FINAL

Environmental Assessment for the Habitat Conservation Plan and Incidental Take Permit

Bitter Ridge Wind Farm, LLC

Jay County, Indiana

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U.S. Fish and Wildlife Service
Indiana Ecological Services Field Office
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Bloomington, IN 47403-2121

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TABLE OF CONTENTS

1 PROJECT OVERVIEW AND BACKGROUND 1
1.1 Introduction....1
1.1.1 The Bitter Ridge Wind Farm 1
1.1.1.1 Project Location 1
1.1.1.2 Project Description....3
1.1.2 Plan Area....3
1.2 Regulatory Background 3
1.2.1 National Environmental Policy Act 3
1.2.2 Endangered Species Act 4
1.2.3 Bald and Golden Eagle Protection Act 5
1.2.4 National Historic Preservation Act 5
1.2.5 Indiana Nongame and Endangered Species Conservation Act....6
2 PURPOSE AND NEED....6
2.1 Purpose of the Environmental Assessment....6
2.2 Proposed Action – Issuance of the Permit 6
2.3 Need for Proposed Action....7
2.4 Decision to be Made 7
3 ALTERNATIVES....7
3.1 Alternatives Retained for Detailed Analysis 8
3.1.1 Alternative 1: No-Action Alternative 8
3.1.1.1 No-Action Alternative Summary....9
3.1.2 Alternative 2: 5.0 Meters per Second Cut-in Speed (Applicant's Proposed Operation, ITP Issuance, HCP with Minimization and Mitigation Measures).....9
3.1.2.1 Operational Minimization Measures....10
3.1.2.2 Mitigation....10
3.1.2.3 Monitoring and Adaptive Management 11
3.1.2.4 Alternative 2 Summary 11
3.1.3 Alternative 3: 6.5 Meters per Second Cut-in Speed (More Restrictive Operations, ITP Issuance, HCP with Minimization and Mitigation Measures) .12
3.1.3.1 Operational Minimization Measures....12
3.1.3.2 Mitigation....12
3.1.3.3 Monitoring and Adaptive Management 12
3.1.3.4 Alternative 3 Summary 12
3.2 Alternatives Eliminated from Detailed Analysis 13

4 AFFECTED ENVIRONMENT 13
4.1 Overview of the Plan Area 14
4.2 Biological Environment 14
4.2.1 Vegetation 14
4.2.2 Wildlife 16
4.2.2.1 Non-flying Wildlife Resources 16
4.2.2.2 Avian Resources 16
4.2.2.3 Bat Resources 18
4.3 Physical Environment 26
4.3.1 Air Quality and Climate 26
4.3.2 Noise 27
4.4 Socioeconomic Environment 27
5 ENVIRONMENTAL CONSEQUENCES 28
5.1 Overview of the Effects Analysis 28
5.2 Biological Environment 30
5.2.1 Vegetation 30
5.2.1.1 Impact Criteria 30
5.2.1.2 Direct and Indirect Effects 30
5.2.1.3 Summary of Effects to Vegetation 31
5.2.2 Non-flying Wildlife Resources 31
5.2.2.1 Impact Criteria 31
5.2.2.2 Direct and Indirect Effects 31
5.2.2.3 Summary of Effects to Non-flying Wildlife 32
5.2.3 Avian Resources 33
5.2.3.1 Impact Criteria 33
5.2.3.2 Direct and Indirect Effects 33
5.2.3.3 Summary of Effects to Avian Resources 38
5.2.4 Bat Resources 39
5.2.4.1 Impact Criteria 39
5.2.4.2 General Bat Mortality Patterns at Wind Projects 39
5.2.4.3 Effectiveness of Turbine Curtailment at Reducing Bat Mortality 40
5.2.4.4 Estimating Bat Mortality 41
5.2.4.5 Habitat Impacts 41
5.2.4.6 Climate Change 41
5.2.4.7 Direct and Indirect Impacts 42
5.2.4.8 Summary of Effects to Bat Resources 46

5.3 Physical Environment 49
5.3.1 Air Quality and Climate 49
5.3.1.1 Impact Criteria 49
5.3.1.2 Direct and Indirect Effects 49
5.3.1.3 Summary of Effects to Air Quality and Climate 50
5.3.2 Noise 50
5.3.2.1 Impact Criteria 50
5.3.2.2 Direct and Indirect Effects 50
5.3.2.3 Summary of Effects to Noise 51
5.4 Socioeconomic Environment 52
5.4.1 Impact Criteria 52
5.4.2 Direct and Indirect Effects 52
5.4.2.1 Project Operations and Maintenance 52
5.4.3 Summary of Effects to the Socioeconomic Environment 53
5.5 Cumulative Effects 53
5.5.1 Wind Energy Development 54
5.5.2 Avian Resources 55
5.5.2.1 Wind Project Mortality 55
5.5.2.2 Climate Change 56
5.5.2.4 Other Anthropogenic Sources of Avian Mortality 57
5.5.2.5 Summary of Cumulative Effects to Avian Resources 58
5.5.3 Bat Resources 58
5.5.3.1 Wind Project Mortality 58
5.5.3.2 White-nose Syndrome 62
5.5.3.3 Climate Change 62
5.5.3.4 Habitat Loss and Fragmentation 63
5.5.3.5 Summary of Cumulative Effects to Bat Resources 63
6 CONSULTATION AND COORDINATION 64
6.1 Agency Coordination 64
6.2 Distribution of the Draft Environmental Assessment 64
7 LIST OF PREPARERS 65
8 REFERENCES 66

LIST OF TABLES

Table 4-1. Status and typical summer and winter habitats of bat species potentially occurring in Jay County, Indiana 19

Table 4-2. Indiana Bat (*Myotis sodalis*) population estimates for the Midwest Recovery Unit 21

Table 4-3. Income statistics in the region of the Bitter Ridge Wind Farm 28

Table 5-1. Comparison of the alternatives retained for detailed analysis 29

Table 5-2. Average reductions in bat mortality by curtailed cut-in speeds 40

Table 5-3. Comparison of the effects to bats for each alternative; italics indicate effects are unique to that alternative 47

Table 5-4. Comparison of estimates of Indiana bat, northern long-eared bat, and unlisted bat species mortality across alternatives 49

Table 5-5. Installed and projected wind energy development in the cumulative effects analysis area 55

Table 5-6. Estimated annual avian mortality from anthropogenic causes in the United States 57

Table 5-7. Comparison of estimates of Indiana bat, northern long-eared bat, and unlisted bat species mortality across alternatives 60

LIST OF FIGURES

Figure 1-1. Location of the Bitter Ridge Wind Farm in Jay County, Indiana 2

Figure 4-1. Land cover of the Bitter Ridge Wind Farm and vicinity 15

LIST OF APPENDICES

Attachment A. Bitter Ridge Bird and Bat Conservation Strategy
Attachment B. Documented Bat Fatalities at Wind Projects in the United States and Canada
Attachment C. Publicly Available Operational Curtailment Studies from Wind Energy Facilities in North America
Attachment D. Technical Assistance Letters
Attachment E. Public Comments and Responses

