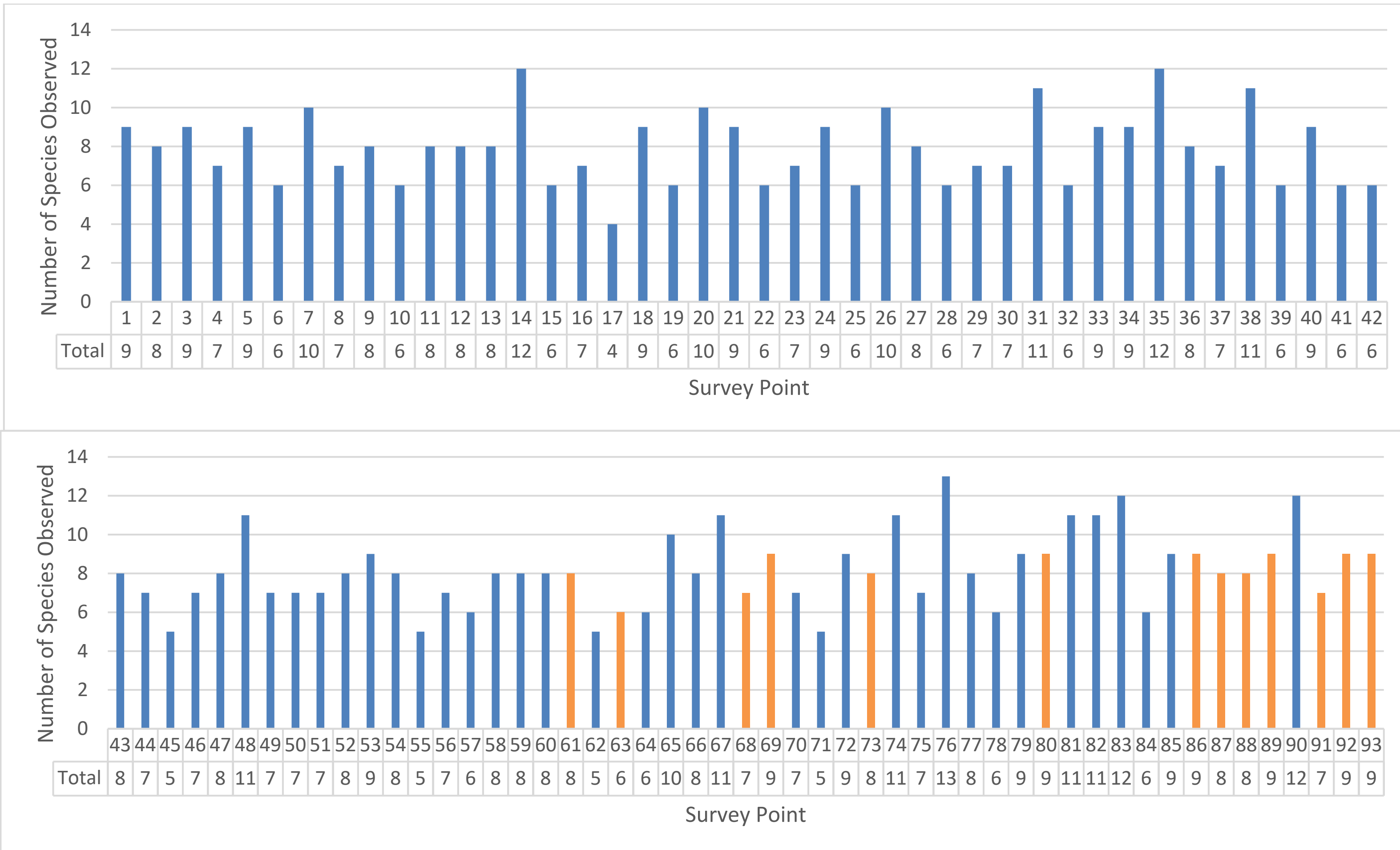


Figure 6 . Number of large bird species observed at each survey point over 24 visits at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri. Points outside the current boundary (see Figure 1) are shown in orange.

3.2.2 Temporal Species Richness

Because all months had an equal level of survey effort (93 points, visited twice), the comparison of species richness can be done without accounting for survey effort. Species richness was highest during September (24 large bird species observed), followed by March (22 species) and April (20 species; Figure 7). Species richness was lowest in July (6 species) and June and August (9 species each; Figure 7).

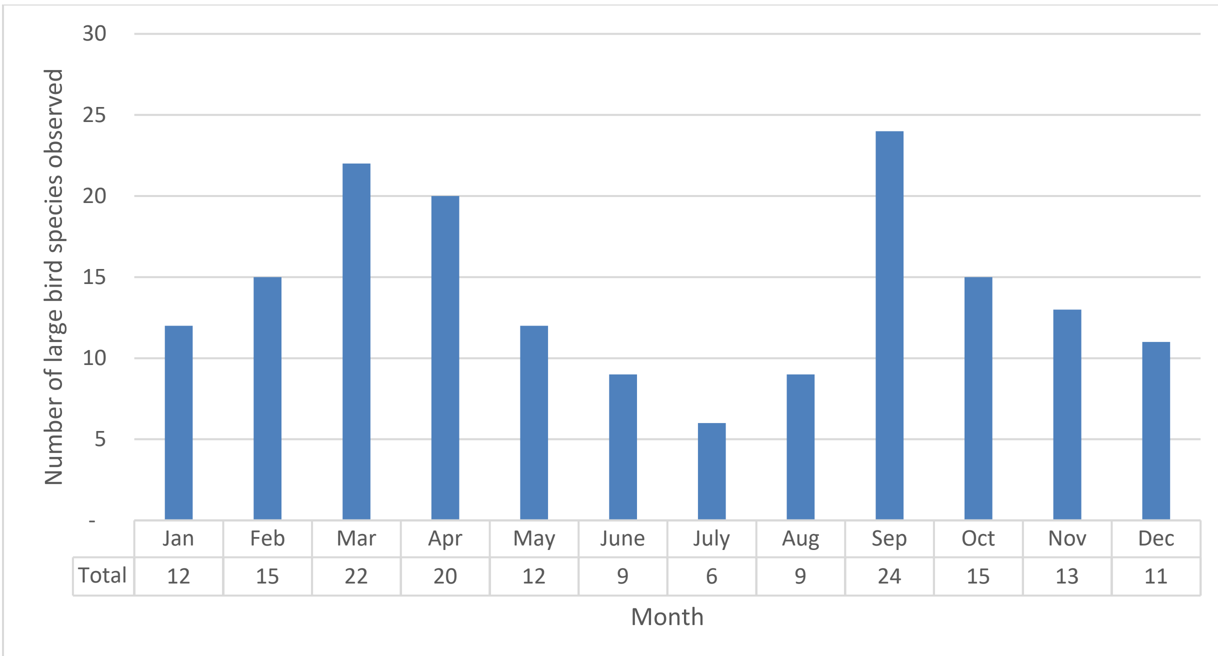


Figure 7. Total number of large bird species observed per month at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

3.2.3 Spatial Bird Use

The number of observations fluctuated by survey point. The highest large bird use was 2,435 observations at Point 9, followed by 834 observations at Point 14 (Figures 1 and 8). The number of observations was highest at Point 9 because 6 large flocks of geese (over 100 individuals) were observed flying through the point during survey event 14 (February 2018), totaling 2,070 individuals. Besides Points 9 and 14, 6 additional points had observations of over 500 (Points 11, 21, 31, 40, 53, and 83) while the rest of the points ranged from 57 to 298 observations (Figure 8).

Results

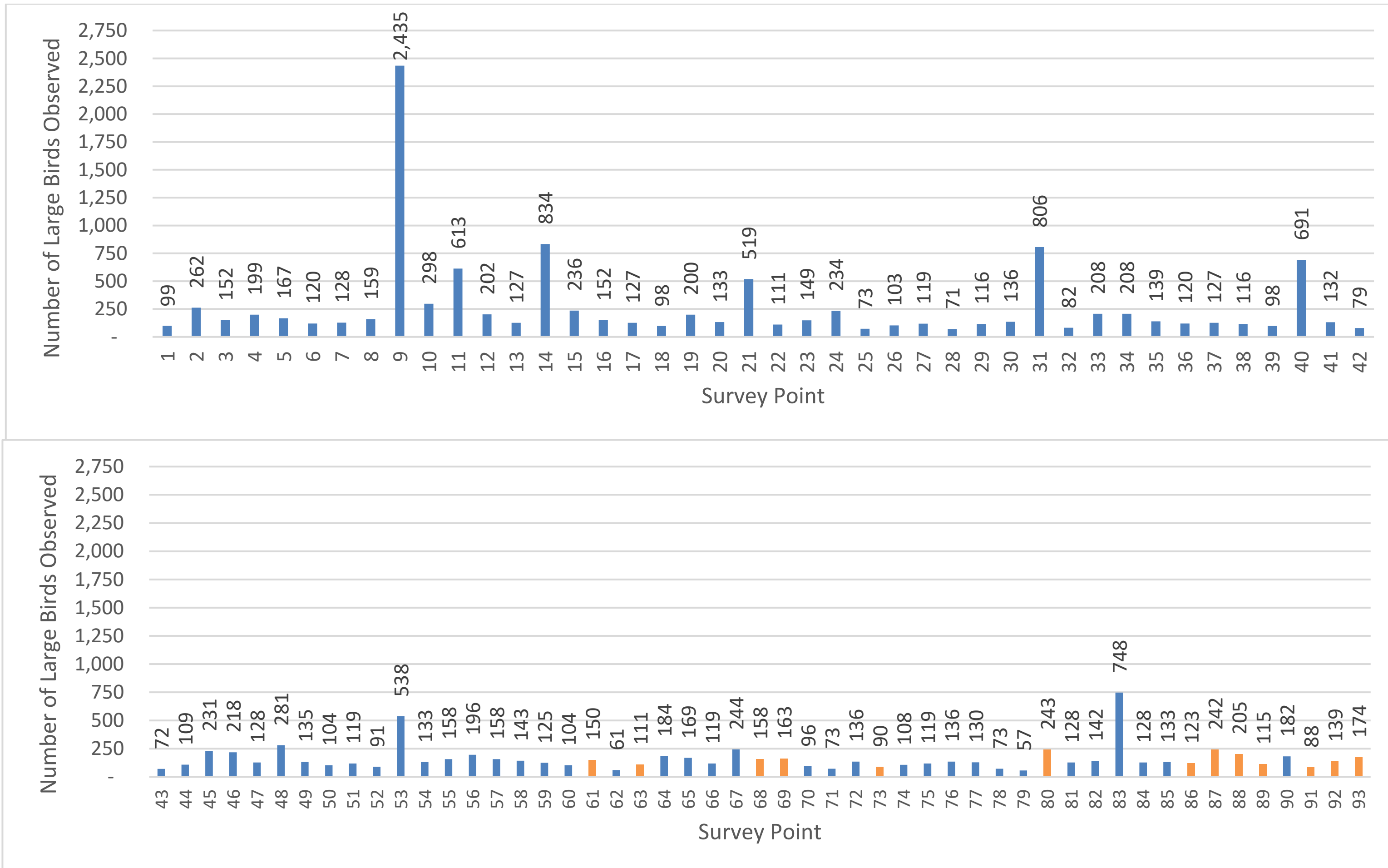


Figure 8. Large bird observations per survey point at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri. Points outside the current boundary (see Figure 1) are shown in orange.

3.2.4 Temporal Bird Use

The highest bird use observed occurred in February, with 5,303 large bird observations, compared to the lowest use of 734 observations in November (Figure 9). February numbers were heavily driven by large flocks of snow geese and Canada geese, with 13 flocks of 100 to 600 individuals observed (total of 3,620 observations, or over 68% of all February observations).

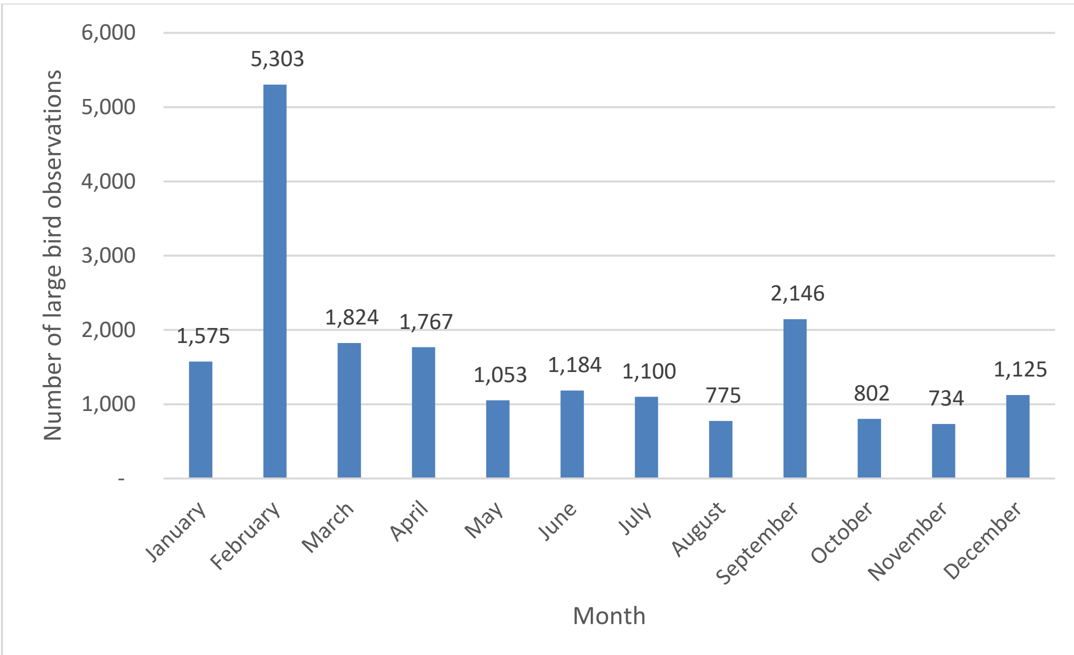


Figure 9. Total number of large bird observations by month at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

3.2.5 Rare Bird Species

No federally listed large bird species were observed during the 34 survey events. Two state-endangered species, the peregrine falcon (1 individual) and northern harrier (316 individuals), were observed during large bird surveys. The peregrine falcon was observed during survey event 33 (September 2019) at Point 76. Norther harriers were observed during every calendar month except for June, July, and August. Northern harriers are generally considered at a lower risk of fatality from wind farms, as their hunting habits include flying low to the ground and using sight and sound to detect prey. Even at sites with relatively high northern harrier use, fatality has been absent or low (Erickson et al. 2002). Of the 316 northern harriers observed during large bird surveys, only 30 (9.5%) were observed flying in the rotor-swept zone (45-156 m; see Appendix A).

An additional five species of special concern in Missouri were observed. This included 1 osprey, 2 sandhill cranes (*Grus canadensis*), 25 short-eared owls, 35 sharp-shinned hawks, and 29 trumpeter swans (Table

6; Appendix A, Table A-2). Two more ospreys, 4 more short-eared owls, and 2 more sharp-shinned hawks were observed incidentally during large bird surveys and 1 loggerhead shrike, another species of special concern in Missouri, was also observed incidental to large bird surveys (outside the 800-m point count boundary or between points).

Table 6. State-listed large bird species detected during the large bird use surveys at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Species	State Status	Number Observed	Month(s)	Survey Point(s)[1]
Northern Harrier	Endangered	316	September-May	1-14, 16-40, 42, 44-52, 54-56, 58-59, 61, 64-65, 67-70, 72, 74, 76-79, 81-85, 87-93
Peregrine Falcon	Endangered	1	September	76
Osprey	Special Concern	1	September	6
Sandhill Crane	Special Concern	2	March	91
Short-eared owl	Special Concern	25	December-March	3, 18, 20, 35, 48, 68, 74, 82
Sharp-shinned Hawk	Special Concern	35	September-April	2,7,24,26,31, 33, 35, 36, 10, 13, 16, 18, 52, 63, 65, 67, 73-75, 81, 83, 90, 92-93
Trumpeter Swan	Special Concern	29	January-February	14, 60

[1]Points 61, 63, 68-69, 73, 80, 86-89 and 91-936 are outside of the current project boundary (see Figure 1).

3.2.6 Incidental Species

Only one species was only observed incidentally (outside 800-m radius large bird plot, small bird species not observed during small bird surveys, or birds observed between survey points), the Wilson’s snipe (*Gallinago delicata*).

3.3 EAGLE USE SURVEY

Eagle use surveys were conducted concurrent with the large bird use surveys (see Table 4 and Table 5). Each point has been surveyed 24 times (twice for each calendar month).

3.3.1 Bald Eagle Use

During the 2,232 hours of survey effort, 547 bald eagles were observed, for a total of 1,480 bald eagle flight minutes (minutes bald eagles were flying within the 800-m buffer and below 200-m in height). While all 93 points were surveyed 24 times each, the current project boundary (Figure 1) no longer includes 13 of the survey points (Points 61, 63, 68-69, 73, 80, 86-89, 91-93; Figure 1).

During 1,920 hours of survey effort at the 80 points still within the project boundary (see Figure 1), a total of 490 bald eagle observations were recorded, for a total of 1,324 bald eagle flight minutes. These 1,324 bald eagle flight minutes were from 408 bald eagle observations (the remaining 82 bald eagle observations were either perched or outside the 800-m survey plot; Appendix A, Table A-5).

Of the 547 bald eagle observations, 427 were adults (78.1%) and 112 were juveniles (i.e., immature; 20.5%), while the remaining observations were of unknown age class. Of the 1,480 bald eagle flight minutes recorded, 1,071 minutes (72.4%) were adult bald eagle observations and 387 minutes (26.2%) were juvenile bald eagle observations (Appendix A, Table A-5).

3.3.1.1 Spatial Bald Eagle Use

Bald eagle flight minutes were recorded at 77 of the 80 points still within the project boundary (all points except for Points 20, 59, and 79; Figure 1; Figure 10; Appendix A, Table A-5). Bald eagle observations and minutes were generally spread out across all points.

The highest number of bald eagles observed at any one point occurred at Point 54 where 16 bald eagles were observed, recording 38 bald eagle flight minutes, however, Point 14 recorded the highest number of bald eagle flight minutes, with 49 bald eagle flights minutes and 8 bald eagle observations (Appendix A, Table A-5).