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
ac	acre
Applicant	Bitter Ridge Wind Farm, LLC
Area 31	Partners in Flight Physiographic Area 31
BBCS	Bird and Bat Conservation Strategy
BCC	Birds of Conservation Concern
BGEPA	Bald and Golden Eagle Protection Act
BRWF	Bitter Ridge Wind Farm, LLC
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Covered Species	species that would be covered by the incidental take permit (Indiana bat [*Myotis sodalis*] and northern long-eared bat [*Myotis septentrionalis*])
dB	decibels
dBA	A-weighted decibel
EA	Environmental Assessment
Eagle Guidance	*Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2*
EO	Executive Order
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
Fowler Ridge	Fowler Ridge Wind Project
FR	Federal Register
ft	foot
ha	hectares
HCP	*Indiana Bat and Northern Long-Eared Bat Habitat Conservation Plan for the Bitter Ridge Wind Farm, Jay County, Indiana*
HF	high frequency
Hz	hertz
IC	Indiana Code
IDEM	Indiana Department of Environmental Management
IDNR	Indiana Department of Natural Resources
IHPA	Indiana State Historic Preservation Agency
INESCA	Indiana Nongame and Endangered Species Conservation Act
IPaC	Information for Planning and Consultation

ITP	incidental take permit
km	kilometer
LF	low frequency
m	meter
m/s	meters per second
MET	meteorological
mi	mile
min	minute
mph	miles per hour
MRU	Midwest Recovery Unit
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NRC	National Research Council
O&M	operations and maintenance
Permit Area	the area in which turbines and other Project components occur
Plan Area	all areas affected directly and indirectly by activities associated with Project operations and mitigation measures
Project	Bitter Ridge Wind Farm
Recovery Plan	Indiana Bat (*Myotis sodalis*) Draft Recovery Plan
Service	U.S. Fish and Wildlife Service
Summer Survey Guidelines	Range-Wide Indiana Bat Summer Survey Guidelines
U.S.	United States
USC	United States Code
USEIA	U.S. Energy Information Administration
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WNS	white-nose syndrome

1 PROJECT OVERVIEW AND BACKGROUND

1.1 Introduction

The U.S. Fish and Wildlife Service (USFWS or Service) received an application for an Incidental Take Permit (ITP), pursuant to the provisions of Section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA) (16 United States Code [USC] §§ 1531–1544 [1973]) for the Bitter Ridge Wind Farm (Project) in Jay County, Indiana (Figure 1-1). If issued, the ITP would authorize the incidental take of Indiana bat (*Myotis sodalis*), a federally endangered species, and northern long-eared bat (*Myotis septentrionalis*), a federally threatened species (together, the Covered Species), during operation of the Project. Under Section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

The Project is owned and operated by Bitter Ridge Wind Farm, LLC (BRWF or Applicant), a Delaware limited-liability company, which is a subsidiary of Scout Clean Energy, LLC. BRWF's ITP application includes its *Indiana Bat and Northern Long-Eared Bat Habitat Conservation Plan for the Bitter Ridge Wind Farm, Jay County, Indiana* (HCP) (BRWF 2019 also available online: https://www.fws.gov/midwest/endangered/permits/hcp/r3hcps.html) that specifies, among other things, the impacts that would be likely to result from taking Indiana bat and northern long-eared bat, and the measures the Applicant would undertake to minimize and mitigate such impacts. The Applicant is applying for an ITP to provide the Project with long-term assurances that no unauthorized take of the Covered Species would occur that could give rise to liability for BRWF or individuals associated with the covered activities described in the proposed HCP. The Service has prepared this Environmental Assessment (EA) in accordance with the National Environmental Policy Act of 1969 (NEPA) (42 USC §§ 4312–4370h [1970]) to evaluate the effects of implementing the Applicant's proposed HCP.[1]

1.1.1 The Bitter Ridge Wind Farm

1.1.1.1 Project Location

The Project is located on private land in east-central Indiana, south and east of the city of Redkey, Indiana, and northwest of the city of Ridgeville, Indiana (Figure 1-1). The total area under lease for the Project covers approximately 8,972 hectares (ha; 22,170 acres [ac]). The Permit Area associated with the Project includes the area in which turbines and other Project components occur (the area where take of the Covered Species may occur that would be authorized by the ITP).

[1] The Council on Environmental Quality on July 16, 2020 issued a final rule updating its regulations for the NEPA (85 Federal Register 43304). The goals of these amended regulations are to reduce paperwork and delays, and to promote better decisions consistent with the policy set forth in Section 101 of the NEPA. The effective date of these amended regulations was September 14, 2020. However, for actions that began before September 14th, such as this one, agencies may continue with the regulations in effect before September 14th because applying the amended regulations would cause delays to the ongoing process. The Service began its NEPA review of the HCP for the Project before September 14th, so to reinitiate planning under the amended regulations would delay not only the NEPA analysis, but delay a decision to issue an ITP to BRWF. The Service believes this would be an inefficient use of funds. Therefore, this final EA, will conclude under the NEPA regulations, policy, and guidance in effect prior to September 14, 2020.

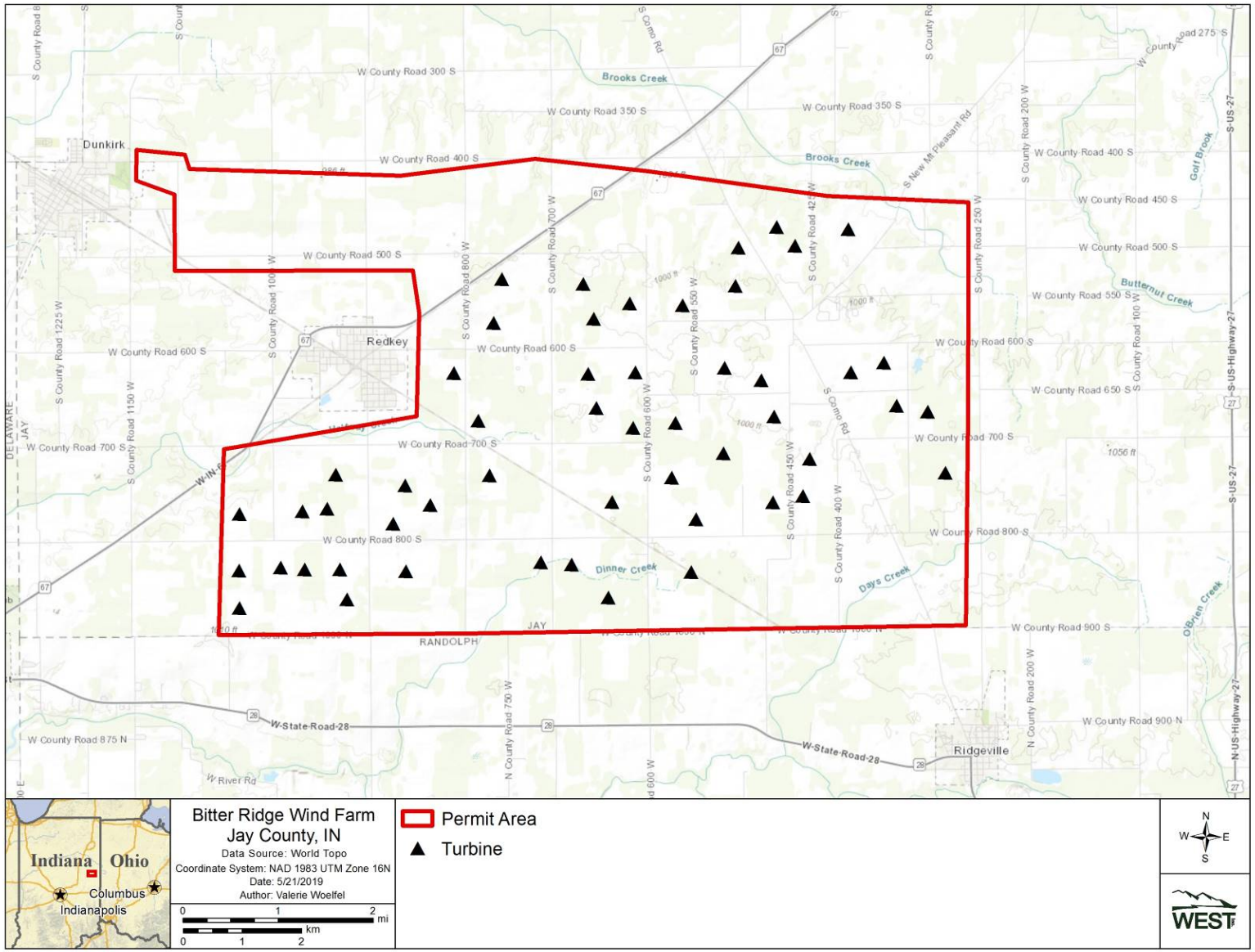

Figure 1-1. Location of the Bitter Ridge Wind Farm in Jay County, Indiana.

1.1.1.2 Project Description

The Project, which is currently operational, consists of 52 wind turbines with a combined nameplate generating capacity of 130 megawatts (MW), an operations and maintenance (O&M) facility, access roads, a generation lead line, underground collection system, a substation and switchyard, and one permanent meteorological (MET) tower (Figure 1-1). More detailed information on the Project components as well as operation and maintenance activities for the Project are described in Sections 2.1 and 2.2, respectively, of the HCP (BRWF 2019).

1.1.2 Plan Area

The Plan Area includes all areas that would be affected directly and indirectly by activities associated with Project operations and mitigation measures, and covers the geographic area that is analyzed in the NEPA analysis and the ESA Section 7 intra-USFWS consultation. The Plan Area includes any and all areas that may be within the HCP's sphere of influence, whether or not take is likely to occur. The Plan Area includes the area in which all 52 turbines are located and all lands involved in the off-site mitigation projects associated with the HCP (BRWF 2019).

1.2 Regulatory Background

1.2.1 National Environmental Policy Act

NEPA is an environmental law fashioned to ensure careful decision-making with respect to the environment. NEPA also established the Council on Environmental Quality (CEQ) in the Executive Office of the President to formulate and recommend national policies to ensure that the programs of the federal government exercise careful decision-making with respect to the environment. The CEQ has set forth regulations (40 Code of Federal Regulations [CFR] Parts 1500-1508 [1978]) to assist federal agencies in implementing NEPA policies, ensuring that the environmental impacts of any proposed decision are fully considered and that appropriate steps are taken to mitigate potential environmental impacts.

The NEPA review also provides an opportunity for the public to be involved in the acting agency's decision-making process. For this Project, the public had the opportunity to comment on the draft EA and Project HCP for 30 days from March 29 to April 28, 2021(86 Federal Register [FR] 16388). Public comments and our responses are included as Attachment E.

The culmination of the EA process is either a Finding of No Significant Impact or a decision to prepare an Environmental Impact Statement. This EA and its analyses assist the USFWS with making an informed decision on issuance of an ITP.

The USFWS has concluded that an EA is the appropriate instrument for reviewing the Applicant's proposal. The USFWS made this determination based on the following:

- wintering habitat (hibernacula) for the Covered Species are not known to occur near the Project;
- the Proposed Action would not impact critical habitat;

- the Applicant would implement a robust multi-year monitoring and adaptive management program;
- the Applicant would share all data and information with the USFWS;
- as discussed in Section 4.2.2.2, the Project site is considered low risk for resident and migratory birds because of its size, distance from known sensitive avian resource areas, minimal open water, and predominantly agricultural setting;
- the Applicant's proposed mitigation measures would fully offset the impact of taking Covered Species;
- the Proposed Action would not affect park lands, wetlands, wild and scenic rivers, or ecologically critical areas;
- the Proposed Action would not contribute to cumulatively significant impacts;
- the Proposed Action would not result in any violation of federal, state, or local law or requirements imposed for the protection of the environment;
- the issuance of an ITP is consistent with USFWS responsibilities under the ESA and NEPA; and
- the Proposed Action does not expose future generations to increased safety or health hazards, does not conflict with local, regional, state or federal land use plans or policies, and does not impose adverse effects on designated or proposed natural or recreation areas.

1.2.2 Endangered Species Act

The USFWS is responsible for implementing and enforcing federal wildlife laws, including the ESA. Federally listed threatened and endangered species and designated critical habitat are governed by the ESA and its implementing regulations (50 CFR Parts 13 [1974] and 17 [1975]). The USFWS also maintains a list of species that are candidates for listing pursuant to the ESA.

Section 9 of the ESA prohibits certain activities that directly or indirectly affect endangered species. For the purpose of the EA and the proposed ITP, the most relevant activity is the prohibition of take of wildlife species listed under the ESA. The ESA defines the term "take" to include harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these acts (16 USC § 1532.19 [1973]). Take of listed wildlife is illegal unless otherwise authorized by the USFWS (or National Marine Fisheries Service in marine systems) pursuant to Section 10 of the ESA.

Section 10 of the ESA allows for exceptions to the take prohibitions described in Section 9 of the ESA. Section 10(a)(1)(B) of the ESA allows the USFWS and National Marine Fisheries Service to authorize the taking of listed species by non-federal entities (e.g., states, counties, local governments, private landowners) if such take is incidental to an otherwise lawful activity. To receive a permit, the applicant submits a conservation plan (also referred to as an HCP) that meets the criteria included in the ESA and its implementing regulations (50 CFR Part 17 [1975] and Part 222 [1999]).