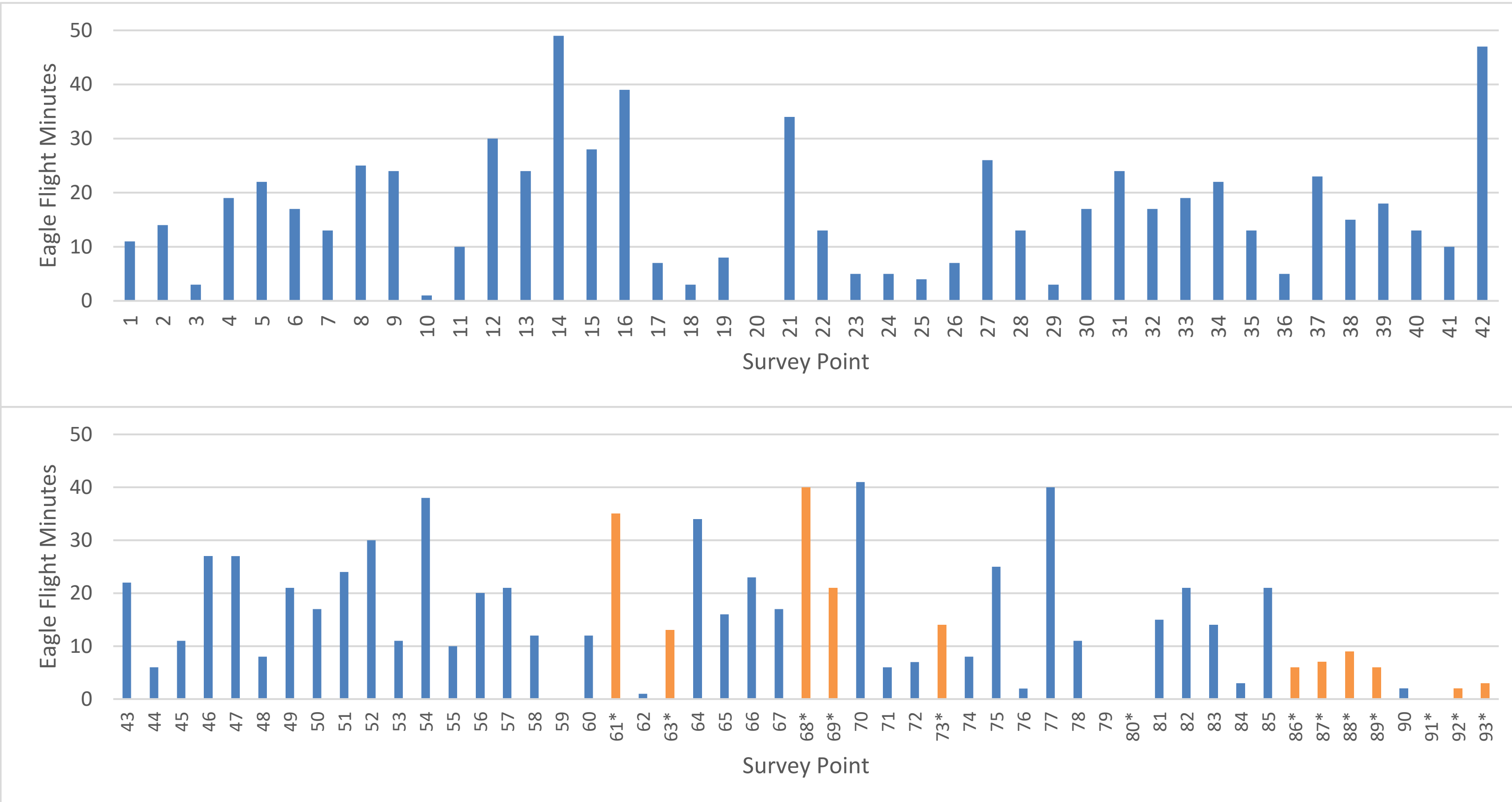


Figure 10. Total bald eagle flight minutes within the 800-m radius by 200-m height survey plot and bald eagle observations by point for the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri. Points outside the current boundary (see Figure 1) are noted with an asterisk and shown in orange.

3.3.1.2 Temporal Bald Eagle Use

Bald eagle flight minutes were recorded during 23 of the 34 survey events (67.6%; Appendix A, Table A-5). The majority of bald eagle observations occurred from November through March with 1,298 of the 1,480 bald eagle flight minutes (87.7%) recorded during these winter months (Figure 11). Zero bald eagle flight minutes were recorded during the month of June (Figure 11).

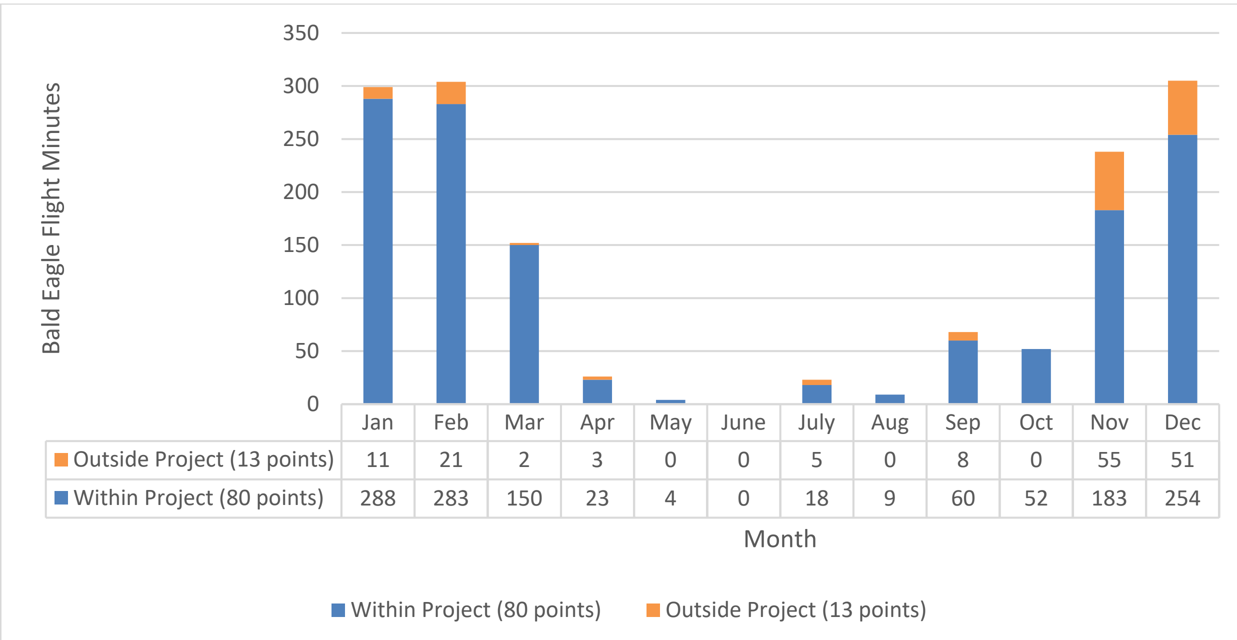


Figure 11. Total bald eagle flight minutes within the 800-m radius by 200-m height survey plots by month for High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

3.3.2 Golden Eagle Use

During the 2,232 hours of survey effort, 5 golden eagles were observed, for a total of 15 golden eagle flight minutes (minutes golden eagles were flying within the 800-m buffer and below 200-m in height). While all 93 points were surveyed 24 times each, the current project boundary (Figure 1) no longer includes 13 of the survey points (Points 61, 63, 68-69, 73, 80, 86-89, 91-93; Figure 1).

During 1,920 hours of survey effort at the 80 points still within the project boundary (see Figure 1), a total of 4 golden eagle observations were recorded, for a total of 11 golden eagle flight minutes (Appendix A, Table A-6).

Immature golden eagles accounted for 4 of the 5 (80%) golden eagle observations and 11 of the 15 golden eagle flight minutes (Appendix A, Table A-6).

3.3.2.1 Spatial Golden Eagle Use

Golden eagles were observed within four plots, at Points 16, 36, 38, 61 (outside current project boundary) and 65 (Figure 1; Appendix A, Table A-6).

3.3.2.2 Temporal Golden Eagle Use

The golden eagles were observed within the plots during the months of March, April, and December with the majority of observations (3; 60%) occurring during the month of April (Appendix A, Table A-6).

3.4 FLIGHT HEIGHT/COLLISION RISK

Species in different avian groupings may have different levels of risk of collision with wind turbine blades (Erickson et al. 2002), including raptors (birds of prey) such as hawks, owls, eagles, falcons, and vultures; water birds such as ducks and geese; shorebirds such as plovers and sandpipers; wading birds such as pelicans and herons; game birds such as pheasants and grouse; nightjars such as the common nighthawk (*Chordeiles minor*); and passerines such as sparrows and blackbirds. All observations by species and species group were broken down by flight height in relation to the rotor-swept zone (Appendix A, Table A-3 and Table A-4).

3.4.1 Small Bird Use Survey

Of the 12,266 small birds observed with known flight height, 37.7% (4,626 observations) of birds were first detected while flying. Of these, 4,269 birds (92.3% of flying observations; 34.8% of all observations) were flying below the rotor-swept zone (0–44 m). A total of 354 birds were observed flying within the rotor-swept zone (45–155 m), representing 7.6% of birds first observed flying and 2.8% of all observations. Three birds, two red-winged black birds and one bank swallow, were observed flying above the rotor swept zone (above 155 m), representing 0.02% of all birds observed and 0.07% of birds first observed flying (Appendix A, Table A-3).

3.4.2 Large Bird Use Survey

Of the 19,388 large birds observed, 91.2% (17,680 observations) of birds were first detected while flying. Of these, 6,200 birds (35.1% of flying observations; 32.0% of all observations) were flying below the rotor-swept zone (0–44 m). A total of 7,089 large bird observations were within the rotor-swept zone (45–155 m), representing 36.6% of all large birds observed during the survey and 40.1% of all flying observations. A total of 4,391 large birds (24.8% of large bird flying observations; 22.6% of all large bird observations) were observed flying above the rotor swept zone (>155 m) (Appendix A, Table A-4). The number of flying bird observations was influenced by flocks of birds observed migrating through the project area, including Canada geese, American crows, and turkey vultures. The four large bird species representing the largest number of individuals observed flying within the rotor-swept zone included:

- Turkey vulture (3,295 observations)
- Canada goose (1,829 observations)
- Snow goose (1,198 observations)
- Red-tailed hawk (259 observations)

3.4.3 Eagle Use Survey

The ECPG (USFWS 2013) considers any eagle at flight to be at risk, regardless of height (unless it's over 200-m in height). During 1,920 hours of survey effort at the 80 points still within the project boundary (see Figure 1), a total of 490 bald eagle observations were recorded, for a total of 1,324 bald eagle flight minutes, and a total of 4 golden eagle observations were recorded, for a total of 11 golden eagle flight minutes. Bald eagle flight use averaged 0.69 bald eagle flight minute per survey hour per survey plot (800-m radius and 200+-m height) and 0.006 golden eagle flight minute per survey hour per survey plot.

4.0 SUMMARY

This report presents the results of the pre-construction small bird, large bird, and eagle use surveys at the High Prairie Wind Energy Project. A summary of the results is presented below:

- A total of 12,542 small bird observations, consisting of 115 species, were observed during the avian use surveys. Of these, 42.9% were red-winged blackbirds, European starlings, mourning doves, blue jays, and American goldfinches.

- A total of 19,388 large bird observations, consisting of 37 species, were observed during the large bird use surveys. Of these, 91.7% were turkey vultures, snow geese, Canada geese, American crows, and red-tailed hawk.

- Bird use averaged 10.1 small birds per 5 minutes per 100-m plot and 8.7 large birds per 60 minutes per 800-m plot.

- Species richness averaged 3.3 small bird species per five-minute count and 1.3 large bird species per 60-minute count.

- No federally listed threatened or endangered bird species were detected during any of the avian use surveys. Two state-endangered large bird species (northern harrier and peregrine falcon) were observed during the large bird surveys; both were observed flying within the rotor-swept zone.

- A total of 1,324 bald eagle flight minutes and 11 golden eagle flight minutes were recorded at points within the current project boundary.

- Of the 4,626 small birds that were first observed flying during the survey, 92.3% were flying below the rotor-swept zone, 7.6% were flying within the rotor-swept zone, and 3 small birds (0.07%) were observed flying above the rotor-swept zone.

Summary

- Of the 17,680 large birds that were first observed flying during the survey, 35.1% were flying below the rotor-swept zone, 40.1% were flying within the rotor-swept zone, and 24.8% were flying above the rotor-swept zone. Of the large birds observed flying within the rotor-swept zone, 6,322 (89.2%) were turkey vultures, Canada geese, and snow geese.

5.0 REFERENCES

Erickson, W. P., G. D. Johnson, D. P. Young, M. D. Strickland, R. E. Good, M. Bourassa, K. Bay and K. J. Sterna. 2002. Synthesis and comparison of baseline avian and bat use, raptor nesting and mortality information from proposed and existing wind developments. Report prepared for Bonneville Power Administration, Portland OR. WEST, Inc., Cheyenne, WY. 124 pp.

Ralph, C. J., S. Droege, and J. R. Sauer. 1995. Managing and monitoring birds using point counts: standards and applications. Pages 161-169 *in* C. J. Ralph, J. R. Sauer, and S. Droege, editors. Monitoring bird populations by point counts. PSW-GTR-149. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, California, USA.

U.S. Fish and Wildlife Service (USFWS). 2012. Land-based Wind Energy Guidelines. U.S. Fish and Wildlife Service.

USFWS. 2013. Eagle Conservation Plan Guidance, Module 1 – Land-based Wind Energy. Version 2. U.S. Fish and Wildlife Service.

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Appendix A - Table A-1. Mean small bird use (defined as smaller than an American crow) based on 100-m plots surveyed during small bird use surveys at the High Prairie Wind Energy Facility in Schuyler and Adair counties, Missouri.

Appendix A SUMMARY TABLES

Table A-1. Mean small bird use (defined as smaller than an American crow) based on 100-m plots surveyed during small bird use surveys at the High Prairie Wind Energy Facility in Schuyler and Adair counties, Missouri.

Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Raptors	American Kestrel (*Falco sparverius*)	66	0.05	0.01	54.5%
	Raptor Total	**66**	**0.05**	**0.01**	**-**
Water/Shore Birds	Green Heron (*Butorides virescens*)	1	<0.01	0.00	4.5%
	Killdeer (*Charadrius vociferus*)	195	0.16	0.02	63.6%
	Pectoral Sandpiper (*Calidris melanotos*)	1	<0.01	0.00	4.5%
	Pied-billed Grebe (*Podilymbus podiceps*)	2	<0.01	0.00	4.5%
	Plover Total	**199**	**0.16**	**0.02**	**-**
Doves	Mourning Dove (*Zenaida macroura*)	634	0.51	0.05	86.4%
	Rock Dove (*Columba livia*)	76	0.06	0.01	45.5%
	Dove Total	**710**	**0.57**	**0.06**	**-**
Woodpeckers	Downy Woodpecker (Dryobates pubescens)	63	0.05	0.01	63.6%
	Hairy Woodpecker (*Dryobates villosus*)	32	0.03	0.00	45.5%
	Northern Flicker (*Colaptes auratus*)	90	0.07	0.01	72.7%

Appendix A - Table A-1. Mean small bird use (defined as smaller than an American crow) based on 100-m plots surveyed during small bird use surveys at the High Prairie Wind Energy Facility in Schuyler and Adair counties, Missouri.

Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Woodpeckers	Pileated Woodpecker (*Dryocopus pileatus*)	6	<0.01	0.00	13.6%
	Red-bellied Woodpecker (*Melanerpes carolinus*)	174	0.14	0.01	59.1%
	Red-headed Woodpecker (*Regulus calendula*)	179	0.14	0.01	59.1%
	Yellow-bellied Sapsucker (*Sphyrapicus varius*)	1	<0.01	0.00	4.5%
	Woodpecker Total	**545**	**0.44**	**0.04**	**-**
Passerines	American Goldfinch (*Carduelis tristis*)	518	0.42	0.04	54.5%
	American Pipit (*Anthus rubescens)*	6	<0.01	0.00	4.5%
	American Robin (*Turdus migratorius*)	497	0.40	0.04	86.4%
	American Tree Sparrow (*Spizelloides arborea*)	78	0.06	0.01	18.2%
	Baltimore Oriole (*Icterus galbula*)	11	0.01	0.00	18.2%
	Bank Swallow (*Riparia riparia*)	1	<0.01	0.00	4.5%
	Barn Swallow (*Hirundo rustica*)	276	0.22	0.02	50.0%
	Bell's Vireo (*Vireo bellii)*	1	<0.01	0.00	4.5%
	Belted Kingfisher (*Megaceryle alcyon*)	1	<0.01	0.00	4.5%

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Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Passerines	Black-billed Cuckoo (*Coccyzus erythropthalmus*)	1	<0.01	0.00	4.5%
	Black-capped Chickadee (*Poecile atricapillus*)	140	0.11	0.01	63.6%
	Blue Grosbeak (*Passerina caerulea*)	7	0.01	0.00	9.1%
	Blue Jay (*Cyanocitta cristata*)	567	0.46	0.05	95.5%
	Blue-gray Gnatcatcher (*Polioptila caerulea*)	3	<0.01	0.00	9.1%
	Blue-headed Vireo (*Vireo solitarius*)	1	<0.01	0.00	4.5%
	Bobolink (*Dolichonyx oryzivorus*)	109	0.09	0.01	36.4%
	Brown Creeper (*Certhia americana*)	2	<0.01	0.00	4.5%
	Brown Thrasher (*Toxostoma rufum*)	23	0.02	0.00	31.8%
	Brown-headed Cowbird (*Molothrus ater*)	95	0.08	0.01	50.0%
	Carolina Wren (*Thryothorus ludovicianus*)	19	0.02	0.00	27.3%
	Cedar Waxwing (*Bombycilla cedrorum*)	85	0.07	0.01	18.2%
	Chestnut-sided Warbler (*Setophaga pensylvanica*)	1	<0.01	0.00	4.5%
	Chimney Swift (*Chaetura pelagica*)	5	<0.01	0.00	9.1%

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Appendix A - Table A-1. Mean small bird use (defined as smaller than an American crow) based on 100-m plots surveyed during small bird use surveys at the High Prairie Wind Energy Facility in Schuyler and Adair counties, Missouri.

Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Passerines	Chipping Sparrow (*Spizella passerine*)	113	0.09	0.01	59.1%
	Cliff Swallow (*Petrochelidon pyrrhonota*)	8	0.01	0.00	13.6%
	Common Grackle (*Quiscalus quiscula*)	108	0.09	0.01	45.5%
	Common Nighthawk (*Chordeiles minor*)	6	<0.01	0.00	4.5%
	Common Yellowthroat (*Geothlypis trichas*)	49	0.04	0.00	27.3%
	Dark-eyed Junco (*Junco hyemalis*)	319	0.26	0.03	27.3%
	Dickcissel (*Spiza americana*)	270	0.22	0.02	40.9%
	Eastern Bluebird (*Sialia sialis*)	265	0.21	0.02	72.7%
	Eastern Kingbird (*Tyrannus tyrannus*)	105	0.08	0.01	45.5%
	Eastern Meadowlark (*Sturnella magna*)	260	0.21	0.02	68.2%
	Eastern Phoebe (*Sayornis phoebe*)	32	0.03	0.00	45.5%
	Eastern Towhee (*Pipilo erythrophthalmus*)	46	0.04	0.00	27.3%
	Eastern Wood-Pewee (*Contopus virens*)	55	0.04	0.00	22.7%
	Eurasian Collard-Dove (*Streptopelia decaocto*)	19	0.02	0.00	27.3%
	Eurasian Tree Sparrow (*Passer montanus*)	11	0.01	0.00	13.6%

Appendix A - Table A-1. Mean small bird use (defined as smaller than an American crow) based on 100-m plots surveyed during small bird use surveys at the High Prairie Wind Energy Facility in Schuyler and Adair counties, Missouri.

Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Passerines	European Starling (*Sturnus vulgaris*)	1998	1.61	0.16	86.4%
	Field Sparrow (*Spizella pusilla*)	130	0.10	0.01	59.1%
	Fox Sparrow (*Passerella iliaca*)	3	<0.01	0.00	9.1%
	Gadwall (*Mareca strepera*)	1	<0.01	0.00	4.5%
	Golden Crowned Kinglet (*Regulus satrapa*)	15	0.01	0.00	9.1%
	Grasshopper Sparrow (*Ammodramus savannarum*)	36	0.03	0.00	27.3%
	Gray Catbird (*Dumetella carolinensis*)	104	0.08	0.01	36.4%
	Great Crested Flycatcher (*Myiarchus crinitus*)	25	0.02	0.00	22.7%
	Henslow's Sparrow (*Centronyx henslowii*)	7	0.01	0.00	9.1%
	Hermit Thrush (*Catharus guttatus*)	3	<0.01	0.00	4.5%
	Hooded Warbler (*Setophaga citrina*)	1	<0.01	0.00	4.5%
	Horned Lark (*Eremophila alpestris*)	165	0.13	0.01	50.0%
	House Finch (*Carpodacus mexicanus*)	12	0.01	0.00	22.7%
	House Sparrow (*Passer domesticus*)	392	0.32	0.03	54.5%
	House Wren (*Troglodytes aedon*)	63	0.05	0.01	27.3%

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Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Passerines	Indigo Bunting (*Passerina cyanea*)	52	0.04	0.00	27.3%
	Lapland Longspur (*Calcarius lapponicus*)	382	0.31	0.03	9.1%
	Lark Sparrow (*Chondestes grammacus*)	4	<0.01	0.00	9.1%
	LeConte's Sparrow (*Ammospiza leconteii*)	1	<0.01	0.00	4.5%
	Lincoln's Sparrow (*Melospiza lincolnii*)	6	<0.01	0.00	4.5%
	Loggerhead Shrike (*Lanius ludovicianus*)	1	<0.01	0.00	4.5%
	Northern Bobwhite (*Colinus virginianus*)	63	0.05	0.01	40.9%
	Northern Cardinal (*Cardinalis cardinalis*)	234	0.19	0.02	86.4%
	Northern Mockingbird (*Mimus polyglottos*)	22	0.02	0.00	50.0%
	Northern Parula (*Setophaga americana*)	1	<0.01	0.00	4.5%
	Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	33	0.03	0.00	13.6%
	Northwestern Crow (*Corvus caurinus*)	1	<0.01	0.00	4.5%
	Orange-crowned Warbler (*Leiothlypis celata*)	7	0.01	0.00	4.5%
	Orchard Oriole (*Icterus spurius*)	4	<0.01	0.00	13.6%

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Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
	Ovenbird (*Seiurus aurocapilla*)	2	<0.01	0.00	9.1%
Passerines	Palm Warbler (*Setophaga palmarum*)	5	<0.01	0.00	4.5%
	Philadelphia Vireo (*Vireo philadelphicus*)	1	<0.01	0.00	4.5%
	Pine Siskin (*Spinus pinus*)	4	<0.01	0.00	9.1%
	Purple Finch (*Haemorhous purpureus*)	20	0.02	0.00	9.1%
	Purple Martin (*Progne subis*)	24	0.02	0.00	9.1%
	Red-eyed Vireo (*Vireo olivaceus*)	8	0.01	0.00	9.1%
	Red-winged Blackbird (*Agelaius phoeniceus*)	2455	1.98	0.20	77.3%
	Rose Breasted Grosbeak (*Pheucticus ludovicianus*)	10	0.01	0.00	13.6%
	Ruby-crowned Kinglet (*Regulus calendula*)	7	0.01	0.00	4.5%
	Rusty Blackbird (*Euphagus carolinus*)	10	0.01	0.00	4.5%
	Savannah Sparrow (*Passerculus sandwichensis*)	30	0.02	0.00	22.7%
	Sedge Wren (*Cistothorus platensis*)	14	0.01	0.00	18.2%
	Song Sparrow (Melospiza melodia)	129	0.10	0.01	59.1%

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Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
	Summer Tanager (*Piranga rubra*)	3	<0.01	0.00	9.1%
	Swamp Sparrow (*Melospiza georgiana*)	9	0.01	0.00	9.1%
Passerines	Tennessee Warbler (*Leiothlypis peregrina*)	1	<0.01	0.00	4.5%
	Tree Swallow (*Tachycineta bicolor*)	26	0.02	0.00	27.3%
	Tufted Titmouse (*Baeolophus bicolor*)	40	0.03	0.00	31.8%
	Upland Sandpiper (*Bartramia longicauda*)	1	<0.01	0.00	4.5%
	Vesper Sparrow (*Pooecetes gramineus*)	11	0.01	0.00	13.6%
	Warbling Vireo (*Vireo gilvus*)	1	<0.01	0.00	4.5%
	Western Meadowlark (*Sturnella neglecta*)	13	0.01	0.00	36.4%
	White-breasted Nuthatch (*Sitta carolinensis*)	92	0.07	0.01	45.5%
	White-crowned Sparrow (*Zonotrichia leucophrys*)	14	0.01	0.00	13.6%
	White-throated Sparrow (*Zonotrichia albicollis*)	86	0.07	0.01	9.1%
	Willow Flycatcher (*Empidonax traillii*)	1	<0.01	0.00	4.5%
	Wilson's Snipe (*Gallinago delicata*)	6	<0.01	0.00	4.5%

AVIAN USE SURVEYS

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Species Group	Species	Number of Observations (within 100 m)	Mean Bird Use (Birds/5-minutes/100-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
	Winter Wren (*Troglodytes hiemalis*)	1	<0.01	0.00	4.5%
	Wood Thrush (*Hylocichla mustelina*)	2	<0.01	0.00	9.1%
Passerines	Yellow Warbler (*Setophaga petechia*)	1	<0.01	0.00	4.5%
	Yellow-billed Cuckoo (*Coccyzus americanus*)	9	0.01	0.00	18.2%
	Yellow-rumped Warbler (*Setophaga coronate*)	96	0.08	0.01	13.6%
	Yellow-throated Vireo (*Vireo flavifrons*)	11	0.01	0.00	9.1%
	Passerines total	**11,022**	**8.87**	**0.88**	**-**
	Grand Total	**12,542**	**10.10**	**-**	**-**

AVIAN USE SURVEYS

Appendix A - Table A-2. Mean large bird use (defined as an American crow or larger) based on 800-m plot point counts during large bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri. Summary Tables

Table A-2. Mean large bird use (defined as an American crow or larger) based on 800-m plot point counts during large bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Number of Observations (within 800 m)	Mean Bird Use (Birds/60-minutes/800-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Ducks, Geese, and Swans	Blue-winged Teal (Spatula discors)	36	0.02	0.002	11.8%
	Canada Goose (Branta canadensis)	3244	1.45	0.167	76.5%
	Greater White-fronted Goose (*Anser albifrons*)	27	0.01	0.001	5.9%
Ducks, Geese, and Swans	Hooded Merganser (Lophodytes cucullatus)	4	<0.01	<0.001	2.9%
	Lesser Scaup (Aythya affinis)	155	0.07	0.008	2.9%
	Mallard (Anas platyrhynchos)	103	0.05	0.005	17.6%
	Northern Pintail (Anas acuta)	2	<0.01	<0.001	2.9%
	Ring-necked Duck (*Aythya collaris*)	8	<0.01	<0.001	2.9%
	Snow Goose (*Anser caerulescens*)	4638	2.08	0.239	14.7%
	Trumpeter Swan (Cygnus buccinator)	29	0.01	0.001	5.9%
	Wood Duck (Aix sponsa)	21	0.01	0.001	11.8%
Ducks and Geese Total		**8,267**	**3.70**	**0.426**	**--**
Herons and Cranes	Great Blue Heron (*Ardea herodias*)	97	0.04	0.005	61.8%

Appendix A - Table A-2. Mean large bird use (defined as an American crow or larger) based on 800-m plot point counts during large bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri. Summary Tables

Species Group	Species	Number of Observations (within 800 m)	Mean Bird Use (Birds/60-minutes/800-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
	Sandhill Crane (*Antigone canadensis*)	2	<0.01	<0.001	2.9%
	Yellow-crowned Night Heron (*Nyctanassa violacea*)	1	<0.01	<0.001	2.9%
Heron Total		**100**	**0.04**	**0.005**	**--**
Raptors	Broad-winged Hawk (*Buteo platypterus*)	76	0.03	0.004	5.9%
	Cooper's Hawk (Accipiter cooperii)	34	0.02	0.002	52.9%
Raptors	Merlin (Falco columbarius)	3	<0.01	<0.001	5.9%
	Northern Harrier (Circus cyaneus)	316	0.14	0.016	61.8%
	Osprey (*Pandion haliaetus*)	1	<0.01	<0.001	2.9%
	Peregrine Falcon (Falco peregrinus)	1	<0.01	<0.001	2.9%
	Rough-legged Hawk (Buteo lagopus)	194	0.09	0.010	47.1%
	Red-shouldered Hawk (Buteo lineatus)	16	0.01	0.001	20.6%
	Red-tailed Hawk (Buteo jamaicensis)	879	0.39	0.045	100.0%
	Sharp-shinned Hawk (Accipiter striatus)	35	0.02	0.002	41.2%
	Turkey Vulture (Cathartes aura)	6603	2.96	0.341	58.8%
Raptor Total		**8,158**	**3.66**	**0.421**	**--**

Appendix A - Table A-2. Mean large bird use (defined as an American crow or larger) based on 800-m plot point counts during large bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri. Summary Tables

Species Group	Species	Number of Observations (within 800 m)	Mean Bird Use (Birds/60-minutes/800-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
Game Birds	Ring-necked Pheasant (*Phasianus colchicus*)	11	<0.01	0.001	23.5%
	Wild Turkey (*Meleagris gallopavo*)	187	0.08	0.010	52.9%
	Game Bird Total	**198**	**0.09**	**0.010**	**--**
Water Birds	American White Pelican (*Pelecanus erythrorhynchos*)	74	0.03	0.004	14.7%
	Double-crested Cormorant (*Phalacrocorax auratus*)	81	0.04	0.004	5.9%
	Water Bird Total	**155**	**0.07**	**0.008**	**--**
Owls	Barred Owl (*Strix varia*)	22	0.01	0.001	35.3%
	Great Horned Owl (*Bubo virginianus*)	3	<0.01	<0.001	2.9%
	Short-eared Owl (*Asio flammeus*)	25	0.01	0.001	20.6%
	Owl Total	**50**	**0.02**	**0.003**	**--**
Corvids	American Crow (*Corvus brachyrhynchos*)	2,414	1.08	0.125	91.2%
	Crow Total	**2,414**	**1.08**	**0.125**	**--**
Gulls	Ring-billed Gull (*Larus delawarensis*)	38	0.02	0.002	5.9%
	Gull Total	**38**	**0.02**	**0.002**	**--**
Terns	Caspian Tern (*Hydroprogne caspia*)	4	<0.01	<0.001	2.9%
	Tern Total	**4**	**<0.1**	**<0.001**	**--**
Woodpeckers	Pileated Woodpecker	2	<0.01	<0.001	5.9%

Appendix A - Table A-2. Mean large bird use (defined as an American crow or larger) based on 800-m plot point counts during large bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri. Summary Tables

Species Group	Species	Number of Observations (within 800 m)	Mean Bird Use (Birds/60-minutes/800-m point count)	Relative Abundance	Frequency of Occurrence (% of survey events detected)
	(*Dryocopus pileatus*)				
	Woodpecker Total	**2**	**<0.1**	**<0.001**	**--**
Nightjars	Common Nighthawk (*Chordeiles minor*)	2	<0.01	<0.001	2.9%
	Nightjar Total	**2**	**<0.1**	**<0.001**	**--**
Grand Total		**19,388**	**8.69**	**--**	**--**

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
Raptors	American Kestrel (*Falco sparverius*)	21	-	-	-	45	66
Raptor Total		**21**	**-**	**-**	**-**	**45**	**66**
Water/Shore Birds	Green Heron (*Butorides virescens*)	-	-	-	-	1	1
	Killdeer (*Charadrius vociferus*)	105	2	-	-	88	195
	Pectoral Sandpiper (*Calidris melanotos*)	-	-	-	-	1	1
	Pied-billed Grebe (*Podilymbus podiceps*)	-	-	-	-	2	2
Water/Shore Bird Total		**105**	**2**	**-**	**-**	**92**	**199**
Doves	Mourning Dove (*Zenaida macroura*)	149	2	-	5	478	634
	Rock Dove (*Columba livia*)	67	2	-	-	7	76
Dove Total		**216**	**4**	**0**	**5**	**485**	**710**
Woodpeckers	Downy Woodpecker (Dryobates pubescens)	9	-	-	2	52	63
	Hairy Woodpecker (*Dryobates villosus*)	6	-	-	-	26	32
	Northern Flicker (*Colaptes auratus*)	28	1	-	2	59	90
	Pileated Woodpecker (*Dryocopus pileatus*)	-	-	-	-	6	6
	Red-bellied Woodpecker (*Melanerpes carolinus*)	17	1	-	4	152	174

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
Woodpeckers	Red-headed Woodpecker (*Regulus calendula*)	16	3	-	-	160	179
	Yellow-bellied Sapsucker (*Sphyrapicus varius*)	-	-	-	-	1	1
	Woodpecker Total	**76**	**5**	**-**	**8**	**456**	**545**
Passerines	American Goldfinch (*Carduelis tristis*)	179	26	-	1	312	518
	American Pipit (*Anthus rubescens*)	-	6	-	-	-	6
	American Robin (*Turdus migratorius*)	210	5	-	20	262	497
	American Tree Sparrow (*Spizelloides arborea*)	30	-	-	-	48	78
	Baltimore Oriole (*Icterus galbula*)	-	-	-	-	11	11
	Bank Swallow (*Riparia riparia*)	-	-	1	-	-	1
	Barn Swallow (*Hirundo rustica*)	213	8	-	1	54	276
	Bell's Vireo (*Vireo bellii*)	-	-	-	-	1	1
	Belted Kingfisher (*Megaceryle alcyon*)	1	-	-	-	-	1
	Black-billed Cuckoo (*Coccyzus erythropthalmus*)	1	-	-	-	-	1
	Black-capped Chickadee (*Poecile atricapillus*)	5	-	-	5	130	140
	Blue Grosbeak (*Passerina caerulea*)	1	-	-	-	6	7
	Blue Jay (*Cyanocitta cristata*)	102	1	-	35	429	567

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
Passerines	Blue-gray Gnatcatcher (*Polioptila caerulea*)	-	-	-	-	3	3
	Blue-headed Vireo (*Vireo solitarius*)	-	-	-	-	1	1
	Bobolink (*Dolichonyx oryzivorus*)	38	4	-	10	57	109
	Brown Creeper (*Certhia americana*)	-	-	-	-	2	2
	Brown Thrasher (*Toxostoma rufum*)	9	-	-	-	14	23
	Brown-headed Cowbird (*Molothrus ater*)	48	-	-	1	46	95
	Carolina Wren (*Thryothorus ludovicianus*)	-	-	-	1	18	19
	Cedar Waxwing (*Bombycilla cedrorum*)	28	42	-	-	15	85
	Chestnut-sided Warbler (*Setophaga pensylvanica*)	-	-	-	-	1	1
	Chimney Swift (*Chaetura pelagica*)	5	-	-	-	-	5
	Chipping Sparrow (*Spizella passerine*)	3	-	-	9	101	113
	Cliff Swallow (*Petrochelidon pyrrhonota*)	7	-	-	-	1	8
	Common Grackle (*Quiscalus quiscula*)	56	6	-	-	46	108
	Common Nighthawk (*Chordeiles minor*)	-	6	-	-	-	6
	Common Yellowthroat (*Geothlypis trichas*)	2	-	-	-	47	49

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
Passerines	Dark-eyed Junco (*Junco hyemalis*)	115	11	-	-	193	319
	Dickcissel (*Spiza americana*)	15	-	-	70	185	270
	Eastern Bluebird (*Sialia sialis*)	63	2	-	1	199	265
	Eastern Kingbird (*Tyrannus tyrannus*)	24	-	-	-	81	105
	Eastern Meadowlark (*Sturnella magna*)	28	-	-	3	229	260
	Eastern Phoebe (*Sayornis phoebe*)	2	-	-	-	30	32
	Eastern Towhee (*Pipilo erythrophthalmus*)	-	-	-	4	42	46
	Eastern Wood-Pewee (*Contopus virens*)	1	-	-	4	50	55
	Eurasian Collard-Dove (*Streptopelia decaocto*)	13	-	-	-	6	19
	Eurasian Tree Sparrow (*Passer montanus*)	4	-	-	-	7	11
	European Starling (*Sturnus vulgaris*)	673	15	-	-	1310	1998
	Field Sparrow (*Spizella pusilla*)	10	-	-	12	108	130
	Fox Sparrow (*Passerella iliaca*)	1	-	-	-	2	3
	Gadwall (*Mareca strepera*)	-	-	-	-	1	1
	Golden Crowned Kinglet (*Regulus satrapa*)	-	-	-	-	15	15

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
Passerines	Grasshopper Sparrow (*Ammodramus savannarum*)	1	-	-	5	30	36
	Gray Catbird (*Dumetella carolinensis*)	1	-	-	3	100	104
	Great Crested Flycatcher (*Myiarchus crinitus*)	6	-	-	-	19	25
	Henslow's Sparrow (*Centronyx henslowii*)	-	-	-	3	4	7
	Hermit Thrush (*Catharus guttatus*)	-	-	-	-	3	3
	Hooded Warbler (*Setophaga citrina*)	-	-	-	-	1	1
	Horned Lark (*Eremophila alpestris*)	108	13	-	-	44	165
	House Finch (*Carpodacus mexicanus*)	5	2	-	-	5	12
	House Sparrow (*Passer domesticus*)	38	-	-	-	354	392
	House Wren (*Troglodytes aedon*)	3	-	-	-	60	63
	Indigo Bunting (*Passerina cyanea*)	6	-	-	2	44	52
	Lapland Longspur (*Calcarius lapponicus*)	358	4	-	-	20	382
	Lark Sparrow (*Chondestes grammacus*)	-	-	-	-	4	4
	LeConte's Sparrow (*Ammospiza leconteii*)	-	-	-	1	-	1

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
	Lincoln's Sparrow (*Melospiza lincolnii*)	-	-	-	-	6	6
Passerines	Loggerhead Shrike (*Lanius ludovicianus*)	1	-	-	-	-	1
	Northern Bobwhite (*Colinus virginianus*)	5	-	-	-	28	33
	Northern Cardinal (*Cardinalis cardinalis*)	3	-	-	4	56	63
	Northern Mockingbird (*Mimus polyglottos*)	20	-	-	9	205	234
	Northern Parula (*Setophaga americana*)	6	-	-	2	14	22
	Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	-	-	-	1	-	1
	Northwestern Crow (*Corvus caurinus*)	-	-	-	-	1	1
	Orange-crowned Warbler (*Leiothlypis celata*)	-	-	-	-	7	7
	Orchard Oriole (*Icterus spurius*)	1	-	-	-	3	4
	Ovenbird (*Seiurus aurocapilla*)	-	-	-	-	2	2
	Palm Warbler (*Setophaga palmarum*)	-	1	-	-	4	5
	Philadelphia Vireo (*Vireo philadelphicus*)	-	-	-	-	1	1
	Pine Siskin (*Spinus pinus*)	1	1	-	-	2	4
	Purple Finch (*Haemorhous purpureus*)	8	6	-	-	6	20

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
	Purple Martin (*Progne subis*)	3	18	-	-	3	24
Passerines	Red-eyed Vireo (*Vireo olivaceus*)	-	-	-	-	8	8
	Red-winged Blackbird (*Agelaius phoeniceus*)	1353	156	2	34	910	2455
	Rose Breasted Grosbeak (*Pheucticus ludovicianus*)	1	0	-	1	8	10
	Ruby-crowned Kinglet (*Regulus calendula*)	-	-	-	-	7	7
	Rusty Blackbird (*Euphagus carolinus*)	-	-	-	-	10	10
	Savannah Sparrow (*Passerculus sandwichensis*)	-	-	-	-	30	30
	Sedge Wren (*Cistothorus platensis*)	-	-	-	5	9	14
	Song Sparrow (Melospiza melodia)	4	-	-	9	116	129
	Summer Tannager (*Piranga rubra*)	-	-	-	-	3	3
	Swamp Sparrow (*Melospiza georgiana*)	-	-	-	-	9	9
	Tennessee Warbler (*Leiothlypis peregrina*)	-	-	-	-	1	1
	Tree Swallow (*Tachycineta bicolor*)	9	-	-	1	16	26
	Tufted Titmouse (*Baeolophus bicolor*)	-	-	-	1	39	40

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
	Upland Sandpiper (*Bartramia longicauda*)	-	1	-	-	-	1
Passerines	Vesper Sparrow (*Pooecetes gramineus*)	-	-	-	-	11	11
	Warbling Vireo (*Vireo gilvus*)	-	-	-	-	1	1
	Western Meadowlark (*Sturnella neglecta*)	-	-	-	1	12	13
	White-breasted Nuthatch (*Sitta carolinensis*)	2	-	-	1	89	92
	White-crowned Sparrow (*Zonotrichia leucophrys*)	-	-	-	-	14	14
	White-throated Sparrow (*Zonotrichia albicollis*)	-	-	-	-	86	86
	Willow Flycatcher (*Empidonax traillii*)	-	-	-	-	1	1
	Wilson's Snipe (*Gallinago delicata*)	6	-	-	-	-	6
	Winter Wren (*Troglodytes hiemalis*)	-	-	-	-	1	1
	Wood Thrush (*Hylocichla mustelina*)	-	-	-	-	2	2
	Yellow Warbler (*Setophaga petechia*)	-	-	-	-	1	1
	Yellow-billed Cuckoo (*Coccyzus americanus*)	2	-	-	3	4	9
	Yellow-rumped Warbler (*Setophaga coronate*)	13	9	-	-	74	96

Appendix A - Summary Tables Table A-3. Small bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the small bird surveys at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri.