Because issuance of an ITP under Section 10(a)(1)(B) of the ESA constitutes a federal action, the USFWS is required to conduct an intra-agency consultation under Section 7 of the ESA. This means the USFWS must conduct an internal formal Section 7 consultation on permit issuance. Intra-agency Section 7 consultation is between the Assistant Regional Director for Ecological Services and the field office that assisted the applicant in developing the HCP (in this instance, the Indiana Ecological Services Field Office). The USFWS's internal consultation on the issuance of an ITP under Section 10(a)(1)(B) represents the last internal "check" that the fundamental standard of avoiding jeopardy has been satisfied. Formal consultation terminates with preparation of a Biological Opinion, which provides the USFWS determination as to whether the Proposed Action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.

1.2.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act of 1940 (BGEPA) (50 CFR 22.26 [2009]) prohibits the "take" of bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*). The USFWS published the Eagle Permit Rule on September 11, 2009, under BGEPA, authorizing limited issuance of take permits for bald and golden eagles for cases where the take is compatible with the preservation of the eagle species and cannot practicably be avoided (USFWS 2009) (74 FR 46836-46879 [September 11, 2009] and 50 CFR 22.26 [2009] and 22.27 [2009]). In December 2016, USFWS published the *Programmatic Environmental Impact Statement for the Eagle Rule Revision* and its final changes to eagle permitting regulations (81 FR 91494-91554 [December 16, 2016]). Although the revised regulations pertain to all non-purposeful take of eagles and eagle nests, specific requirements are included for wind energy facilities.

On May 5, 2013, the USFWS released their *Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2* (Eagle Guidance) (USFWS 2013). The Eagle Guidance interprets and clarifies the Eagle Permit requirements in the regulations (50 CFR 22.26 [2009] and 22.27 [2009]). The Eagle Guidance also provides recommendations for pre-construction surveys, avoidance and minimization measures, and post-construction monitoring at commercial wind farms.

The Project has a low likelihood for taking or disturbing eagles. However, wind projects have killed eagles, including projects in the Midwest. Therefore, this EA addresses potential effects to eagles.

1.2.4 National Historic Preservation Act

The Service's issuance of an ITP under ESA Section 10(a)(1)(B) is considered an "undertaking" as defined by regulation and must comply with Section 106 of the National Historic Preservation Act (16 USC § 470 et seq.) and its implementing regulations at 36 CFR Part 800. Section 106 requires the Service to assess and determine the potential effects on historic properties that would result from the proposed undertaking. When an adverse effect to a historic property cannot be avoided, the Service must consult with State Historic Preservation Office, the Tribal Historic Preservation Office, and other interested parties to identify ways to mitigate the effects of the undertaking. This process may result in the development of a Memorandum of Agreement, which identifies the steps the agency will take to reduce, avoid, or mitigate the adverse effect. The Memorandum of Agreement will be submitted to the Advisory Council on Historic

Preservation for review and comment. The Service must document National Historic Preservation Act compliance and include such documentation in the administrative record for the HCP.

1.2.5 Indiana Nongame and Endangered Species Conservation Act

Indiana enacted the Indiana Nongame and Endangered Species Conservation Act (INESCA) (Indiana Code [IC] 14-22-34 [1973]) in response to the enactment of the federal ESA. INESCA defines endangered species as "any species or subspecies of wildlife whose prospects of survival or recruitment within Indiana are in jeopardy or are likely within the foreseeable future to become so..." (IC 14-22-34 [1973]). Animal species classified as endangered under the federal ESA that occur in Indiana are also considered endangered under INESCA. There is no regulatory distinction between threatened and endangered in Indiana; any species or subspecies considered vulnerable enough to require protection under INESCA is considered endangered.

The Indiana Department of Natural Resources (IDNR) Division of Fish and Wildlife maintains a list of endangered and special concern species (i.e., any species requiring monitoring due to known or suspected limited abundance or distribution or due to a recent change in legal status or required habitat).

Because the Project has the potential to affect species protected under INESCA, this EA addresses effects to state-listed species.

2 PURPOSE AND NEED

2.1 Purpose of the Environmental Assessment

The USFWS' purpose in considering the proposed action is to fulfill our authority under the ESA, Section 10(a)(1)(B). Non-federal applicants, whose otherwise lawful activities may result in take of ESA-listed wildlife, can apply to the USFWS for incidental take authority so that their activities may proceed without potential violations of Section 9 of the ESA.

To carry out these responsibilities, we must comply with a number of environmental laws and regulations, Executive Orders (EO), and agency directives and policies. As the USFWS fulfills these responsibilities and obligations, we will:

- ensure that issuance of the ITP and implementation of the HCP achieve long-term species and ecosystem conservation objectives at ecologically appropriate scales; and
- ensure that the conservation actions approved with issuance of the ITP occur within a spatially explicit Landscape Conservation Design capable of supporting species mitigation projects over the long-term, or for a period commensurate with the nature of the impacts.

2.2 Proposed Action – Issuance of the Permit

The Proposed Action being evaluated by this EA is the request from BRWF to the USFWS for an ITP authorizing take of the federally listed Indiana bat and northern long-eared bat at the Project, including implementation of BRWF's associated HCP. BRWF is seeking a 35-year permit term to implement their HCP. This term coincides with the 35-year operational life of the

Project. If, at the end of the 35-year term of the ITP, BRWF decides to continue to operate the Project, it would apply for a permit amendment or for a permit renewal. The USFWS's Proposed Action is to issue an ITP to BRWF on the conditions predicated in BRWF's proposed HCP. The purpose of issuing an ITP to BRWF is to authorize take of listed species that is incidental to their otherwise lawful activities.

2.3 Need for Proposed Action

Section 10 of the ESA specifically directs the USFWS to issue ITPs to non-federal entities for 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 HCP complies with other applicable federal laws and regulations. We must ensure our permit decision complies with the National Historic Preservation Act of 1966 (16 USC § 470 et. seq. [1966]); treaties; and EO 11998 (1977), EO 11990 (1977), EO 13186 (2001), EO 12630 (1988), and EO 12962 (1995). In addition, the USFWS enforces the BGEPA, the Migratory Bird Treaty Act of 1918, and other requirements of the ESA in addition to Section 10. If we issue an ITP, we may condition the permit to ensure the permittee's compliance with BGEPA, Migratory Bird Treaty Act of 1918, and all ESA requirements.

On June 18, 2020, the USFWS received an application from BRWF for an ITP under the authority of Section 10(a)(1)(B) of the ESA. If the application is approved and the USFWS issues a permit, the ITP would authorize BRWF to take the Indiana bat and northern long-eared bat as a result of their Project operations. The USFWS has prepared this EA to inform the public of our Proposed Action and the effects of the Proposed Action and its alternatives, seek information from the public, and to use information collected and analyzed to make better informed decisions concerning this ITP application.

2.4 Decision to be Made

The USFWS must decide whether to issue or deny the ITP. If the permit issuance criteria contained in Section 10(a)(1)(B) of the ESA are satisfied, the USFWS is required to issue the ITP to the Applicant. The USFWS may decide to issue a permit conditioned on implementation of the HCP as submitted by the Applicant, or to issue a permit conditioned on implementation of the HCP as submitted together with other measures specified by the USFWS. If the ESA's criteria are not satisfied, the USFWS is required to deny the permit request.

The USFWS has analyzed the impacts of the proposed covered activities on all elements of the natural and human environment that could be affected, including other wildlife species that occur within the covered lands. The USFWS has indicated the selected alternative in the FONSI. The USFWS provides a summary of its rationale for issuing the ITP in the BO, which is its findings document on the intra-USFWS Section 7 consultation.

3 ALTERNATIVES

Pursuant to NEPA, federal agencies must consider a range of reasonable alternatives to the Proposed Action when evaluating the effects of their actions (40 CFR 1505.1(e) [1978]). This

section describes the Applicant's Proposed Action and alternatives to that action, including the No-Action Alternative.

The scope of reasonable alternatives is defined by the purpose and need for the action and guided by the goals and objectives of the acting agency. Reasonable alternatives include those that are practical or feasible from both a technical and economic standpoint and using common sense, rather than simply desirable alternatives from the standpoint of the Applicant. Alternatives were developed to address the potential for take of the Covered Species during Project operation and are primarily operational alternatives relating to the dates and times of operation and changes in cut-in speed (i.e., the wind speed at which turbines begin generating power and sending it to the electrical grid).

The Project is a 52-turbine wind energy facility with the potential to harm or kill the Covered Species, thus the necessity for an ITP. Reasonable alternatives were considered in response to the Applicant's request for take of Indiana bats and northern long-eared bats. Alternatives were evaluated for their capacity to meet the USFWS's purpose and need for the federal action. Alternatives are also included that were considered but eliminated from detailed analyses (pursuant to 40 CFR 1502.14(a) [1978]).

The alternatives described below were evaluated based on their capacity to meet stated goals and objectives of the USFWS's action and project intent (described in Section 2.3). The potential effects on the human environment for each of the retained alternatives are described in detail in Section 5 - Environmental Consequences.

3.1 Alternatives Retained for Detailed Analysis

Alternatives vary by operational adjustments and the extent of mitigation for offsetting the unavoidable take of Covered Species. Because operational adjustments are assumed to affect the level of take, they also define the amount of mitigation needed to compensate for the impact of the taking.

3.1.1 Alternative 1: No-Action Alternative

Under the No-Action Alternative, the Project would continue to operate under the requirements of a Technical Assistance Letter from the USFWS,[2] which would result in the risk of take of Indiana bats and northern long-eared bats being so low that obtaining an ITP would be unnecessary. In order to reduce the risk of take of Covered Species, the Technical Assistance Letter would require fully feathering the wind turbines from 0.5 hour before sunset to 0.5 hour after sunrise under the following conditions:

- **Spring Migration (April 1 through May 15).** Turbine blades would be feathered when winds are below 5.0 meters per second (m/s; 11.1 miles per hour [mph]).

[2] The Project is currently operating under the requirements of Technical Assistance Letters issued by the USFWS on September 9, 2020 (covering the fall 2020 migratory season) and March 31, 2021 (covering the spring 2021 migratory season and summer 2021 season), which are included as Attachment D.

- **Summer Maternity (May 16 – July 31).** Turbine blades would be feathered at the 39 turbines within 305 m (1,000 ft) of summer habitat when wind speeds are below 6.9 m/s (15.4 mph); turbine blades would be feathered below the manufacturer's cut-in speed of 3.0 m/s (6.7 mph) at the 13 remaining turbines outside of 305 m of summer habitat.
- **Fall Migration (August 1 – October 15).** All turbine blades would be feathered below a wind speed of 6.9 m/s (15.4 mph).
- **Inactive Season (October 16 – March 31).** All turbine blades would be feathered below 3.0 m/s (6.7 mph), regardless of temperature or distance from suitable habitat.

BRWF would operate under these restrictions, or other operational measures deemed effective, for the life of the Project. BRWF would also implement the BBCS (provided in Appendix A). Because take of Indiana bats and northern long-eared bats is unlikely under these restrictions, BRWF would not obtain an ITP or implement an HCP.

The No-Action Alternative would have an overall neutral effect on both bat species because no take would occur. To verify anticipated avoidance of take, BRWF would conduct post-construction mortality monitoring as specified in the Technical Assistance Letter.

3.1.1.1 No-Action Alternative Summary

The No-Action Alternative meets the USFWS's goals and objectives for protecting and conserving the Indiana bat and northern long-eared bat and its habitats in the context of the Project for the continuing benefit of the people of the United States (U.S.). Under the No-Action Alternative, Project operations are unlikely to pose risks to Indiana bats or northern long-eared bats because the turbines would be fully feathered from 0.5 hour before sunset to 0.5 hour after sunrise at higher than the manufacturer's cut-in speed, or alternate measures deemed as effective during the permit term, over the entire bat active season. The No-Action Alternative would be the alternative implemented if the USFWS denies the Applicant the ITP; however, the No-Action Alternative does not meet the Applicant's purpose and need for providing a source of renewable energy practicably and economically (see Section 7.0 of the Project HCP).

3.1.2 Alternative 2: 5.0 Meters per Second Cut-in Speed (Applicant's Proposed Operation, ITP Issuance, HCP with Minimization and Mitigation Measures)

Under Alternative 2, the Applicant's Proposed Operation, the Service would issue an ITP to authorize incidental take of Indiana bats and northern long-eared bats associated with the Project operation. BRWF would implement an HCP that includes operational measures to reduce take of listed bats, off-site conservation measures to mitigate unavoidable take of Covered Species, post-construction monitoring to measure the effectiveness of operational measures to reduce take, and adaptive management. These measures are described in additional detail in the following sections.

3.1.2.1 Operational Minimization Measures

The Applicant would minimize the take of Covered Species by adjusting turbine operations. For the permit term, the Applicant would implement the following, as described in additional detail in Section 5.2.2 of the HCP:

- **Spring Migration (April 1 through May 15).** The rotation of turbine blades would be minimized (referred to as feathering) when wind speeds are below the manufacturer's default cut-in speed, which is 3.0 m/s (6.7 mph). This minimization measure would be implemented 24 hours per day, regardless of temperature.

- **Summer Maternity (May 16 – July 31).** Turbine blades would be feathered at a subset of 39 turbines from a half hour before sunset to a half hour after sunrise when winds are below 5.0 m/s (11.1 mph) and the ambient temperature is above 10 degrees Celsius (°C; 50 degrees Fahrenheit [°F]). When the 5-minute (min) rolling average temperature drops below 10 °C (50 °F), turbines would operate under normal conditions. At the remaining 13 turbines, blades would be feathered when wind speeds are below 3.0 m/s (6.7 mph).