Species Group	Species	Flyover Observation			Unknown Flight Height	Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)			
	Yellow-throated Vireo (*Vireo flavifrons*)	-	-	-	-	11	11
Passerines total		**3,851**	**343**	**3**	**263**	**6,562**	**11,022**
	Grand Total	**4,269**	**354**	**3**	**276**	**7,640**	**12,542**

Appendix A - Table A-4. Large bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the large bird use surveys at the at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri . Summary Tables

Table A-4. Large bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the large bird use surveys at the at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri .

Species Group	Species	Flyover Observation			Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)		
Ducks, Geese and Swans	Blue-winged Teal (*Spatula discors*)	4	0	0	32	36
	Canada Goose (*Branta canadensis*)	678	1,829	394	343	3,244
	Greater White-fronted Goose (*Anser albifrons*)	0	0	27	0	27
	Hooded Merganser (*Lophodytes cucullatus*)	0	0	0	4	4
	Lesser Scaup (*Aythya affinis*)	0	0	0	155	155
	Mallard (*Anas platyrhynchos*)	2	64	12	25	103
	Northern Pintail (*Anas acuta*)	2	0	0	0	2
	Ring-necked Duck (*Aythya collaris*)	0	0	0	8	8
	Snow Goose (*Anser caerulescens*)	10	1,198	3,430	0	4,638
	Trumpeter Swan (*Cygnus buccinator*)	18	0	0	11	29
	Wood Duck (*Aix sponsa*)	8	0	0	13	21
Ducks, Geese, and Swan Total		**722**	**3,091**	**3,863**	**591**	**8,267**
Herons and Cranes	Great Blue Heron (*Ardea herodias*)	72	15	0	10	97

Appendix A - Table A-4. Large bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the large bird use surveys at the at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri . Summary Tables

Species Group	Species	Flyover Observation			Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)		
	Sandhill Crane (*Antigone canadensis*)	0	2	0	0	2
	Yellow-crowned Night Heron (*Nyctanassa violacea*)	1	0	0	0	1
Heron and Crane Total		**73**	**17**	**0**	**10**	**100**
Raptors	Broad-winged Hawk (*Buteo platypterus*)	1	11	64	0	76
	Cooper's Hawk (*Accipiter cooperii*)	17	11	3	3	34
	Merlin (*Falco columbarius*)	1	0	0	2	3
	Northern Harrier (*Circus hudsonius*)	266	31	7	12	316
	Osprey (*Pandion haliaetus*)	0	0	1	0	1
	Peregrine Falcon (*Falco peregrinus*)	0	1	0	0	1
	Rough-legged Hawk (*Buteo lagopus*)	106	52	1	35	194
	Red-shouldered Hawk (*Buteo lineatus*)	5	2	0	9	16
	Red-tailed Hawk (*Buteo jamaicensis*)	408	259	50	162	879
	Sharp-shinned Hawk (*Accipiter striatus*)	27	5	2	1	35
	Turkey Vulture (*Cathartes aura*)	2,851	3,295	376	81	6,603

Appendix A - Table A-4. Large bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the large bird use surveys at the at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri . Summary Tables

Species Group	Species	Flyover Observation			Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)		
Raptor Total		**3,682**	**3.667**	**504**	**305**	**8,158**
Game Birds	Ring-necked Pheasant (*Phasianus colchicus*)	5	0	0	6	11
	Wild Turkey (*Meleagris gallopavo*)	6	0	0	181	187
Game Bird Total		**11**	**0**	**0**	**187**	**198**
Water Birds	American White Pelican (*Pelecanus erythrorhynchos*)	0	65	9	0	74
	Double-crested Cormorant (*Phalacrocorax auratus*)	12	55	14	0	81
Water Bird Total		**12**	**120**	**23**	**0**	**155**
Owls	Barred Owl (*Strix varia*)	3	0	0	19	22
	Great Horned Owl (*Bubo virginianus*)	0	0	0	3	3
	Short-eared Owl (*Asio flammeus*)	23	1	0	1	25
Owl Total		**26**	**1**	**0**	**23**	**50**
Corvids	American Crow (*Corvus brachyrhynchos*)	1,634	188	1	591	2,414
Corvid Total		**1,634**	**188**	**1**	**591**	**2,414**
Gulls	Ring-billed Gull (*Larus delawarensis*)	37	1	0	0	38
Gull Total		**37**	**1**	**0**	**0**	**38**
Terns	Caspian Tern (*Hydroprogne caspia*)	0	4	0	0	4

Appendix A - Table A-4. Large bird groupings and observed flight heights in relation to rotor-swept zone (RSZ) observed during the large bird use surveys at the at the High Prairie Wind Energy Facility, Schuyler and Adair counties, Missouri . Summary Tables

Species Group	Species	Flyover Observation			Non-Flyover Observation (i.e., Perched)	Total
		Below RSZ (0-44 m)	Within RSZ (45-155 m)	Above RSZ (above 155 m)		
Tern Total		**0**	**4**	**0**	**0**	**4**
Woodpeckers	Pileated Woodpecker (*Dryocopus pileatus*)	1	0	0	1	2
Woodpecker Total		**1**	**0**	**0**	**1**	**2**
Nighthawks	Common Nighthawk (*Chordeiles minor*)	2	0	0	0	2
Nighthawk Total		**2**	**0**	**0**	**0**	**2**
Grand Total		**6,200**	**7,089**	**4,391**	**1,708**	**19,388**

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
7	12	11/2/2016	1	Adult	2	20	0	0
7	13	11/3/2016	1	Adult	6	0	2	0
7	13	11/3/2016	1	Adult	8	0	0	0
7	17	11/6/2016	1	Immature	3	0	1	0
7	31	11/2/2016	1	Adult	1	2	0	0
7	40	11/2/2016	1	Adult	1	0	0	0
8	2	12/1/2016	1	Immature	3	0	0	0
8	6	12/2/2016	1	Adult	6	0	1	0
8	6	12/2/2016	1	Immature	2	0	1	0
8	10	12/3/2016	1	Adult	0	13	0	0
8	12	12/1/2016	1	Adult	4	0	3	0
8	16	12/2/2016	1	Adult	2	0	0	0
8	19	12/3/2016	1	Adult	2	13	0	0
8	30	12/22/2016	1	Adult	1	0	0	0
8	30	12/22/2016	1	Immature	2	0	1	0
8	35	12/7/2016	1	Adult	5	0	2	0
8	39	12/22/2016	1	Unknown	0	0	2	0
8	39	12/22/2016	1	Adult	3	0	0	0
8	39	12/22/2016	1	Immature	8	0	0	0
8	41	12/23/2016	1	Immature	2	0	0	0
8	41	12/23/2016	1	Immature	2	0	0	0
8	42	12/22/2016	1	Adult	13	0	0	0
8	42	12/22/2016	1	Adult	13	0	0	0
8	42	12/22/2016	1	Immature	6	0	1	0
8	42	12/22/2016	1	Immature	12	0	1	0
9	1	1/10/2017	1	Adult	4	0	2	0
9	5	1/10/2017	1	Unknown	0	0	3	0
9	5	1/10/2017	1	Adult	3	0	4	0
9	5	1/10/2017	1	Adult	4	0	7	1
9	5	1/10/2017	1	Adult	4	0	7	1
9	6	1/11/2017	1	Adult	2	0	1	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
9	8	1/9/2017	1	Adult	2	0	1	0
9	8	1/9/2017	1	Adult	2	0	1	0
9	8	1/9/2017	1	Adult	6	5	1	0
9	14	1/10/2017	1	Adult	2	0	3	0
9	14	1/10/2017	1	Adult	3	0	1	0
9	14	1/10/2017	1	Adult	5	11	3	0
9	14	1/10/2017	1	Adult	12	0	0	0
9	15	1/14/2017	1	Adult	4	0	5	0
9	16	1/11/2017	1	Adult	2	0	1	0
9	16	1/11/2017	1	Adult	5	0	1	0
9	21	1/14/2017	1	Adult	2	0	0	0
9	21	1/14/2017	1	Adult	3	3	0	0
9	21	1/14/2017	1	Adult	20	0	10	0
9	22	1/13/2017	1	Adult	0	0	8	0
9	26	1/10/2017	1	Adult	0	0	6	0
9	26	1/10/2017	1	Adult	3	0	8	0
9	29	1/17/2017	1	Adult	2	0	0	0
9	30	1/17/2017	1	Adult	1	0	0	0
9	30	1/17/2017	1	Adult	2	0	1	0
9	30	1/17/2017	1	Immature	3	0	1	0
9	32	1/13/2017	1	Immature	10	18	1	0
9	37	1/12/2017	1	Adult	1	0	15	0
9	38	1/13/2017	1	Adult	4	0	5	0
9	41	1/12/2017	1	Adult	4	0	1	0
10	5	2/5/2017	1	Adult	2	0	0	0
10	6	2/4/2017	1	Adult	6	0	2	0
10	9	2/5/2017	1	Unknown	0	0	7	0
10	9	2/5/2017	1	Unknown	0	0	7	0
10	9	2/5/2017	1	Adult	1	0	0	0
10	9	2/5/2017	1	Adult	9	0	5	0
10	14	2/5/2017	1	Adult	0	0	17	0
10	14	2/5/2017	1	Unknown	0	0	17	0
10	14	2/5/2017	1	Immature	12	0	8	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
10	14	2/5/2017	1	Unknown	6	0	0	0
10	16	2/4/2017	1	Adult	2	0	0	0
10	16	2/4/2017	1	Immature	22	0	1	0
10	17	2/4/2017	1	Adult	2	15	0	0
10	24	2/6/2017	1	Adult	1	24	0	0
10	24	2/6/2017	1	Adult	1	24	0	0
10	24	2/6/2017	1	Adult	3	1	0	0
10	25	2/10/2017	1	Adult	4	0	3	0
10	30	2/10/2017	1	Immature	3	0	2	0
10	37	2/7/2017	1	Adult	1	0	1	0
10	37	2/7/2017	1	Adult	4	0	0	0
10	38	2/9/2017	1	Adult	7	0	1	0
10	42	2/9/2017	1	Unknown	0	0	13	0
10	42	2/9/2017	1	Unknown	0	0	13	0
11	2	11/29/2017	1	Adult	3	0	0	0
11	4	11/22/2017	2	Immature	0	0	26	0
11	4	11/22/2017	3	Adult	0	0	39	0
11	4	11/22/2017	1	Adult	2	39	0	0
11	4	11/22/2017	1	Immature	8	0	1	0
11	7	11/22/2017	1	Adult	3	0	1	0
11	7	11/22/2017	1	Adult	3	0	2	0
11	16	11/27/2017	1	Adult	1	0	0	0
11	22	11/29/2017	1	Adult	1	0	0	0
11	23	11/29/2017	1	Adult	1	0	0	0
11	29	11/28/2017	1	Adult	1	0	2	0
11	30	11/20/2017	1	Adult	3	0	2	0
11	31	11/28/2017	1	Adult	2	0	0	0
11	33	11/29/2017	1	Adult	1	1	0	0
11	33	11/29/2017	1	Adult	2	19	0	0
11	39	11/28/2017	1	Adult	1	0	0	0
11	40	11/28/2017	1	Adult	4	0	3	0
11	43	11/22/2017	1	Immature	5	0	2	0
11	47	11/20/2017	1	Adult	1	0	1	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
11	47	11/20/2017	1	Adult	2	0	1	0
11	47	11/20/2017	1	Immature	1	0	1	0
11	50	11/20/2017	1	Adult	2	0	1	0
11	50	11/20/2017	1	Immature	2	2	0	0
11	50	11/20/2017	1	Immature	3	5	1	0
11	52	11/20/2017	1	Adult	2	0	0	0
11	55	11/28/2017	1	Adult	1	0	1	0
11	55	11/28/2017	1	Adult	4	0	0	0
11	64	11/21/2017	1	Immature	8	19	1	0
11	57	11/27/2017	1	Adult	3	0	0	0
11	57	11/27/2017	1	Adult	3	0	1	0
11	62	11/27/2017	1	Adult	0	0	2	0
11	68	11/21/2017	1	Immature	7	0	6	0
11	65	11/27/2017	1	Adult	1	0	1	0
11	68	11/21/2017	1	Immature	5	0	4	0
11	68	11/21/2017	1	Immature	5	36	0	0
11	75	11/21/2017	1	Adult	0	0	5	0
11	75	11/21/2017	1	Adult	5	0	0	0
11	78	11/28/2017	2	Adult	0	0	4	0
11	78	11/28/2017	1	Adult	6	0	1	0
11	68	11/21/2017	1	Adult	4	0	0	0
11	68	11/21/2017	1	Immature	3	17	0	0
11	61	11/21/2017	1	Adult	2	0	1	0
11	64	11/21/2017	1	Immature	2	1	0	0
11	69	11/21/2017	1	Adult	2	0	1	0
11	83	11/29/2017	1	Adult	2	2	1	0
11	83	11/29/2017	1	Adult	2	51	0	0
11	89	11/29/2017	1	Adult	2	0	1	0
11	83	11/29/2017	1	Adult	1	0	0	0
11	68	11/21/2017	1	Adult	0	16	0	0
12	61	12/5/2017	1	Immature	7	0	10	0
12	61	12/5/2017	1	Adult	6	0	13	0
12	61	12/5/2017	1	Immature	5	0	1	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
12	61	12/5/2017	1	Unknown	5	0	4	0
12	61	12/5/2017	1	Immature	4	0	0	0
12	83	12/20/2017	1	Adult	4	0	0	0
12	4	12/6/2017	1	Adult	3	0	1	0
12	5	12/21/2017	1	Adult	1	0	0	0
12	5	12/21/2017	1	Adult	1	12	0	0
12	6	12/6/2017	1	Adult	1	9	0	0
12	9	12/21/2017	1	Adult	2	0	1	0
12	14	12/21/2017	1	Adult	3	0	2	0
12	22	12/18/2017	1	Adult	4	0	1	0
12	27	12/18/2017	1	Adult	2	0	3	0
12	28	12/18/2017	1	Adult	4	0	1	0
12	31	12/7/2017	1	Adult	3	0	0	0
12	31	12/7/2017	1	Adult	4	0	6	0
12	31	12/7/2017	1	Adult	6	0	6	0
12	31	12/7/2017	1	Adult	6	0	6	0
12	33	12/19/2017	1	Adult	3	0	3	0
12	33	12/19/2017	1	Adult	4	0	5	0
12	34	12/7/2017	1	Unknown	1	0	1	0
12	36	12/19/2017	1	Adult	1	0	0	0
12	38	12/19/2017	1	Adult	2	0	0	0
12	40	12/7/2017	1	Adult	8	0	1	0
12	41	12/19/2017	1	Adult	2	0	0	0
12	43	12/6/2017	1	Adult	0	0	3	0
12	43	12/6/2017	1	Adult	0	0	4	0
12	43	12/6/2017	1	Adult	0	0	10	0
12	43	12/6/2017	1	Adult	0	0	10	0
12	43	12/6/2017	1	Adult	4	0	1	0
12	45	12/6/2017	1	Immature	6	0	1	0
12	47	12/22/2017	2	Adult	0	120	0	0
12	47	12/22/2017	1	Adult	1	27	0	0
12	54	12/20/2017	1	Adult	1	0	0	0
12	54	12/20/2017	1	Adult	3	0	5	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
12	54	12/20/2017	1	Adult	4	0	2	0
12	54	12/20/2017	1	Immature	1	0	0	0
12	54	12/20/2017	1	Immature	1	5	0	0
12	54	12/20/2017	1	Immature	4	0	2	0
12	54	12/20/2017	1	Immature	4	0	5	0
12	58	12/19/2017	1	Adult	2	5	0	0
12	61	12/5/2017	1	Adult	3	17	0	0
12	66	12/19/2017	1	Adult	2	0	0	0
12	66	12/19/2017	1	Adult	7	0	0	0
12	67	12/20/2017	1	Adult	3	0	0	0
12	67	12/20/2017	1	Adult	12	0	0	0
12	78	12/20/2017	1	Adult	2	0	0	0
12	81	12/5/2017	1	Adult	2	0	0	0
12	81	12/5/2017	1	Adult	3	0	1	0
12	85	12/5/2017	1	Adult	1	0	1	0
12	85	12/5/2017	1	Adult	1	0	1	0
12	68	12/5/2017	1	Adult	2	0	1	0
12	68	12/5/2017	1	Adult	2	0	3	0
12	73	12/20/2017	1	Adult	2	0	0	0
12	69	12/5/2017	1	Adult	0	0	2	0
13	46	1/23/2018	1	Adult	5	0	2	0
13	69	1/29/2018	1	Adult	4	0	2	0
13	71	1/8/2018	1	Adult	3	0	1	0
13	2	1/12/2018	1	Adult	2	18	0	0
13	6	1/23/2018	1	Adult	0	0	2	0
13	8	1/10/2018	1	Adult	0	20	0	0
13	8	1/10/2018	1	Immature	0	29	0	0
13	8	1/10/2018	1	Adult	1	0	1	0
13	8	1/10/2018	1	Adult	1	6	0	0
13	8	1/10/2018	1	Adult	2	0	0	0
13	8	1/10/2018	1	Adult	3	0	0	0
13	8	1/10/2018	1	Immature	2	10	0	0
13	8	1/10/2018	1	Immature	3	9	0	0