- **Fall Migration (August 1 – October 15).** All turbine blades would be feathered from a half hour before sunset to a half hour after sunrise when winds are below 5.0 m/s (11.1 mph) and the 5-min rolling ambient temperature is above 10 °C (50 °F).

- **Inactive Season (October 16 – March 31).** All turbine blades would be feathered below 3.0 m/s (6.7 mph), regardless of temperature or distance from suitable habitat.

3.1.2.2 Mitigation

The measures proposed by the Applicant to compensate for incidental take of the Covered Species are described in Section 5.3 of the HCP. Due to similarities between the two Covered Species, the USFWS accepts that any mitigation efforts for Indiana bats may also partially benefit northern long-eared bats. The USFWS also accepts that if habitat is suitable for multiple listed species that are being impacted by a Project, a single mitigation area may be used for those species for that particular project (USFWS 2003).

BRWF would mitigate for the impacts of take of the Covered Species through protections of summer maternity habitat and fall staging/swarming habitat. Specifically, BRWF would permanently protect approximately 39 ha (97 ac) of summer maternity habitat for Indiana bats and northern long-eared bats and approximately 2 ha (5 ac) of staging/swarming habitat for Indiana bats. Summer maternity habitat would be protected at the Bear Lake Property in Martin County, Indiana, where the presence of both Covered Species was confirmed in 2018. Staging/swarming habitat would be protected at the Cunningham Property in Greene County, Indiana, which is located 1.6 kilometers (km; 1.0 mile [mi]) from Ray's Cave (which has been classified as a Priority 1 Indiana bat hibernaculum, USFWS 2007). Additional details pertaining to these properties are described in BRWF's Bat Habitat Mitigation Plan, which is appended to the HCP (see Appendix B of the HCP).

3.1.2.3 Monitoring and Adaptive Management

In addition to 1 year of post-construction monitoring that BRWF would implement as part of its BBCS for the Project (Attachment A), a monitoring program would be implemented as part of the HCP that consists of two components: compliance monitoring to estimate the amount of take of Covered Species and mitigation project effectiveness monitoring. The Applicant has developed an adaptive management plan to ensure that the estimated take of Covered Species at the Project does not exceed the authorized take over the permit term, and that minimization measures are commensurate with the estimated level of take at the Project.

Compliance monitoring would occur during the active bat period (April 1 – October 15) the first 3 years of the permit term, and would be conducted in intervals throughout the remainder of the 35-year permit term (described in additional detail in BRWF 2019). Data collected during compliance monitoring would be used to estimate take of Covered Species. Based on the take estimate derived from compliance monitoring, adaptive management would be used to make modifications to the proposed minimization and mitigation measures if BRWF finds these measures have been ineffective at meeting the biological goals and objectives of the HCP. The Applicant's adaptive management plan includes a framework for both short-term and long-term adaptive management triggers, which are described in detail in Section 5.4.3 of the HCP (BRWF 2019).

The goal of mitigation project effectiveness monitoring is to ensure the success of mitigation efforts at offsetting the impacts of unavoidable take of the Covered Species from the Project. Monitoring would include an assessment of the functionality of the habitat protection measures and the need for any maintenance measures to retain effectiveness of the mitigation project. Additional details of the proposed mitigation monitoring program are provided in Section 5.4.2 of the HCP (BRWF 2019) and Attachment A.

3.1.2.4 Alternative 2 Summary

Within the context of this Project, the Applicant's Proposed Operation meets the USFWS's purpose to ensure ESA compliance for the Project to avoid, minimize, and mitigate take of listed species and legally authorize the incidental take of the Indiana bat and northern long-eared bat consistent with permit issuance criteria (Section 10(a)(1)(B) of the ESA) and associated implementing regulations (50 CFR 17.22(b)(2) [1985] and 17.32(b)(2) [1985]). The Proposed Action's compensation for the unavoidable Project impacts to Covered Species is to be achieved through suitable mitigation that fully offsets the impact of the taking, which is 133 Indiana bats and 58 northern long-eared bats over the 35-year permit term. If the permit issuance criteria contained in Section 10(a)(1)(B) of the ESA are satisfied, the USFWS is required to issue the permit to the Applicant.

The Proposed Action meets the Project's overall purpose, which is to generate energy from a renewable source, in this case wind. The Proposed Action would also minimize impacts to listed species while still generating power that meets the Applicant's Power Purchase Agreement requirements and provides power generation from a non-polluting, renewable energy source. In the absence of an ITP, the Project would be unlawful if take of Indiana bats or northern long-eared bats occurred.

3.1.3 Alternative 3: 6.5 Meters per Second Cut-in Speed (More Restrictive Operations, ITP Issuance, HCP with Minimization and Mitigation Measures)

Under Alternative 3, the Service would issue an ITP to authorize incidental take of Indiana bats and northern long-eared bats associated with more restrictive Project operation than described under Alternative 2, but less restrictive operation than Alternative 1. As with Alternative 2, BRWF would implement an HCP that includes operational measures to reduce take of listed bats, off-site conservation measures to mitigate unavoidable take of Covered Species, post-construction monitoring to measure the effectiveness of operational measures to reduce take, and adaptive management. These measures are described in additional detail in the following sections.

3.1.3.1 Operational Minimization Measures

Under Alternative 3, turbine cut-in speed (the wind speed at which the blades would begin to turn and electricity produced) would be higher than the Applicant's Proposed Operation during the spring and fall migration periods. From April 1 through May 15, and August 1 through October 15, all turbines would be feathered up to wind speeds of 3.5 m/s (7.8 mph) and 6.5 m/s (14.5 mph), respectively, from a half hour before sunset to a half hour after sunrise when the ambient temperature is above 10 °C (50 °F) based on a 5-min rolling average. Additionally, 39 turbines within 305 m (1,000 ft) of summer habitat would be feathered up to 6.5 m/s (14.5 mph) and all remaining turbines would be feathered below the turbine manufacturer's rated cut-in speed of 3.0 m/s (6.7 mph) during the period from May 16 through July 31, further minimizing collision risks for bats.

3.1.3.2 Mitigation

Under Alternative 3 (more restrictive operations), the Applicant would implement off-site mitigation measures to offset the impact of the taking of the Covered Species. The type of mitigation under this alternative would be the same as that described for Alternative 2 (in Section 3.1.2.2) and in Section 5.3 of the HCP (BRWF 2019). However, less mitigation would be needed due to the estimated decrease in the impact of take when operating at a higher cut-in speed.

3.1.3.3 Monitoring and Adaptive Management

Under Alternative 3, the Applicant would implement the Project-specific BBCS (Attachment A) and conduct monitoring as described for Alternative 2 (see Section 3.1.2.3, above; also described in detail in BRWF 2019). Monitoring results may trigger similar adaptive management measures as described for Alternative 2 (see Section 3.1.2.3, above), which are also described in Section 5.4.3 of the HCP (BRWF 2019).