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Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
13	9	1/9/2018	1	Immature	7	0	1	0
13	10	1/12/2018	1	Adult	0	0	8	0
13	10	1/12/2018	1	Adult	1	0	1	0
13	11	1/23/2018	1	Adult	0	0	1	0
13	13	1/10/2018	1	Adult	5	42	0	0
13	13	1/10/2018	1	Immature	2	13	1	0
13	13	1/10/2018	1	Immature	3	0	1	0
13	14	1/12/2018	1	Adult	6	0	2	0
13	15	1/12/2018	1	Immature	4	0	3	0
13	16	1/24/2018	1	Adult	3	0	0	0
13	21	1/26/2018	1	Unknown	0	0	2	0
13	21	1/26/2018	1	Adult	2	0	0	0
13	26	1/26/2018	1	Adult	1	0	0	0
13	27	1/24/2018	1	Adult	4	0	0	0
13	27	1/24/2018	1	Adult	4	0	0	0
13	28	1/24/2018	1	Adult	4	0	4	0
13	28	1/24/2018	1	Immature	4	0	7	0
13	31	1/8/2018	1	Immature	2	0	1	0
13	36	1/25/2018	1	Adult	2	0	1	0
13	43	1/23/2018	1	Adult	2	0	0	0
13	43	1/23/2018	1	Adult	3	6	0	0
13	64	1/31/2018	1	Adult	2	0	1	0
13	47	1/22/2018	1	Adult	2	0	0	0
13	47	1/22/2018	1	Adult	6	0	0	0
13	47	1/22/2018	1	Adult	9	0	2	0
13	49	1/26/2018	1	Adult	2	0	1	0
13	50	1/22/2018	1	Adult	2	0	1	0
13	51	1/22/2018	1	Adult	2	0	0	0
13	71	1/8/2018	1	Adult	2	0	1	0
13	62	1/10/2018	1	Adult	0	0	4	0
13	74	1/10/2018	1	Immature	0	0	1	0
13	74	1/10/2018	1	Adult	8	0	3	0
13	75	1/29/2018	1	Adult	1	0	0	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
13	77	1/9/2018	1	Adult	2	0	1	0
13	77	1/9/2018	1	Adult	2	3	0	0
13	77	1/9/2018	1	Adult	3	0	0	0
13	78	1/9/2018	1	Adult	0	17	0	0
13	78	1/9/2018	1	Adult	1	18	0	0
13	81	1/10/2018	1	Adult	0	0	0	27
13	82	1/9/2018	1	Adult	0	0	1	0
13	84	1/9/2018	1	Adult	1	0	0	0
13	86	1/10/2018	1	Adult	1	3	0	0
13	87	1/9/2018	1	Unknown	1	0	0	0
13	92	1/10/2018	1	Adult	1	46	0	0
14	64	2/14/2018	1	Adult	4	0	1	0
14	89	2/13/2018	1	Adult	4	27	0	0
14	93	2/13/2018	1	Adult	3	0	1	0
14	46	2/15/2018	1	Adult	2	0	0	0
14	56	2/27/2018	1	Adult	2	0	0	0
14	68	2/14/2018	1	Adult	2	0	1	0
14	73	2/15/2018	1	Adult	2	0	1	0
14	90	2/13/2018	1	Adult	2	0	0	0
14	4	2/15/2018	1	Adult	4	24	0	0
14	7	2/15/2018	1	Adult	2	46	0	0
14	7	2/15/2018	1	Adult	3	46	0	0
14	17	2/2/2018	1	Adult	0	0	2	0
14	17	2/2/2018	1	Adult	0	0	8	0
14	18	2/2/2018	1	Adult	1	3	1	34
14	21	2/1/2018	1	Adult	1	0	0	0
14	23	2/1/2018	1	Immature	4	0	0	0
14	27	2/1/2018	1	Adult	2	0	4	0
14	27	2/1/2018	1	Adult	3	0	7	0
14	28	2/12/2018	1	Adult	0	0	2	0
14	28	2/12/2018	1	Adult	0	0	3	0
14	32	2/12/2018	1	Adult	1	0	4	0
14	32	2/12/2018	1	Immature	4	0	0	0

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Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
14	33	2/14/2018	1	Adult	1	5	1	0
14	35	2/14/2018	1	Adult	6	0	1	0
14	39	2/14/2018	1	Adult	2	0	1	0
14	42	2/12/2018	1	Adult	2	0	1	0
14	47	2/15/2018	1	Adult	2	0	0	0
14	48	2/2/2018	2	Adult	0	0	2	0
14	51	2/2/2018	1	Adult	5	0	1	0
14	52	2/12/2018	1	Immature	0	0	1	0
14	52	2/12/2018	1	Adult	1	0	0	0
14	52	2/12/2018	1	Adult	3	0	0	0
14	52	2/12/2018	1	Adult	4	0	1	0
14	52	2/12/2018	1	Adult	6	0	1	0
14	52	2/12/2018	1	Immature	6	0	1	0
14	54	2/14/2018	4	Adult	0	240	0	0
14	54	2/14/2018	2	Adult	4	0	2	0
14	55	2/14/2018	1	Adult	0	25	0	0
14	58	2/12/2018	1	Adult	4	0	0	0
14	60	2/12/2018	1	Adult	2	0	1	0
14	73	2/15/2018	1	Adult	1	0	0	0
14	65	2/14/2018	1	Adult	1	0	2	0
14	65	2/14/2018	1	Adult	1	34	0	0
14	65	2/14/2018	1	Adult	1	44	0	0
14	65	2/14/2018	1	Adult	2	0	0	0
14	65	2/14/2018	1	Adult	2	48	0	0
14	65	2/14/2018	1	Adult	0	1	0	0
14	65	2/14/2018	1	Immature	2	54	0	0
14	65	2/14/2018	1	Immature	3	9	0	0
14	65	2/14/2018	1	Immature	3	16	0	0
14	66	2/14/2018	1	Adult	0	0	3	0
14	75	2/13/2018	1	Immature	0	0	2	0
14	75	2/13/2018	1	Adult	2	0	0	0
14	81	2/13/2018	1	Adult	0	0	3	0
14	81	2/13/2018	1	Adult	2	0	1	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
14	81	2/13/2018	1	Immature	2	0	1	0
14	81	2/13/2018	1	Immature	2	0	3	0
14	82	2/13/2018	1	Immature	3	0	7	0
14	82	2/13/2018	1	Immature	4	0	3	0
14	84	2/13/2018	1	Adult	0	0	2	0
14	87	2/13/2018	1	Adult	0	0	3	0
15	46	3/7/2018	1	Adult	5	0	0	0
15	84	3/9/2018	1	Immature	0	0	5	0
15	69	3/8/2018	1	Adult	2	0	2	0
15	71	3/10/2018	1	Adult	1	4	0	0
15	5	3/15/2018	1	Adult	1	21	0	0
15	5	3/15/2018	1	Adult	3	0	0	0
15	7	3/7/2018	1	Adult	1	1	1	57
15	8	3/2/2018	1	Unknown	0	0	2	0
15	12	3/2/2018	3	Adult	0	0	6	0
15	12	3/2/2018	1	Adult	1	0	0	0
15	12	3/2/2018	1	Adult	1	19	0	0
15	12	3/2/2018	1	Adult	1	59	0	0
15	12	3/2/2018	1	Adult	2	43	0	0
15	12	3/2/2018	1	Adult	4	16	4	1
15	12	3/2/2018	1	Adult	4	50	1	0
15	12	3/2/2018	1	Adult	6	54	0	0
15	12	3/2/2018	1	Immature	5	0	1	0
15	14	3/14/2018	1	Adult	0	0	2	0
15	15	3/15/2018	1	Adult	4	0	1	0
15	18	3/12/2018	1	Adult	2	0	3	0
15	26	3/5/2018	1	Adult	3	0	0	0
15	29	3/5/2018	1	Adult	0	0	1	0
15	30	3/12/2018	1	Adult	0	0	1	0
15	36	3/14/2018	1	Adult	1	0	0	0
15	36	3/14/2018	1	Adult	1	0	1	0
15	39	3/5/2018	2	Adult	2	0	0	0
15	40	3/10/2018	1	Immature	0	0	8	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
15	53	3/14/2018	1	Adult	0	0	1	0
16	43	4/4/2018	1	Adult	0	0	3	0
16	43	4/4/2018	1	Adult	6	0	4	0
16	62	4/11/2018	1	Adult	0	0	3	0
19	69	7/11/2018	1	Adult	5	0	2	0
19	3	7/13/2018	1	Adult	3	0	2	0
19	15	7/13/2018	1	Adult	3	0	2	0
19	15	7/13/2018	1	Immature	4	0	0	0
19	35	7/2/2018	1	Adult	2	0	1	0
19	53	7/2/2018	1	Adult	6	0	1	0
20	1	8/8/2018	1	Adult	7	0	3	0
20	55	8/12/2018	1	Adult	0	0	5	0
20	55	8/12/2018	1	Adult	2	0	5	0
20	75	8/1/2018	1	Adult	0	0	2	0
21	63	9/26/2018	1	Immature	8	0	2	0
21	46	9/18/2018	1	Immature	2	0	1	0
21	11	9/18/2018	1	Adult	5	0	3	0
21	11	9/18/2018	1	Immature	5	0	3	0
21	33	9/25/2018	1	Adult	8	0	3	0
21	37	9/25/2018	1	Immature	14	0	4	0
21	48	9/17/2018	1	Immature	6	0	3	0
21	53	9/26/2018	1	Immature	1	0	0	0
21	54	9/19/2018	1	Adult	1	0	3	0
21	67	9/26/2018	1	Immature	0	0	1	0
21	67	9/26/2018	1	Adult	0	0	2	0
21	77	9/27/2018	1	Adult	14	0	0	0
22	5	10/3/2018	1	Adult	2	0	1	0
22	17	10/24/2018	1	Adult	2	0	2	0
22	19	10/4/2018	1	Immature	1	0	1	0
22	22	10/23/2018	1	Immature	8	0	1	0
22	32	10/24/2018	1	Immature	0	0	5	0
22	32	10/24/2018	2	Adult	2	0	8	0
22	33	10/24/2018	1	Adult	0	0	1	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
22	34	10/24/2018	1	Adult	4	0	1	0
22	37	10/24/2018	1	Adult	0	0	1	0
22	37	10/24/2018	1	Adult	1	4	0	0
22	37	10/24/2018	1	Adult	2	0	1	0
22	50	10/24/2018	1	Adult	1	0	1	0
22	50	10/24/2018	1	Adult	1	28	0	0
22	50	10/24/2018	1	Adult	2	25	0	0
23	63	11/27/2018	1	Adult	5	0	0	0
23	69	11/24/2018	2	Unknown	4	0	8	0
23	88	11/8/2018	1	Adult	4	0	1	0
23	73	11/7/2018	1	Adult	3	0	1	0
23	73	11/7/2018	1	Immature	3	0	1	0
23	68	11/24/2018	1	Adult	0	0	2	0
23	69	11/24/2018	1	Adult	2	0	1	0
23	69	11/24/2018	1	Unknown	2	0	3	0
23	73	11/7/2018	1	Immature	2	0	1	0
23	56	11/27/2018	1	Unknown	1	0	0	0
23	68	11/24/2018	3	Unknown	0	0	9	0
23	73	11/7/2018	1	Adult	0	0	2	0
23	84	11/8/2018	1	Adult	0	0	2	0
23	45	11/28/2018	1	Adult	1	0	0	0
23	50	11/28/2018	1	Adult	2	0	0	0
23	51	11/28/2018	1	Adult	1	6	0	0
23	51	11/28/2018	1	Adult	3	0	0	0
23	51	11/28/2018	1	Adult	6	0	0	0
23	51	11/28/2018	1	Immature	6	6	0	0
23	54	11/9/2018	1	Adult	2	0	0	0
23	54	11/9/2018	1	Adult	3	0	0	0
23	62	11/29/2018	1	Adult	1	0	1	0
23	66	11/29/2018	1	Adult	1	0	0	0
23	67	11/7/2018	1	Immature	0	0	4	0
23	70	11/7/2018	1	Adult	1	0	2	0
23	70	11/7/2018	1	Adult	3	0	3	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
23	70	11/7/2018	2	Adult	4	0	0	0
23	70	11/7/2018	1	Adult	4	0	1	0
23	70	11/7/2018	2	Adult	16	0	12	0
23	70	11/7/2018	1	Immature	1	0	2	0
23	72	11/29/2018	1	Adult	1	22	0	0
23	75	11/24/2018	1	Adult	13	0	1	0
24	56	12/18/2018	1	Adult	6	14	0	0
24	61	12/19/2018	1	Adult	3	0	0	0
24	68	12/6/2018	1	Adult	3	0	1	0
24	87	12/5/2018	1	Adult	3	0	0	0
24	87	12/5/2018	1	Immature	3	0	0	0
24	86	12/5/2018	1	Immature	1	17	0	0
24	88	12/5/2018	1	Immature	1	0	0	0
24	92	12/4/2018	1	Immature	1	0	0	0
24	47	12/3/2018	1	Adult	2	0	0	0
24	49	12/19/2018	1	Immature	4	0	1	0
24	50	12/3/2018	1	Adult	2	0	0	0
24	54	12/19/2018	1	Adult	1	50	0	0
24	54	12/19/2018	1	Adult	6	0	1	0
24	55	12/19/2018	1	Immature	0	0	1	0
24	55	12/19/2018	1	Adult	0	60	0	0
24	55	12/19/2018	1	Immature	3	0	1	0
24	66	12/17/2018	1	Adult	2	0	0	0
24	72	12/17/2018	1	Adult	6	24	1	0
24	75	12/6/2018	1	Immature	4	0	0	0
24	76	12/4/2018	1	Adult	2	0	0	0
24	77	12/4/2018	1	Adult	1	0	0	0
25	64	1/4/2019	1	Adult	9	31	0	
25	56	1/2/2019	1	Adult	5	0		
25	64	1/4/2019	1	Immature	5	0		
25	64	1/4/2019	1	Adult	4	0		
25	88	1/14/2019	1	Adult	4	0		
25	56	1/2/2019	1	Adult	2	0		

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
25	53	1/2/2019	1	Immature	2	0		
25	57	1/2/2019	1	Adult	0	0	1	37
25	57	1/2/2019	1	Immature	0	0	2	58
25	57	1/2/2019	1	Adult	0	0	0	60
25	57	1/2/2019	1	Adult	0	0	0	60
25	57	1/2/2019	1	Adult	0	0	0	60
25	57	1/2/2019	1	Adult	3	0	1	
25	57	1/2/2019	1	Adult	8	0	2	3
25	58	1/18/2019	1	Adult	2	0		
25	78	1/15/2019	1	Adult	2	0		
25	81	1/16/2019	1	Adult	3	0		
25	82	1/16/2019	1	Adult	2	0		
26	46	2/5/2019	1	Adult	6	0	4	0
26	86	2/26/2019	1	Adult	4	0	3	0
26	68	2/27/2019	1	Adult	3	0	0	0
26	83	2/25/2019	1	Adult	3	0	5	0
26	84	2/25/2019	2	Unknown	2	0	14	0
26	46	2/5/2019	1	Adult	2	25	0	0
26	46	2/5/2019	1	Adult	2	31	0	0
26	46	2/5/2019	1	Immature	2	0	1	0
26	56	2/6/2019	1	Adult	2	0	1	0
26	83	2/25/2019	1	Adult	2	0	0	0
26	46	2/5/2019	1	Adult	1	25	0	0
26	68	2/27/2019	1	Immature	1	0	1	0
26	73	2/26/2019	1	Immature	1	0	1	0
26	44	2/5/2019	1	Adult	1	0	0	0
26	45	2/5/2019	1	Adult	2	58	0	0
26	47	2/5/2019	1	Adult	1	0	1	0
26	48	2/5/2019	1	Immature	2	0	1	0
26	49	2/8/2019	1	Adult	1	42	0	0
26	49	2/8/2019	1	Immature	2	0	1	0
26	52	2/9/2019	1	Adult	0	0	2	0
26	52	2/9/2019	1	Immature	0	0	5	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
26	53	2/6/2019	1	Adult	2	0	0	0
26	54	2/9/2019	1	Adult	1	0	0	0
26	55	2/9/2019	1	Unknown	0	0	7	0
26	55	2/9/2019	1	Adult	0	0	9	0
26	58	2/9/2019	1	Adult	2	0	4	0
26	66	2/8/2019	1	Adult	3	0	1	0
26	66	2/8/2019	1	Adult	4	0	1	0
26	66	2/8/2019	1	Immature	2	0	0	0
26	70	2/8/2019	1	Adult	4	0	2	0
26	70	2/8/2019	1	Adult	8	0	2	0
26	74	2/27/2019	1	Adult	0	1	0	0
26	77	2/8/2019	1	Adult	6	0	3	0
26	81	2/27/2019	1	Adult	0	0	2	0
26	82	2/25/2019	1	Adult	4	0	1	0
26	85	2/25/2019	1	Adult	2	0	2	0
26	85	2/25/2019	1	Adult	3	0	0	0
26	85	2/25/2019	1	Adult	3	0	1	0
26	85	2/25/2019	1	Adult	4	0	0	0
26	85	2/25/2019	1	Immature	2	0	1	0
26	85	2/25/2019	1	Immature	3	0	4	0
27	2	3/5/2019	1	Unknown	0	0	2	0
27	2	3/5/2019	1	Unknown	0	0	2	0
27	2	3/5/2019	1	Adult	0	0	12	0
27	2	3/5/2019	1	Adult	0	0	12	0
27	2	3/5/2019	1	Adult	3	0	2	0
27	4	3/12/2019	1	Adult	2	0	5	0
27	5	3/15/2019	1	Adult	1	0	0	0
27	7	3/12/2019	1	Adult	1	0	0	0
27	8	3/7/2019	1	Adult	3	0	0	0
27	9	3/7/2019	1	Unknown	0	0	2	0
27	9	3/7/2019	1	Adult	0	2	0	15
27	9	3/7/2019	1	Adult	2	2	0	0
27	9	3/7/2019	1	Adult	3	15	0	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
27	15	3/5/2019	1	Immature	3	0	1	0
27	15	3/5/2019	1	Immature	6	0	0	0
27	16	3/5/2019	1	Adult	2	0	1	0
27	19	3/7/2019	1	Adult	1	0	0	0
27	19	3/7/2019	1	Adult	2	26	1	1
27	19	3/7/2019	1	Immature	2	0	1	0
27	21	3/6/2019	1	Adult	1	0	2	0
27	21	3/6/2019	1	Adult	2	29	2	0
27	21	3/6/2019	1	Adult	3	24	2	0
27	27	3/11/2019	1	Adult	9	0	1	0
27	29	3/6/2019	1	Unknown	0	0	2	0
27	30	3/4/2019	1	Adult	1	0	1	0
27	30	3/4/2019	1	Adult	1	0	1	0
27	33	3/11/2019	1	Adult	0	0	2	0
27	34	3/11/2019	1	Adult	6	0	5	0
27	34	3/11/2019	1	Adult	8	0	5	0
27	34	3/11/2019	1	Immature	3	0	2	0
27	38	3/6/2019	1	Adult	2	0	1	0
27	39	3/4/2019	1	Adult	2	0	0	0
27	42	3/6/2019	1	Adult	1	0	0	0
27	43	3/12/2019	1	Immature	2	0	0	0
27	44	3/12/2019	1	Immature	2	0	0	0
27	49	3/6/2019	1	Immature	2	0	1	0
27	49	3/6/2019	1	Immature	3	0	6	0
27	49	3/6/2019	1	Immature	7	0	1	0
27	52	3/4/2019	1	Adult	4	0	0	0
27	52	3/4/2019	1	Immature	4	0	0	0
27	54	3/4/2019	1	Immature	2	2	2	0
27	58	3/6/2019	1	Adult	2	0	3	0
27	60	3/15/2019	1	Adult	2	0	0	0
27	67	3/13/2019	1	Adult	2	0	0	0
28	68	4/10/2019	1	Adult	3	0	1	0
28	2	4/18/2019	1	Immature	3	0	1	0

Appendix A - Table A-5. Bald eagle observations within the 800-m radius by 200-m height plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Survey Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
28	10	4/1/2019	1	Adult	0	60	0	0
28	27	4/1/2019	1	Adult	2	34	0	0
28	28	4/2/2019	1	Adult	1	0	0	0
28	51	4/12/2019	1	Adult	1	0	0	0
28	60	4/18/2019	1	Adult	3	25	1	0
28	60	4/18/2019	1	Adult	5	0	1	0
28	85	4/22/2019	1	Adult	2	0	0	0
29	56	5/5/2019	1	Adult	2	0	0	0
29	92	5/10/2019	1	Adult	0	0	5	0
29	66	5/1/2019	1	Immature	2	0	0	0
33	57	9/25/2019	1	Adult	4	0	2	0
34	44	10/29/2019	1	Immature	3	0	0	0
34	44	10/29/2019	1	Immature	0	0	2	0
34	45	10/29/2019	1	Adult	2	0	1	0
34	77	10/31/2019	1	Adult	3	0	2	0
34	77	10/31/2019	1	Immature	7	0	3	0
34	77	10/31/2019	1	Adult	2	0	0	0
34	81	10/14/2019	1	Adult	1	0	1	0
34	82	10/31/2019	1	Adult	4	0	1	0
34	82	10/31/2019	1	Adult	4	0	1	0
Total			**547**		**1,480**	**2,369**	**947**	**415**

Appendix A - Table A-6. Golden eagle observations within the 800-m radius plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Table A-6. Golden eagle observations within the 800-m radius plots at the High Prairie Wind Energy Project in Adair and Schuyler counties, Missouri.