3.1.3.4 Alternative 3 Summary

Within the context of this Project, Alternative 3 meets the USFWS's purpose to ensure ESA compliance for the Project to avoid, minimize, and mitigate take of listed species and legally authorize the incidental take of the Indiana bat and northern long-eared bat consistent with the permit issuance criteria (Section 10(a)(1)(B) of the ESA) and associated implementing regulations (50 CFR 17.22(b)(2) [1985] and 17.32(b)(2) [1985]). Alternative 3's compensation

for the unavoidable Project impacts to Covered Species would be achieved through suitable mitigation that offsets the impact of the taking. However, Alternative 3 does not meet the Applicant's purpose and need for providing a source of renewable energy practicably and economically.

3.2 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 [1978]). Early discourse between the USFWS and the Applicant on potential minimization and mitigation measures identified 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 USFWS or Applicant. Other alternatives could not be legally undertaken, or were found to be lacking in sufficient protection for the Covered Species or other wildlife resources, or included conservation measures that were not practicable given the magnitude of potential effects. Alternatives considered but eventually dismissed from detailed analysis include: Project shut-down at night during the active bat period (April 1 – October 15); lower than proposed cut-in speed during summer (May 16 – July 31) and fall migration (August 1 – October 15) seasons; and fully feathering turbines at wind speeds below 6.9 m/s (15.4 mph) during the migration seasons (April 1 – May 15, and August 1 – October 15), and from May 16 – July 31 at the 39 turbines determined to pose a risk to Indiana bats during the summer maternity season. However, because night-time shut-down would be more onerous than long-term operation under an avoidance strategy and because none of these alternatives would meet the purpose of maximizing energy production while also minimizing take of the Covered Species to the maximum extent practicable, they were eliminated from consideration.

4 AFFECTED ENVIRONMENT

The affected environment is the area and its resources (i.e., biological, physical, socioeconomic) potentially impacted by the Proposed Action and alternatives. Relative to the BRWF, the affected environment includes those settings where take of the Covered Species is expected to occur and be authorized by the ITP and where mitigation to offset the impacts of the take would occur. This is the Plan Area, which includes: 1) the portion of the Bitter Ridge Wind Farm where 52 turbines would operate and mortality monitoring would occur; and 2) the two proposed mitigation sites, which would protect staging/swarming habitat for Indiana bats and summer maternity habitat for Indiana bats and northern long-eared bats. Because Project-related activity associated with the mitigation projects would largely be limited to the preservation of existing forested habitat, discussion of the Plan Area in this section is focused on the portion of the Bitter Ridge Wind Farm where wind turbines will operate.

Our detailed analysis is confined to the biological environment (vegetation, wildlife, avian, and bats), physical environment (air quality and climate, noise), and socioeconomic environment. Project operations are unlikely to have significant effects to geology and soils, surface and ground water, environmental justice, land use, visual resources, cultural resources, transportation, or communications; therefore, our review does not include detailed analyses of these resources.

4.1 Overview of the Plan Area

The Project is located in Jay County in east-central Indiana just outside of the city of Redkey (Figure 1-1). The Permit Area for the Project totals 8,972 ha (22,170 ac) and consists of the area in which turbines, the underground collection system, substation/switchyard, O&M facilities, permanent MET tower, access roads, generator lead line, and collection lines are located. The Plan Area also includes the proposed mitigation sites, including 39 ha (97 ac) of summer maternity habitat for the Indiana bat and northern long-eared bat in Martin County and 2 ha (5 ac) of staging/swarming habitat for Indiana bats in Greene County, Indiana.

The Permit Area is located within the Eastern Corn Belt Plains ecological region, which generally consists of rolling glacial till plain with local end moraines (U.S. Environmental Protection Agency [USEPA] 2017). The setting primarily includes agricultural lands (Figure 4-1) that are farmed for corn (*Zea mays*) and soybean (*Glycine max*), and total approximately 7,365 ha (18,200 ac) of land within the Permit Area (U.S. Geological Survey National Land Cover Database 2011, Homer et al. 2015). State Route 1 runs north-south through the western portion of the Permit Area and State Route 67 runs northeast-southwest through the western portion of the Permit Area. Developed areas total 1,164 ac (471 ha) of the Permit Area and are generally confined to residences and farms.

Water sources in the Permit Area include Brook's Creek in the north and tributaries of the Mississinewa River in the south (Figure 4-1). There also are several unnamed streams and a few farm ponds in the Permit Area. Approximately 20 ha (49 ac) of open water and 10 ha (26 ac) of wetlands occur in the Permit Area. Forested habitat within the Permit Area is primarily limited to approximately 718 ha (1,775 ac) of deciduous forest, although small areas of evergreen forest are also present (Figure 4-1).

4.2 Biological Environment

4.2.1 Vegetation

Vegetation resources include all plants, including rare, threatened, and endangered plants. As described above, the majority of the Permit Area (82%) is cultivated cropland. In addition, vegetation classifications within the Permit Area include deciduous forest (8%); hay/pasture (4%); and small areas of evergreen forest, shrub/scrub, and wetlands totaling less than 1% of the Permit Area.

A review of our Information for Planning and Consultation (IPaC) database indicated that no federally listed rare, threatened, or endangered plants or designated critical habitat occur in the Plan Area (USFWS 2019b). Based on current information from the Indiana Natural Heritage Data Center, there are a total of 16 state-listed plants that are known or have the potential to occur in Jay County (three species), Martin (eight species), and/or Greene County (seven species); two species occur in two counties (IDNR 2019b, 2019c, 2019d). Based on a request for site-specific review of the Plan Area, the IDNR did not identify any rare, threatened, or endangered plants species as occurring or likely to occur in the Permit Area (Teresa Clark, IDNR, Indiana Natural Heritage Data Center, pers. comm. October 26, 2017).