Survey Event	Point	Date	Number of Eagles	Age	Minutes within Plot		Minutes outside Plot	
					Flying	Perched	Flying	Perched
12	16	12/18/2017	1	Adult	4	-	-	-
16	36	4/5/2018	1	Immature	4	-	2	-
16	65	4/11/2018	1	Immature	1	-	2	-
27	38	3/6/2019	1	Immature	2	-	8	-
28	61	4/10/2019	1	Immature	4	-	11	-
Total			**5**	**1 Adult 4 Immature**	**15**	**-**	**23**	**-**

APPENDIX C: TABLE C-1

Table C-1. Bird fatality rates from publicly available reports on post-construction monitoring conducted at wind energy facilities in the Midwest

State	Site	Survey Period	Birds per MW	Reference
IL	Crescent Ridge	Sep 5, 2005–Aug 29, 2006	0.33	Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory bird & bat monitoring study at the Crescent Ridge Wind Power Project, Bureau County, Illinois. Final draft. May
IN	Fowler Ridge I	Apr 6–Oct 30, 2009	2.83	Johnson, G. D., M. Ritzert, S. Nomani, and K. Bay. 2010. Final report. bird and bat fatality studies, Fowler Ridge I Wind-Energy Project, Benton County, Indiana. 12 April.
IA	Top of Iowa	Apr 15–Dec 15, 2003	0.43	Koford, R., A. Jain, G. Zenner, and A. Hancock. 2004. Avian mortality associated with the Top of Iowa Wind Farm. Progress report, calendar year 2003. 28 February.
IA	Top of Iowa	Mar 24–Dec 10, 2004	1.00	Koford, R., A. Jain, G. Zenner, and A. Hancock. 2005. Avian mortality associated with the Top of Iowa Wind Farm. Progress report, calendar year 2004. 2 February.
MN	Buffalo Ridge I	not reported	2.88	Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Final report, avian monitoring studies at the Buffalo Ridge, Minnesota Wind Resource Area: results of a 4-Year Study. 22 September.
MN	Buffalo Ridge II	not reported	3.03	Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Final report, avian monitoring studies at the Buffalo Ridge, Minnesota Wind Resource Area: results of a 4-Year Study. 22 September.
MN	Buffalo Ridge III	not reported	5.93	Johnson, G. D., W. P. Erickson, M. D. Strickland, M. F. Shepherd, and D. A. Shepherd. 2000. Final report, avian monitoring studies at the Buffalo Ridge, Minnesota Wind Resource Area: results of a 4-Year Study. 22 September.
MN	Prairie Rose	Apr 15–Jun 13, Aug 15–Oct 29, 2014	0.44	Chodachek, K., K. Adachi, and G. DiDonato. 2015. Post-construction fatality surveys for the Prairie Rose Wind Energy Project, Rock County, Minnesota. Final report. 23 January.
WI	Blue Sky Green Field	Jul 21–Oct 31, 2008; Mar 17–Jun 4, 2009	7.17	Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-construction bat and bird fatality study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin. 17 December.
WI	Cedar Ridge	Mar 15–May 31; Jul 15–Nov 15, 2009	6.55	BHE Environmental, Inc. 2010. Post-construction bird and bat mortality study, Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Interim report. February.
WI	Kewaunee County	Jul 1999–Sep 2000	1.95	Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of wind turbines on birds and bats in northeastern Wisconsin. 21 November.
MN	Odell Wind Energy Project	Dec 20, 2016–Dec 10, 2017	6.14	Chodachek, K. and Z. Gustafson. 2018. Tier 4 post-construction mortality monitoring study for the Odell Wind Energy Project, Cottonwood and Jackson Counties, Minnesota. Final fatality report December 2016–December 2017. 15 March.
		Average Rate	**3.22**	

APPENDIX D: Documented Covered Species Fatalities at Wind Energy Facilities

Table D-1. Species composition of bat carcasses found and identified at wind projects in the Midwest that provided publicly available post-construction monitoring reports.

Project	State	Bat carcasses identified	Migratory tree-roosting[1]	Cave-hibernating[2]	Reference
Buffalo Ridge, Phases I–III	MN	163	93%	7%	Johnson et al. 2003
Buffalo Ridge, Lake Benton I & II	MN	151	93%	7%	Johnson et al. 2004
Blue Sky Green Field	WI	235	50%	50%	Gruver et al. 2009
Kewaunee County	WI	72	90%	10%	Howe et al. 2002
Cedar Ridge (2009)	WI	89	68%	32%	BHE Environmental (BHE) 2011
Cedar Ridge (2010)	WI	155	74%	26%	BHE 2011
Crescent Ridge	IL	20	100%	0%	Kerlinger et al. 2007
Top of Iowa	IA	76	64%	36%	Jain 2005
Forward Energy Center	WI	108	78%	22%	Grodsky and Drake 2011
Fowler Ridge	IN	809	95%	4%	Good et al. 2011
Fowler Ridge	IN	573	96%	4%	Good et al. 2012
Total		**1,642**	**Median = 84%**	**Median = 16%**	

[1] Hoary bat, eastern red bat, silver-haired bat, Seminole bat.
[2] *Myotis* species, big brown bat, tricolored bat; includes evening bat, although not a cave-hibernating bat.

Table D-2. Documented Indiana bat fatalities; US wind energy facilities (Pruitt and Reed 2020).

State	Estimated Date of Death	Sex	Age
Indiana	September 8 – 9, 2009	Female	Adult
Indiana	September 17, 2010	Female	Adult
Pennsylvania	September 25, 2011	Female	Young of Year
West Virginia	July 7, 2012	Male	Adult
Ohio	October 2 – 3, 2012	Female	Adult
Ohio	October 7 – 9, 2013	unknown	Adult
Ohio	April 13 – 14, 2014	Female	Adult
Indiana	August 23, 2015	unknown	Unknown
Iowa	July 13, 2016	unknown	Unknown
Illinois	September 23, 2016	unknown	Unknown
Indiana	July 2017	Unknown	Unknown
Indiana	May 1, 2018	Unknown	Unknown
Indiana	September 17, 2018	Male	Unknown
Indiana	September 18, 2019	Unknown	Unknown

Table D-3. Summary of publicly available documented northern long-eared bat fatalities at wind projects in the United States and Canada

Site	Location	Number	Study Period	Date Found	Reference
Fowler Ridge	Benton County, IN	1	Apr 6–Oct. 30, 2009	Aug. 25	Johnson et al. 2010
Cohocton and Dutch Hill	Steuben County, NY	1	Apr. 26–Oct. 22, 2010	Jun. 22	Stantec 2011
Mountaineer	Tucker and Preston counties, WV	6	Apr. 4–Jun. 24, Jul. 28–29, Aug–Nov. 22, 2003	Aug. 18–Sep. 8	Kerns and Kerlinger 2004
Mount Storm	Grant County, WV	1	Jul. 18 – Oct. 17, 2008	Aug. 26	Young et al. 2009
Meyersdale	Somerset County, PA	2	Aug. 2–Sep. 13, 2004	Sep. 11, 13	Kerns et al. 2005
Ellenburg	Clinton County, NY	1	Apr. 28–Oct. 13, 2008	Not specified	Jain et al. 2009
Kingsbridge I	Huron County, Ontario	1	May 2–23, Sep. 6–Oct. 26, 2006	Oct. 5	Stantec , Inc.2007
Ripley	Bruce County, Ontario	2	Apr. 13–May 31, Jul. 1 – Oct. 17, 2008	Aug. 5, Sep. 5	Jacques Whitford 2009
Wethersfield	Wyoming County, NY	6	Apr. 15–Oct. 15, 2010	Jun. 11	Jain et al. 2011

Table D-3. Summary of publicly available documented northern long-eared bat fatalities at wind projects in the United States and Canada

Site	Location	Number	Study Period	Date Found	Reference
Bliss/ Wethersfield	Wyoming County, NY	5	Apr. 15–Sep. 30, 2011	Jul. 17, Aug. 6, Aug. 18, Sep. 2, 3	Kerlinger et al. 2011
Erie Shores	Elgin County, Ontario	6	Mar. 13–Jun. 15, Aug. 21–Nov. 7, 2007[1]	May 25, Jun. 11, 12, Aug. 28, 30	James 2008
California Ridge	Vermilion County, IL	1	2013, period not specified	Fall	K. Shank, personal communication[2]
Undisclosed site	PA	1	2009, period not specified	Sep.	Taucher et al. 2012
Undisclosed site	PA	1	2012, period not specified	Jul. 30	J. Taucher, personal communication[3]
Steel Winds	NY	6	2007	Unknown	Grehan 2008
Criterion	MD	1	2011	Summer	Young et al. 2013
Template 5	MO	1	2009	Unknown	USFWS 2016c
Pioneer Prairie II	IA	2	2013	Unknown	USFWS 2016c
Heritage Garden	MI	1	2012	Unknown	USFWS 2016c
Undisclosed location	IN	2	unknown	Unknown	USFWS 2016c

[1] Dates of study period not specified in report; estimated based on dates recorded for bird and bat carcass detections.
[2] K. Shank, Illinois Department of Natural Resources, comments to U.S. Fish and Wildlife Life Service (USFWS) on Pioneer Trail Wind Farm Habitat Conservation Plan.
[3] J. Taucher, Pennsylvania Game Commission, personal communication with M. Turner, USFWS.

Table D-4. Bat fatality estimates for wind projects in the Midwest with publicly available post-construction monitoring reports. Fatality rates were averaged across multiple survey years.

Project	State	MW	Bat fatalities per MW per study[1]	Study Period	Reference
Buffalo Ridge, Phases I–III	MN	235.6	2.30	Mar. 15–Nov. 15, 1996 Mar. 15–Nov. 15, 1999	Johnson et al. 2003
Buffalo Ridge, Lake Benton I & II	MN	210.8	2.88	Jun. 15–Sep. 15, 2001 Jun. 15–Sep. 15, 2002	Johnson et al. 2004
Blue Sky Green Field	WI	145.0	24.60	Jul. 21–Oct. 31, 2008 Mar. 15–May 31, 2009	Gruver et al. 2009
Kewaunee County	WI	20.5	6.45	Jul. 1999–Jul. 2001	Howe et al. 2002

Table D-4. Bat fatality estimates for wind projects in the Midwest with publicly available post-construction monitoring reports. Fatality rates were averaged across multiple survey years.

Project	State	MW	Bat fatalities per MW per study[1]	Study Period	Reference
Cedar Ridge	WI	67.6	50.50 (2009) 39.80 (2010)	Mar. 15–May 31, 2009 Jul. 15–Nov. 15, 2009 Mar. 15–May 31, 2010 Jul. 15–Oct. 15, 2020	BHE Environmental 2011
Crescent Ridge	IL	54.5	1.71	Sep.–Nov. 2005 Aug. 2006	Kerlinger et al. 2007
Top of Iowa	IA	80.1	8.57	Apr. 15–Dec. 15, 2003 Apr. 15–Dec. 15, 2004	Jain 2005
Forward Energy Center	WI	129.0	17.50	Jul. 15–Nov. 15, 2008 Apr. 15–May 31, 2009 Jul. 15–Oct. 15, 2009 Apr. 15–May 31, 2010	Grodsky and Drake 2011
Fowler Ridge	IN	600.0	29.79 (2010) 34.10 (2011)	Apr. 13–May 15, 2010 Aug. 1–Oct. 15, 2010 Apr. 1–May 15, 2011 Jul. 15–Oct. 29, 2011	Good et al. 2012[2]
Arithmetic mean			**19.84**		

[1] Averaged across multiple survey seasons.
[2] Estimates of bat fatality rates at control plots were determined using an empirical estimator after 2010 estimates were adjusted for bats falling outside of plots.
MW = megawatt.

References

BHE (BHE Environmental, Inc.). 2011. Post-construction bird and bat mortality study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Final report. BHE Environmental, Inc., Cincinnati, OH. February.

Good, R. E, W. Erickson, A. Merrill, S. Simon, K. Murray, K. Bay, and C. Fritchman. 2011. Bat monitoring studies at the Fowler Ridge Wind Farm, Benton County, Indiana. April 1-October 31, 2010. Western EcoSystems Technology, Inc. Cheyenne, WY. 28 January.

Good, R. E., A. Merrill, S. Simon, K. Murray, and K. Bay. 2012. Bat monitoring studies at the Fowler Ridge Wind Farm, Benton County, Indiana. April 1-October 31, 2011. Western EcoSystems Technology, Inc. Bloomington, IN. 31 January.

Grehan, J. R. 2008. Steel Winds bird mortality study, final report. Buffalo Society of Natural Sciences, Buffalo, NY. April.

Grodsky, S. M., and D. Drake. 2011. Assessing bird and bat mortality at the Forward Energy Center. University of Wisconsin-Madison, Madison, WI.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-construction bat and bird fatality study at the Blue Sky Green Field Wind Energy Center, Fond du Lac County, Wisconsin July 21, 2008 – October 31, 2008 and March 15, 2009 – June 4, 2009. Western EcoSystems Technology, Cheyenne, WY. 17 January.

Howe, R. W., W. Evans, and A. T. Wolf. 2002. Effects of wind turbines on birds and bats in northeastern Wisconsin. Prepared for Wisconsin Public Service Corporation and submitted to Wisconsin Public Service Corporation and Madison Gas and Electric Company. University of Wisconsin, Green Bay, WI. 21 November.

Jacques Whitford (Jacques Whitford Stantec Limited). 2009. Ripley Wind Power Project post-construction monitoring program. Jacques Whitford Stantec Limited, Markham, Ontario. 9 November.

Jain, A. 2005. Bird and bat behavior and mortality at a Northern Iowa Wind Farm. M.S. Thesis. Iowa State University, Ames.

Jain, A., P. Kerlinger, R. Curry, L. Slobodnik, A. Fuerst, and C. Hansen. 2009. Annual report for the Noble Ellenburg Windpark, LLC, post-construction bird and bat fatality study – 2008. Curry and Kerlinger, LLC., Cape May Point, NJ. 13 April.

Jain, A., P. Kerlinger, L. Slobodnik, R. Curry, and A. Harte. 2011. Annual report for the Noble Wethersfield Windpark, LLC post-construction bird and bat fatality study – 2010. Curry and Kerlinger, LLC., Cape May, NJ. 22 January.

James, R. D. 2008. Erie Shores Wind Farm, Port Burwell, Ontario, fieldwork report for 2006 and 2007 during the first two years of operation. Report to Environment Canada, Ontario Ministry of Natural Resources, Erie Shores Wind Farm LP – McQuarrie North American and AIM PowerGen Corporation.

Johnson, G., M. Perlik, W. Erickson, M. Strickland, D. Shepard, and P. Sutherland, Jr. 2003. Bat interactions with wind turbines at the Buffalo Ridge, Minnesota Wind Resource Area: an assessment of bat activity, species composition, and collision mortality. Western EcoSystems Technology, Cheyenne, WY.

Johnson, G. D., M. K. Perlik, W. P. Erickson, and M. D. Sutherland. 2004. Bat activity, composition and collision mortality at a large wind plant in Minnesota. Wildlife Society Bulletin 32: 1278-1288.

Johnson, G. D., M. Ritzert, S. Nomani, and K. Bay. 2010. Final report: bird and bat fatality studies Fowler Ridge I Wind-Energy Facility, Benton County, Indiana, April 6 – October 30, 2009. Western EcoSystems Technology, Cheyenne, WY. 12 April.

Kerlinger, P., R. Curry, A. Hasch, and J. Guarnaccia. 2007. Migratory bird and bat monitoring study at the Crescent Ridge Wind Power Project, Bureau County, Illinois: September 2005- August 2006. Curry & Kerlinger, LLC, McLean, VA. May.

Kerlinger, P., J. Guarnaccia, L. Slobodnik, and R. Curry. 2011. A comparison of bat mortality in farmland and forested habitats at the Noble Bliss and Wethersfield Windparks, Wyoming County, New York. Curry & Kerlinger, LLC, Cape May Point, NJ November.

Kerns, J., and P. Kerlinger. 2004. A study of bird and bat collision fatalities at the MWEC Wind Energy Center, Tucker County, West Virginia: annual report for 2003. Curry and Kerlinger, LLC, Cape May Point, NJ. 14 February.

Kerns, J., W. P. Erickson, and E. B. Arnett. 2005. Bat and bird fatalities in Pennsylvania and West Virginia. Pages 24-95 in E. B. Arnett, editor. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. Bat Conservation International, Austin, TX.

Pruitt, L., and M. Reed. 2021. Indiana bat fatalities at wind energy facilities. U.S. Fish and Wildlife Service, Bloomington Indiana Field Office. January. < https://www.fws.gov/midwest/es/wind/inbafatalities.html>. Accessed 27 January 2021.

Stantec (Stantec Consulting Services Inc.). 2011. Year 2 post-construction monitoring report, 2010, Cohocton and Dutch Hill Wind Farms in Cohocton, New York. Stantec Consulting Services Inc., Topsham, ME. January.

Stantec Ltd. (Stantec Consulting Ltd.). 2007. Kingsbridge I Wind Power Plant post-construction bird and bat monitoring report: 2006. Stantec Consulting Ltd., Guelph, Ontario. 7 March.

Taucher, J., T. Librandi Mumma, and W. Capouillez. 2012. Wind energy voluntary cooperation agreement third summary report. Pennsylvania Game Commission, Bureau of Wildlife Habitat Management, Harrisburg, PA. 27 December.

USFWS. 2016. Programmatic biological opinion on final 4(d) rule for the northern long-eared bat and activities excepted from take prohibitions. Regions 2, 3, 4, 5, and 6. U.S. Fish and Wildlife Service, Bloomington, MN. 5 January.

Young, D. P., Jr., W. P. Erickson, K. Bay, S. Nomani, and W. Tidhar. 2009. Mount Storm Wind Energy facility, Phase 1 post-construction avian and bat monitoring, July – October 2008. Western EcoSystems Technology, Inc., Cheyenne, WY.

Young, D., C. Nations, M. Lout, and K. Bay. 2013. 2012 Post-construction monitoring study, Criterion Wind Project, Garrett County, Maryland, April–November 2012. Western EcoSystems Technology, Inc. Cheyenne, WY and Waterbury, VT.

APPENDIX E: Technical Assistance Letter

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Missouri Ecological Services Field Office
101 Park DeVille Drive, Suite A
Columbia, Missouri 65203-0057
Phone: (573) 234-2132 Fax: (573) 234-2181

June 5, 2020

Mr. Mark Casper
TG High Prairie, LLC
437 Madison Ave, Suite 22A
New York, NY 10022

Dear Mr. Casper:

The U.S. Fish and Wildlife Service (USFWS or Service) has been coordinating with TG High Prairie, LLC (Applicant) on their application for an incidental take permit, for operations of the High Prairie Wind Facility (Project), a 400 MW wind energy facility in Adair and Schuyler Counties, Missouri. In March 2020 discussions with the Service, the Applicant requested a technical assistance letter (TAL) documenting their compliance with the Endangered Species Act (ESA) of 1973 (as amended).

Section 9(a)(1)(B) of the ESA, 16 U.S.C.§ 1538 (a)(1)(B), makes it unlawful for any person to "take" an endangered species. Take of threatened species is prohibited pursuant to 50 C.F.R. § 17.31, which was issued by the USFWS under the authority of Sections 4(d) and 9(a)(1)(G) of the ESA, 16 U.S.C. §§ 1533(d) and 1538(a)(1)(G), respectively. "Take" is defined by the ESA as to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct" 16 U.S.C. § 1532(19).

The Applicant's 2016 and 2018 pre-construction surveys[1] of the project area indicated presence of all Covered Species (i.e., Indiana bat, northern long-eared bat, and little brown bat) during the summer maternity season. In addition, results of mist-net surveys between June and August of 2016 and 2018 were used to estimate 8 Indiana bat maternity colonies, 12 northern long-eared bat maternity colonies, and 4 little brown bat maternity colonies within the Project Area.

To avoid potential effects to federally listed species (i.e. Indiana bat and northern long-eared bat) caused by the turbine operation, and pending Habitat Conservation Plan (HCP) completion and potential Incidental Take Permit (ITP) issuance, the Applicant agrees to implement all avoidance measures and monitoring efforts listed below. Operating the Project in accordance with these avoidance measures will result in insignificant or discountable take of federally listed species.

[1] Surveys were conducted according to the Service's 2016 "Range-wide Indiana Bat Survey Guidelines"

This TAL will be valid for up to a full year or until an ITP for the Covered Species is obtained and the Project begins operating under the ITP coverage.

Avoidance Measures

The Applicant commits to feathering all turbines during the spring migration period, summer maternity period, and fall migration period (March 15th- October 31st) for the first year of Project operations or until an ITP is obtained for the Covered Species (whichever is sooner), below a cut-in speed of 6.9 meters per second (m/s) for 0.5 hour before sunset to 0.5 hour after sunrise when the air temperature is above 50ºF.

Turbines will be monitored and controlled based on wind speed on an individual basis (i.e., the entire facility will not alter cut-in speed at the same time, rather operational changes will be based on wind speed conditions specific to each turbine). Turbines will begin operating when the 10-minute rolling average wind speed is above 6.9 m/s; turbines will be feathered again if the 10-minute rolling average wind speed goes below 6.9 m/s during the course of the night.

Monitoring and Reporting Commitments

The Applicant commits to monitoring all turbines during the first year of Project operations, or until an ITP is obtained, whichever comes first. Monitoring will not occur at turbines which had not operated since the last visit, or which had only operated between 0.5 hour after sunrise and 0.5 hour before sunset. To document overall bat fatality rates, areas around operating turbines will be searched with a weekly search interval (I=7), and 10% of turbines will be assigned to full plots, and 90% of turbines will be searched on the roads and pads. Monitoring is designed to achieve a detection probability (g) of 0.1 (based on the assumptions outlined in the draft HCP).

Search Methods:
In all seasons, road and pad search plots will include the entire gravel turbine pad and all gravel access roads within 95 m (312 ft) of the turbine. At 60 m (197 ft) radius cleared-plot turbines, 23 transects will be spaced at approximately 16.4-foot intervals. Observers will walk at a rate of approximately 2 mph, scanning the ground for carcasses within 8.2 feet of each transect. The observer will start at one side of the circular plot and systematically search in a north/south or east/west direction, switching the search pattern on a weekly basis. At road/pad turbines, the observer will walk the access road starting at 312 feet from the turbine and walk towards the turbine, around the turbine, and back towards the starting point, searching out 8.2 feet on each side until the entire road/access pad is searched.

Searchers may be assisted by trained canines. Searchers will be familiar with and able to accurately identify bat species likely to be found in the Project area. Any unknown bats or suspected individuals of the covered species discovered during fatality searches will be sent to a qualified USFWS-approved bat expert for positive identification or may be sent for genetic testing to determine species and/or sex.

Any carcass of a listed species (or suspected listed species, prior to confirming ID) will be reported to the Service within 24 hours of finding.

Data Collection:
Data to be recorded for each search include date, start time, end time, observer, turbine area searched (including Universal Transverse Mercator [UTM] coordinates) and weather information. When a dead bat or bird is found, the observer will either record data, or place a flag near the carcass and continue the search. The observer will record data including the date, species, sex and age (when possible), observer name, turbine number, measured distance and bearing to turbine, habitat surrounding carcass, condition of carcass (intact, scavenged), and estimated time of death (e.g., less than one day, two days, etc.). The condition of each carcass found will be recorded using the following categories:

- Intact - a carcass that is completely intact, is not badly decomposed, and shows no sign of being fed upon by a predator or scavenger.
- Scavenged - an entire carcass that shows signs of being fed upon by a predator or scavenger, a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass, etc.), or a carcass that has been heavily infested by insects
- Feather Spot - 10 or more feathers at one location indicating predation or scavenging of a bird carcass.

A digital picture of each detected carcass (all species, not just the covered species) will be taken before the carcass is handled and removed. All bat carcasses will be labeled with a unique number, bagged, and stored frozen as needed for future studies (with a copy of the original data sheet) at the Project operations and maintenance building. The Applicant will also collect a tissue sample from each bat carcass for submission to the USFWS and/or the Missouri Department of Conservation (MDC).

Bird carcasses will be identified and recorded as described above, but will not be collected and instead will be left in place. Bird carcasses will be noted to ensure carcasses are not recorded multiple times during surveys. All injured bats and birds observed in search plots also will be recorded (labeled as intact) and considered as fatalities for future analyses. The health of injured birds will be assessed in the field, and in consultation with a wildlife rehabilitator. If the bird is considered a candidate for rehabilitation by the wildlife rehabilitator, and able to be safely captured, the bird will be carefully captured by the observer and immediately transported to the nearest wildlife rehabilitation center, depending on the rehabilitation center availability. No injured bats will be transported from the facility due to the concern of spreading white-nose syndrome. Injured, non-myotis bat species will be humanely euthanized. Any bat that is euthanized will be placed in a plastic bag, labeled, and maintained similarly to the carcasses described above.

Carcasses found in non-search areas (e.g., near a turbine not included in the search area) or outside of the scheduled search time will be coded as incidental discoveries and will be documented in a similar fashion as those found during standard searches. Incidental discoveries found outside the scheduled search area will not be included in the calculation of fatality estimates. Those found outside scheduled search times, but within a scheduled search area, will be included in estimates under the assumption that they would have been found during the next search had they not been found incidentally. Data on incidental discoveries will be included in all reports.

Annual Reporting:
Annual reports describing the avoidance measures implemented and the methods and results from mortality monitoring will be submitted to the Missouri Field Office within one year after the TAL goes into effect. Annual reports will include:

- Results from monitoring, including results of bias corrections (i.e., searcher efficiency trials, scavenger removal trials, and searchable area adjustments) and estimates of bat mortality;
- Raw data sheets (that include all bat and bird fatalities); and
- Spreadsheets showing the temperature, timing, and actual speeds at which theturbines were operational and feathered during the monitoring period.

In addition, the Applicant commits to the following while operating under the TAL for High Prairie Wind Facility:

1. The Applicant will implement the voluntary Bird and Bat Conservation Strategy plan pursuant to the USFWS's Wind Energy Guidelines that describes: (a) risks to wildlife associated with the Project, (ii) avoidance and minimization techniques incorporated into the design and operation Project, and (iii) post-construction mortality monitoring and reporting. That plan, including post-construction monitoring, will be in place at the start of operations. The Applicant should retain all bat carcasses and send tissue samples (protocol forthcoming) to the Missouri Ecological Services Field Office.

2. To reduce effects to all bat species in the area, the Applicant will limit tree clearing to between Nov 1- Mar 31, with the possible exception of supplemental tree-clearing necessary to accommodate any final layout design changes.

3. The measures outlined in this TAL will be superseded by the avoidance, minimization, and mitigation measures established in the HCP and the ITP, pending Service evaluation and determination of permit issuance.

This office is not authorized to provide guidance in regards to the USFWS Office of Law Enforcement (OLE) investigative priorities involving federally listed species. However, we understand that OLE carries out its mission to protect ESA-listed species through investigation and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to avoid take of listed species; and by encouraging others to implement measures to avoid take of listed species. It is not possible to absolve individuals or companies from liability for unpermitted take of listed species, even if such take occurs despite the implementation of appropriate take avoidance measures. However, the OLE focuses its enforcement resources on individuals and companies that take listed species without identifying and implementing all reasonable, prudent and effective measures to avoid such take.

This office concludes that, if the Applicant follows the measures above, the High Prairie Wind Facility is unlikely to result in prohibited take of ESA listed species.

Thank you for your continuing coordination on project development. Should you have questions regarding this TAL, please contact Laurel Hill, 573/234-5038; Laurel_Hill@fws.gov, of my office.

Sincerely,

KAREN HERRINGTON
Digitally signed by KAREN HERRINGTON
Date: 2020.06.05 15:25:49 -05'00'

Karen Herrington
Field Supervisor

cc: MDC, Jefferson City, MO (J. Campbell)

[EXTERNAL] Interim Take Avoidance for High Prairie Wind Farm Commencing March 15, 2021

Atkins, Kevin D <KAtkins@ameren.com>

Sun 3/14/2021 3:26 PM

To: Herrington, Karen <karen_herrington@fws.gov>; Hill, Laurel A <laurel_hill@fws.gov>
Cc: Arora, Ajay K <AArora@ameren.com>; Knowles, Susan B <SKnowles@ameren.com>; Moore, Jeffrey W <JMoore3@ameren.com>; Meiners, David D <DMeiners@ameren.com>; Smith, Richard C <RSmith3@ameren.com>; Morgan, Nancy <NMorgan@ameren.com>

Karen,

In a conservative approach to avoid take of the Indiana bat or northern long-eared bat while we discuss a revised TAL with the USFWS, Ameren Missouri proposes to not operate the wind turbines at the High Prairie Renewable Energy Center when night time ambient air temperatures are above 50 degrees Fahrenheit. This conservative, temperature based curtailmnent of the turbines will be in effect 45-minutes prior to sunset through 45 minutes following sunrise, whenever ambient air temperatures are above 50 degrees Fahrenheit. When triggered, this curtailment will see the turbine blades will be feathered out of the wind.

Kevin D. Atkins, M.S. CE - PWS – CESSWI-AI*
::
Career Environmental Scientist, Permitting & Natural Resources Group,
Environmental Strategy & Analysis, Ameren Services Corporation

1901 Chouteau Avenue MC602
St. Louis, MO 63166-6149
C 314-610-5575

*Certified Ecologist – Professional Wetland Scientist – Certified Erosion Sediment and Stormwater Inspector-Approved Instructor

....
Ameren.com

[EXTERNAL] RE: Turbine M-03 Operational Data - High Prairie Renewable Energy Center

Atkins, Kevin D <KAtkins@ameren.com>

Thu 4/22/2021 3:32 PM

To: Hill, Laurel A <laurel_hill@fws.gov>; Herrington, Karen <karen_herrington@fws.gov>; jennifer.campbell@mdc.mo.gov <jennifer.campbell@mdc.mo.gov>; Jordan Meyer <jordan.meyer@mdc.mo.gov>; Theresa Hyland <Theresa.Hyland@mdc.mo.gov>
Cc: Morgan, Nancy <NMorgan@ameren.com>; Stephenson, Molly <Molly.Stephenson@stantec.com>; VanDeWalle, Terry <terry.vandewalle@stantec.com>; Mark Casper (mcasper@terra-gen.com) <mcasper@terra-gen.com>; Janice.Schneider@lw.com <Janice.Schneider@lw.com>; Zaheer.Tajani@lw.com <Zaheer.Tajani@lw.com>; Meiners, David D <DMeiners@ameren.com>; Smith, Richard C <RSmith3@ameren.com>

1 attachments (130 KB)

Raw Data M-03(T168) Turbine Report 4-7-21 to 4-15-21.xlsx;

All, now that Ameren has delivered the turbine data, and our summary of what we feel is the most likely risk period associated with this mortality event. I would like to schedule a call either tomorrow or Monday to discuss the resumption of the processing of the ITA for the facility. If nothing else the data indicates that the facility was being operated in accordance with our voluntary commitment to not operate turbines at the facility at night, while the ambient air temperature at each turbine is above 50˚F (10˚ C). We have since altered the curtailment such that the turbines are fully curtailed whenever the temperature is above -20˚ C, and it is within 45 minutes prior to sunset through 45-minutes following sunrise.

If you would please let me know your availability and preference to meet, I would appreciate it.

Kevin D. Atkins, M.S. CE - PWS – CESSWI-AI*

Career Environmental Scientist, Permitting & Natural Resources Group,
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Ameren.com

From: Stephenson, Molly <Molly.Stephenson@stantec.com>
Sent: Thursday, April 22, 2021 4:18 PM
To: Hill, Laurel A <laurel_hill@fws.gov>; karen_herrington@fws.gov
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Subject: [EXTERNAL] Turbine M-03 Operational Data - High Prairie Renewable Energy Center

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Laurel et al.,

The raw operational data from Turbine M-03 between 4-7-2021 and 4-15-2021 are attached, including the following information:

- Column B – ending time stamp of each 10-minute period, converted to central daylight time (i.e., data is for the preceding 10 minute block)
- Column E – average wind speed for that period in m/s
- Column F – average temperature in Celsius (turbines curtailed if ≥10)
- Columns G and H – energy production; if negative, this indicates turbine curtailed (they are consuming power to keep their systems functional/available while in an idled state, which is why this is a negative value)
- Column K – total accumulated energy, can be used to verify that periods without data were not producing energy
- Column O – average RPM of the rotor, this appears to be <1 when curtailed
- Column R – blade pitch angle, this appears to be ~82 when the turbine is curtailed

The following is Stantec's summary of the Indiana bat fatality that was found on 4/15/2021 at ~2:30PM. Based on the condition of the carcass, the field biologist estimates the carcass died 1-2 nights prior (4/14 or 4/13). The turbine was last searched on 4/8/2021, however, based on data from the nearest weather station, there was rain on 4/10/2021, and therefore the evidence suggests that the bat died between 4/11 and 4/14 (since the carcass did not appear to have been out in the rain). Below are some highlights from those four nights based on our review of the raw data from the SCADA system:

- 4/11/2021 – turbine did not operate that night due to faulting out. Per Ameren, this can be verified by looking at the "Total Accumulated" column (Column K), which will show that no energy generation accumulated between the times with data, and that the blade pitch angle (Column R) was feathering prior to and after the fault period.
- 4/12/2021 – turbine was curtailed from sunset to midnight when temperature was above 50 degrees; turbine then operated uncurtailed from midnight to 45 minutes after sunrise because temperatures were below 50 degrees. Wind speeds were relatively high (>5.0 m/s) until 4am, when temperatures had dropped to <40 degrees.
- 4/13/2021 – turbine curtailed for ~30 minutes at the beginning of the night, but then the temperature dropped below 50 degrees and the turbine operated uncurtailed the rest of the evening. Temperature remained close to 50 degrees for several hours after this, while wind speeds were low (ranged from 3.4-7.9 m/s over the course of the night).
- 4/14/2021 – project operated all night because temperatures were always below 50 degrees. Wind speeds ranged from 4.6-8.8 m/s. Temperatures ranged from 37.4-44.6 degrees.

Based on the above, a likely scenario is that the bat died on the night of 4/13/2021 given that the night started off with more favorable conditions (>50 degrees F), and therefore a bat that was already out flying may have continued to do so despite the drop in temperature.

As mentioned, the raw operational data are attached, from 4/7/2021 to 4/15/2021. We've also pulled out the nighttime data (7pm-7:20am) from the three nights of interest into separate tabs for easy review.

Please let us know if you have any questions or need anything else.

Thank you!

Molly

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APPENDIX F: Estimating Populations of Northern Long-eared Bats and Little Brown Bats

Appendix F. Population Estimates for Northern Long-eared Bats and Little Brown Bats

Northern long-eared bat

Prior to the onset of WNS, northern long-eared bats were abundant throughout much of the eastern United States. In 2016 the Service estimated the U.S. population to be 6,500,000 individuals (adults and juveniles), including 428,923 in Missouri (USFWS 2016). These population estimations were derived using occupancy rates as reported primarily from mist-net surveys (e.g., the ratio of mist-net captures to attempts), and assuming all forested areas as potential habitat (15,471,947 acres in Missouri).

The USFWS estimates there are 2,785,032 northern long-eared bats in Region 3 (USFWS 2016). In Missouri, consistent surveys of 20 caves indicate a rate of 99.6% decline (Colastskie 2017). The decline in numbers of hibernating bats is one useful element used to characterize population trends, although it's important to understand the limitations of hibernacula data. Hibernacula counts provide limited insight into the population dynamics for northern long-eared bats. Northern long-eared bats tend to occur in small numbers in numerous hibernacula across its range (Figure 1). Unlike Indiana bats, who cluster in large clusters, northern long-eared bats are difficult to find in caves and rarely found in large numbers. Northern long-eared bats can be overlooked in caves and mines; tucked into cracks and crevices, and in inaccessible reaches. They also hibernate in places other than caves and mines such as rock faces and bluffs (Lemen et al. 2016; Hurt 2017), and these areas have not been surveyed in Missouri. Because hibernacula counts provide limited insight of the northern long-eared bat population in Missouri, we used the occupancy rate-based estimate in our analyses modeling state-wide population, as explained below.

Based on occupancy rate, the estimated pre-WNS population size in Missouri is 428,922 individuals (USFWS 2016). Using the same methods and assumptions (as explained in USFWS 2016, Section 2.4.5), we used Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019 to estimate current Missouri population of northern long-eared bats:

- 15,471,947 forested acres x 0.168 occupancy rate = 2,592,497 occupied acres;
- 2,592,497 occupied acres x 0.90 overlap with males = 2,344,395 colony-occupied acres;
- 2,344,395.11 acres / 1,000 acres per colony = 2,344 colonies in Missouri;
- 2,344 colonies x 20 females per colony = 46,887 adult females; and
- Adult females x 2 (assuming 50:50 sex ratio) = 93775 total adults; and
- **Total adults + pups (assuming 1 pup/adult female) = 140,664 individuals**

These data indicate an estimated 67% reduction in the population post WNS.

Little brown bat

The little brown bat, once commonly found statewide in Missouri, was recently reassigned a state conservation status rank of S2 (imperiled species) declines in populations in response to the impact of WNS (MDC 2018). Missouri's winter populations, counted in hibernacula, have declined by approximately 84 percent since winter 2010/2011 (Colastskie 2017).

The southern edge of the little brown bat range (Figure 2) is limited by the lack of caves, whereas the northern edge of the range is likely defined by a limited number of suitable hibernacula and the longer length of the hibernation season (Humphries et al. 2002). Unlike Indiana bats, within hibernacula little brown bats do not form tightly packed clusters; bats may hang singly, in small or large loose or very loose clusters often on walls rather than ceilings, and often along shelfs or in cracks. Because hibernacula counts provide limited insight of the little brown bat population, we use occupancy rate to estimate little brown population sizes for Missouri and Region 3, as described below.

Using the same methods and assumptions as USFWS 2016 (as explained in USFWS 2016, Section 2.4.5), we used Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019 to estimate current Missouri population of little brown bats:

- 15,471,947 forested acres x 0.175 occupancy rate = 2,711,521 occupied acres;
- 2,711,521 occupied acres x 0.833 overlap with males[1] = 2,258,697 colony-occupied acres;
- 2,258,697 acres / 2,300 acres per colony[2] = 982 colonies in Missouri;
- 982 colonies x 50 females per colony[3] = 49,102 adult females; and
- Adult females x 2 (assuming 50:50 sex ratio) = 98,204 total adults; and
- **Total adults + pups (assuming 1 pup/adult female) = 147,306 individuals**

Using the same methods and assumptions as USFWS 2016, (as explained in USFWS 2016, Section 2.4.5), we used Missouri occupancy rates informed by post-WNS mist-net and acoustic surveys from 2017-2019 to estimate current Region 3 population of little brown bats:

- 90,729,419[4] forested acres x 0.175 occupancy rate = 2,711,521 occupied acres;
- 2,711,521 occupied acres x 0.833 overlap with males[5] = 15,900,697 colony-occupied acres;
- 15,900,697 acres / 2,300 acres per colony[6] = 5,758 colonies in Region 3;
- 5,758 colonies x 50 females per colony[7] = 287,940 adult females; and
- Adult females x 2 (assuming 50:50 sex ratio) = 575,881 total adults; and
- **Total adults + pups (assuming 1 pup/adult female) = 863,823 individuals**

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[1] We used pre-construction survey data from the Applicant to calculate the overlap between summer home range of reproductive females and males and non-reproductive females consistent with USFWS (2016d). Little brown bats were captured at six mist-net locations. Four of these locations had reproductive females or juveniles (indicative of a maternity colony) and one of the other two captures was within 3.9 miles of a female capture. Therefore, we assume 83.3% overlap between maternity colonies and males (five of the six sites were used by a maternity colony or were within foraging distance of a maternity colony).
[2] Assuming that each adult female requires 46 acres of suitable bat habitat (USFWS 2016) and using the estimate of 50 adult females per maternity colony (post-WNS), each maternity colony would require approximately 2,300 acres of habitat (50 adult females multiplied by 46 acres per female).
[3] Based on literature disseminated in HCP Section 4.3.8.1, we assumed that pre-WNS there were an average of 750 little brown bats per maternity colony (375 adult females), and that post-WNS there will be an average of 100 little brown bats per maternity colony (50 adult females).
[4] Forest acres in Region 3 as reported in USFWS 2016
[5] We used pre-construction survey data from the Applicant to calculate the overlap between summer home range of reproductive females and males and non-reproductive females consistent with USFWS (2016d). Little brown bats were captured at six mist-net locations. Four of these locations had reproductive females or juveniles (indicative of a maternity colony) and one of the other two captures was within 3.9 miles of a female capture. Therefore, we assume 83.3% overlap between maternity colonies and males (five of the six sites were used by a maternity colony or were within foraging distance of a maternity colony).
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[7] Based on literature disseminated in HCP Section 4.3.8.1, we assumed that pre-WNS there were an average of 750 little brown bats per maternity colony (375 adult females), and that post-WNS there will be an average of 100 little brown bats per maternity colony (50 adult females).

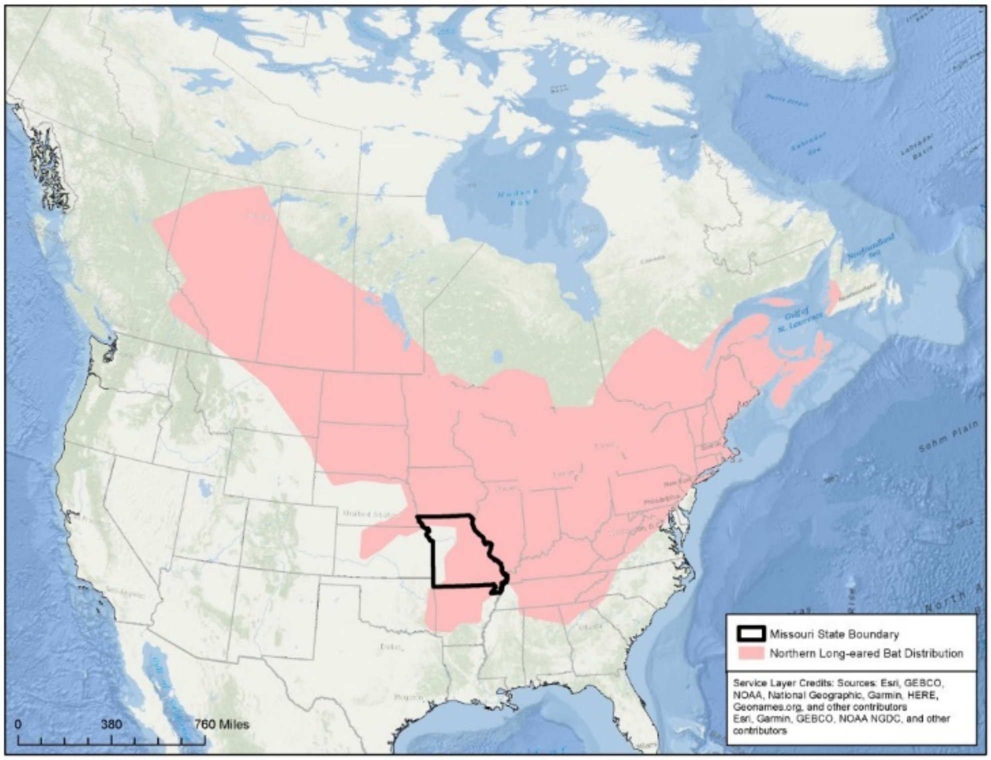

Figure 1 Range-wide Distribution of the Northern Long-eared Bat

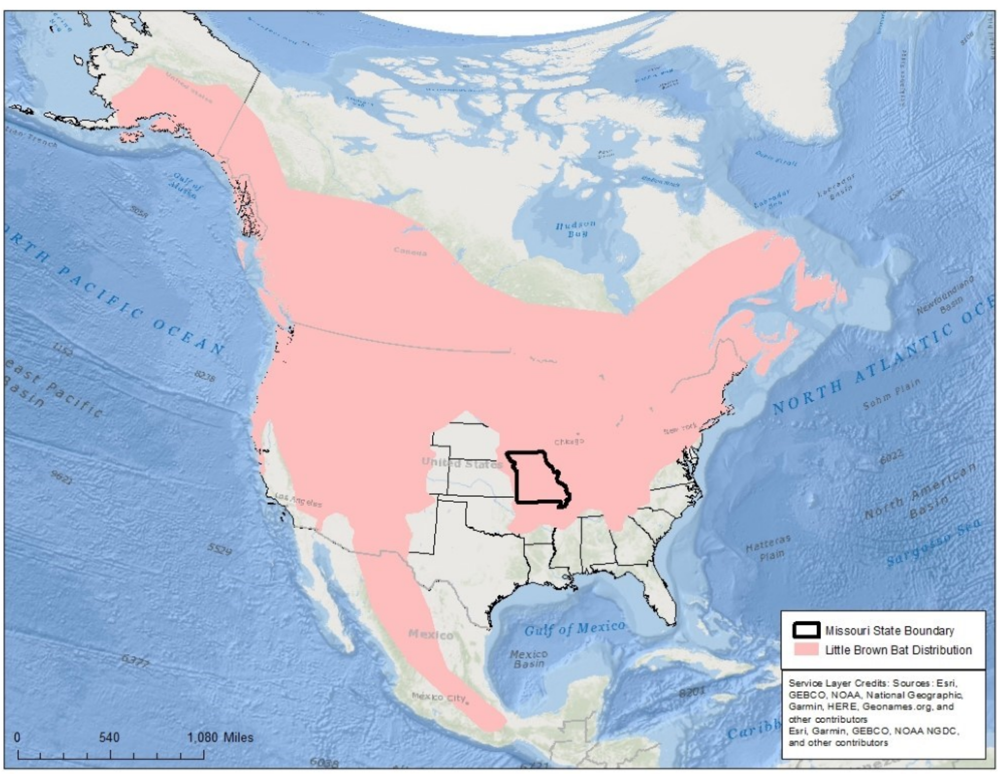

Figure 2 Range-wide Distribution of the Little Brown Bat

References

Colatskie, S. 2017. Missouri bat hibernacula survey results from 2011–2017, following white-nose syndrome arrival. Technical brief. Missouri Department of Conservation.

Hurt, A. 2017. Bat Hibernacula Searches in Central Iowa, February/March 2017. Report Prepared by Working Dogs for Conservation.

Humphries, M. M., Thomas, D. W., & Speakman, J. R. 2002. Climate-mediated energetic constraints on the distribution of hibernating mammals. Nature, 418(6895), 313-316.

Lemen, C. A., Freeman, P. W., & White, J. A. 2016. Acoustic evidence of bats using rock crevices in winter: a call for more research on winter roosts in North America.

MDC. 2018c. Little brown myotis (little brown bat) Myotis lucifugus. <http://nature.mdc.mo.gov/discover-nature/field-guide/little-brown-myotis-little-brown-bat>. Accessed 28 March 2019.

USFWS. 2016. Programmatic biological opinion on final 4(d) rule for the northern long-eared bat and activities excepted from take prohibitions. Midwest Regional Office, Bloomington, Minnesota. 5 January.

APPENDIX G: Responses to Public Comments

Public Comments and Responses on the Draft Environmental Assessment and Draft Habitat Conservation Plan for the High Prairie Wind Energy Facility in Adair and Schuyler Counties, Missouri

In accordance with the National Environmental Policy Act, the Draft Environmental Assessment (EA) was circulated for public review and comment on December 1, 2020. Concurrently, the Draft Habitat Conservation Plan (HCP) was also published for public review and comment. The public review period was initiated with the publication of the Notice of Availability in the Federal Register (85 FR 77234–77236), and the 30-day public comment period ended on December 31, 2020. A comment letter was received from the Missouri Department of Conservation (MDC), two sets of comments were received from the general public, and one comment was received from the Applicant, TG High Prairie LLC. Comments were considered in assessing Project impacts. The U.S. Fish and Wildlife Service (USFWS) provided responses to the general comments and those on the EA, while TG High Prairie LLC, (Applicant) provided responses to comments on the HCP. All comments and responses are provided below.

1. Anonymous General Comment: "Please deny this permit and protect the Indiana bats, the Northern long-eared bats, and the Little Brown Bats from further harm. The estimated total of bats that will be killed by these wind turbines over the 6-year period will be bringing more devastation to these bats. Over six million bats have already died from white-nose syndrome since 2006 and something like this will just harm their population more. So please look out for these bats to ensure their survival. Thank you."

   USFWS Response: Thank you for your comment.

2. Nakila Blessing General Comment: "[I]t is disheartening that wind energy facilities are allowed to be built, tested and operated prior to a habitat conservation plan being in place. Ideally, these plans, along with incidental take permits, should need to be completed and issued prior to the start of construction of these projects. It is a great disservice to the environment and these animals that this loophole is in place."

   USFWS Response: Thank you for your comment.

3. Nakila Blessing EA Comment: " . . . Alternative 1/No Action Alternative is the appropriate choice for the USFWS to implement. This alternative has the highest cut-in speed and has the longest duration of blade feathering, to hopefully reduce the risk to bats. Even with this plan in place during testing, a bat was still discovered near a turbine. Even with the more stringent guidelines, the risk to bats is still a serious concern."

   USFWS Response: Thank you for your comment.

4. Nakila Blessing EA Comment: " . . .the next most reasonable option is Alternative 3: 6.5 m/s Cut-in Speed. Ideally, the cut in speed of this alternative would be increased from 6.5 m/s to 6.9 m/s and continue to include the monitoring and adaptive management."

   USFWS Response: Thank you for your comment.

5. Nakila Blessing Comment: "Coincidentally, Alternative 2/Applicant's HCP/Cut-In Speed 5.0 m/s should be removed entirely. It is a poor option and would undoubtedly lead to the unnecessary deaths of multiple bats in the area. This option should not be considered for approval by the USFWS."

   USFWS Response: Thank you for your comment.

6. Nakila Blessing Comment: "[I]n section 3.5.1 Affected Environment, the Statement, "Because the Facility is already constructed, the operation of the Facility's wind turbines is also part of the baseline noise levels in the Permit Area" is remarkably unethical and arrogant. Is the USFWS seriously operating under the assumption that life did not exist prior to construction of this project? How can the USFWS allow the following statement, "In the context of this project, we would consider a significant noise impact to be the generation of noise that is substantially different in type or intensity than the existing noise profile such that injury to humans or wildlife is expected," yet then turn around and accept post-construction noise studies as acceptable? What about pre-construction noise studies and monitoring? This is maddening and baffling. Typical rural background noise is around 30 dbA. To say that noise after construction will be 45- 49 dbA is an INCREASE of 15-20 dbA. How if this acceptable? As someone who lives within the footprint of this project, the sound landscape has been altered significantly.

USFWS Response: The purpose of the environmental assessment is to evaluate the impacts of the Proposed Action and action alternatives to the human environment. The facility will continue to operate under all alternatives considered and baseline noise levels are outside the scope of the Service's action. Noise levels associated Noise levels and the rate of occurrence of noise within and surrounding the Facility during daylight hours are not influenced by the Proposed Action. Nighttime noise levels will not change. However, the rate of occurrence of noise associated with operations at night may increase depending on the frequency and duration that wind speeds are above 5.0 m/s versus or above 6.9 m/s (i.e., under the No-Action alternative) between April 1st and October 31st each year. Based on the information considered in the environmental assessment, the decrease in cut-in speed under the Proposed Action at night would not increase the time during which turbines operate to a point where impacts to public health or safety are meaningful.

7. TG High Prairie LLC EA Comment: Supportive letter that cites specifically how the HCP minimizes and mitigates take. Requests that the proposed HCP be approved, and ITP be issued in January 2021. Urges the USFWS to develop a Finding of No Significant Impact.

   USFWS Response: Thank you for your comment.

8. MDC HCP Comment: Several MDC comments referencing MO stipulations associated with PSC case EA-2018-0202.

   USFWS: The validity of the Permit is conditioned upon strict observance of all applicable foreign, state, local tribal, or other federal law.

9. MDC HCP Comment: Comments on Precedent and applicability of the short-term HCP approach.

   USFWS Response: Results from post-construction monitoring and site-specific monitoring for maternity colonies in this first six years will inform current and future management decisions (and any future permit decisions) over the life of the Project. The results from these structured monitoring protocols were designed to study and better understand wind impacts to maternity colonies and inform future operations strategies that protect Covered Species at this Project site and throughout the region.

   The 6-year term of the permit and associated monitoring study is intended to inform, rather than set precedent for, future actions, while minimizing impacts. By limiting the term of the permit and also implementing adaptive management that adjusts operations in response to pre-determined monitoring data triggers, potential impacts to Covered Species will be controlled (and significant impacts avoided) while data is collected.

   Approval of the HCP and issuance of the ITP informed by this EA have no bearing on future permit decisions; if the Applicant decides to pursue a subsequent ITP, the Service will evaluate that ITP application and comply with NEPA accordingly.

The remaining comments pertained specifically to the HCP, which is the Applicant's document. TG High Prairie LLC has provided the responses for these comments.

10. Nakila Blessing HCP Comment: "Perhaps, the HCP should be amended to allow the USFWS and/or the MDC to perform monitoring."

    Applicant Response: The Service will receive seasonal reports by June 15th, September 15th, and November 31st summarizing post construction monitoring progress. In addition the MDC may audit monitoring activities through the Stipulations of the Public Service Certificate of Convenience.

11. Nakila Blessing HCP Comment: " . . . I agree with the Missouri Department of Conservations recommendations for operational monitoring . . . " [Comment reiterates MDC recommendations for Evidence of Absence at G-level of 0.3.]

    Applicant Response: The Applicant coordinated the post-construction monitoring plan with both USFWS and MDC throughout the development of the HCP. The methods may vary from year to year to achieve the desired level of detection, and the HCP has been revised to reflect that the Evidence of Absence G-level goal of 0.2 is a minimum, and a higher detection probability may be achieved.

12. MDC HCP Comment: "(1) The HCP approach relies heavily on fatality data to understand site risk and evaluate the need for additional operational minimization efforts. Thus, the Department recommends the use of dog search teams or other techniques to increase the probability of carcass detection (g-level)."

    Applicant Response: Text in the HCP has been revised to allow flexibility of using dogs if needed to increase the detection probability.

13. MDC HCP Comment: "(2) The Department expects to be included in all future meetings on this topic based upon the Stipulation filed in PSC case EA-2018-0202. The Department recommends USFWS ensure the HCP specifies that the Department will be included in these discussions."

    Applicant Response: The HCP has been revised to commit to future coordination with MDC. As stated above, the validity of the Permit is conditioned upon strict observance of all applicable foreign, state, local tribal, or other federal law.

14. MDC HCP Comment: "(3) The Department recommends USFWS address how maternity colony trends observed at HPWF would be evaluated to isolate impacts of facility operation from white-nose syndrome or other mortality sources in the event the Department's research project is not funded in whole or part. Additionally, a direct or indirect comparison between maternity colony trends at HPWF and reference sites will likely benefit from statistically comparable study methodology. The Department recommends that USFWS ensure that maternity colony comparisons are meaningful between HPWF and any reference sites."

    Applicant Response: The HCP has been revised to include language in Section 7.4 stating that Ameren will coordinate with USFWS and MDC to ensure the study design is expected to yield significant results, and results will be comparable to off-site control studies and data. In addition, text was added that Ameren will coordinate with USFWS and MDC to find comparable publicly available data if needed for comparison.

15. MDC HCP Comment: "(4) The Department recommends HPWF provide little brown bat with a similar magnitude of protection as other covered species in this permit. The Department recommends:

    (1) USFWS re-valuate the population models for a 50-year term to assist in identifying a protective regime for little brown bat adaptive management triggers, and

    (2) HPWF coordinate with USFWS and the Department to refine little brown bat adaptive management triggers so impacts to maternity colonies are better aligned with impacts to the other covered species in this permit."

    USFWS: Little brown bat adaptive management triggers were updated and are more protective of resident maternity colonies. The updated population model results are reported in Final EA Section 3.4.2, and all model results were reported at year 50 to conform to methods established in Thogmartin et al. 2013.

    Applicant Response: The Applicant coordinated with USFWS and MDC after the draft HCP was published to revise the adaptive management for the little brown bat, such that it is now modeled along the same lines as the Indiana bat. Edits are included in the HCP and Appendices.

16. MDC HCP Comment: "(5) The Department recommends the HCP acknowledge that hibernacula count trends for northern long-eared bat observed at Sodalis Nature Preserve may not be representative of the northern long-eared bat population impacted by HPWF."

    Applicant Response: Thank you for your comment.

17. MDC HCP Comment: "(7) To the extent mitigation might be required as part of an HCP for federally protected bats, the Department recommends bat mitigation areas be at least five (5) miles from the HPWF boundary, and preferably to the East of the HPWF to intercept individuals from traveling through the HPWF, to avoid the potential for mitigation areas to attract wildlife to the HPWF."

Applicant Response: The current mitigation for the HPWF is being implemented at an approved mitigation bank.

18. MDC HCP Comment: "(8) The Department recommends Section 7.3.4 of the HCP be updated to clarify that the Department will also receive notification about covered species (Indiana bat, northern long-eared bat, and little brown bat) at the same time as the USFWS (e.g. within 48 hours), as well as any Endangered Species Act species, state-listed species, and SOCC at the same time as USFWS based upon the Stipulation filed in PSC case EA-2018-0202. The Department appreciates the HPWF commitment to report SOCC fatalities to the Department within 24 hours."

    Applicant Response: Text in the HCP has been revised to reflect this commitment.

19. MDC HCP Comment: "HPWF reports it considered smart curtailment and deterrent strategies using real-time data to reduce bat fatalities (HCP Section 7.2.1.5), but did not pursue them because "they are not yet commercially available." The justification continued to clarify that these technologies are unproven with bats in the Myotis genus (including Indiana bat)."

    Applicant Response: Thank you for your comment. The HCP includes a changed circumstance related to smart curtailment and deterrent strategies.

20. MDC HCP Comment: "The High Prairie Wind Farm (HPWF) is proposed in a "high risk" location for Indiana bats and other bat species. The Habitat Conservation Plan (HCP) notes that the presence of on-site bat maternity colonies makes the HPWF unique to wind projects in the Midwest Region (HCP, Section 7.2.1.4). Additionally, the HPWF is also likely used by Indiana bats during migration. The discovery of an Indiana bat carcass during test operations with a 6.9m/s cut-in speed in September 2020 (page 8 of the EA) underscores the importance of robust fatality monitoring, adaptive management, and operational minimization efforts at the HPWF site."

    Applicant Response: Thank you for your comment. The Applicant coordinated with the USFWS and MDC to develop the robust fatality monitoring, adaptive management, and operational minimization efforts detailed in the HCP.