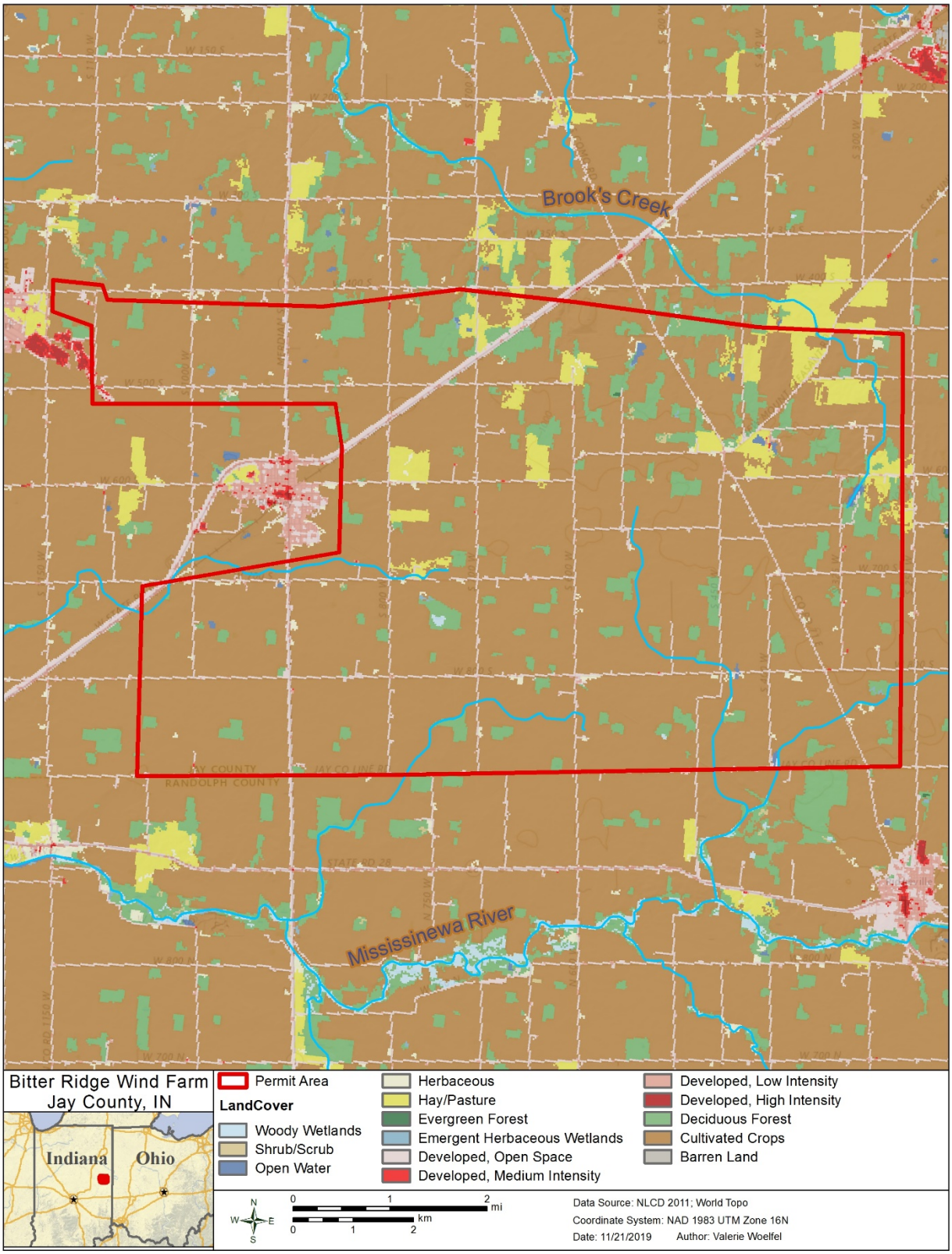

Figure 4-1. Land cover of the Bitter Ridge Wind Farm and vicinity.

4.2.2 Wildlife

4.2.2.1 Non-flying Wildlife Resources

This section describes non-flying terrestrial and aquatic wildlife within the Permit Area, which includes general wildlife, as well as rare, threatened, and endangered terrestrial and aquatic animals. Avian and bat species are addressed in Sections 4.2.2.2 and 4.2.2.3, respectively.

Habitat Conditions for General Wildlife

The majority of the habitat within the Permit Area consists of agricultural lands (82%). Smaller areas of deciduous forest habitat (8%), developed open space (primarily residences, farms, and roads; 5%), and hay/pasture (4%) are scattered throughout the Permit Area. As a result of the habitat present, terrestrial wildlife predominantly associated with the Project are generalist species that are adapted to living in agricultural environments. Common mammal species that may be present include coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), squirrels (*Sciurus* spp.), eastern cottontail (*Sylvilagus floridanus*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), and several shrew species (*Blarina brevicauda*, *Cryptotis parva*, and *Sorex* spp.).

Limited habitat for aquatic and wetland species exists, and cumulatively makes up less than 1% of the Permit Area. Streams, wetlands, and drainages, although limited in the Permit Area, may be used by amphibians such as American toad (*Anaxyrus americanus*) and Fowler's toad (*Bufo woodhousii fowleri*), and reptiles such as common snapping turtle (*Chelydra serpentine serpentina*), midland painted turtle (*Chrysemys picta marginata*), and garter snake (*Thamnophis sirtalis*).

There are no federal nature preserves or fish and wildlife areas in Jay County (U.S. Geological Survey Gap Analysis Project 2018). The closest IDNR-protected area is the Bell-Croft Woods Nature Preserve located 2.3 km (1.4 mi) north of the Permit Area.

Rare, Threatened, and Endangered Non-flying Wildlife

Federally listed species are afforded protection under the ESA. In Indiana, state-listed species are afforded protection under INESCA (IC 14-22-34 [1973]; see Section1.2). Based on information from IDNR's Heritage Database, our IPaC database, agency correspondence received for the Project, and site-specific surveys completed for the Project, no state or federally listed non-flying terrestrial mammals, reptiles, or amphibians are known to occur in the Plan Area.

4.2.2.2 Avian Resources

Passerines and Waterbirds/Waterfowl

Birds rarely use cultivated agricultural lands as nesting habitat, although certain disturbance-tolerant species (e.g., blackbird, horned lark [*Eremophila alpestris*], and Canada goose [*Branta canadensis*]), are known to forage in croplands. Native habitat for birds within the Permit Area

consists primarily of scattered areas of deciduous forest and pasture, as well as small amounts of riparian habitat and farm ponds. However, these habitats are fragmented and contain a high percentage of edge habitat, which may increase the incidence of nest predation and parasitism. Use of these habitats are likely to be higher during migration periods, because fragmented habitat often serves as stopover habitat for migrating passerines and waterbirds/waterfowl (Wallheimer 2009). Topographic or major riparian features that would increase the potential for high concentrations of migrating birds to utilize the Permit Area are not present.

Eagles

No large bodies of water or large, mature forests are present within the Permit Area that would provide ideal foraging or nesting habitat for bald eagle. Eagles are more likely to nest, forage, and winter outside of the Permit Area along forested corridors of large rivers, such as the Salamonie River (located north of the Project), Mississinewa River (located south of the Project), and White River (located south of the Project) all of which are large tributaries to the Wabash River. A total of four active bald eagle nests were documented within 16 km (10 mi) of the Project in 2019, all of which were along these rivers (Brown and Conway 2019, which is appended to Attachment A [within the BBCS, see Appendix D – Bitter Ridge Wind Farm 2019 Raptor Nest Survey Report]). The closest bald eagle nest to the Project was 10.3 km (6.4 mi) southwest of the Project along the Mississinewa River. Bald eagles could potentially nest and forage along the smaller tributaries of these waterways located within and near the Project; however, this potential is considered low based on the absence of suitable nesting habitat and the limited number of bald eagle observations recorded at the Project over a 2-year study (three bald eagle observations; Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]).

The Project is located outside of the breeding range of the golden eagle (Brock 2006), and there are no records of nesting golden eagles in Indiana. Due to the known range of the golden eagle, the preferred nesting habitats, and the lack of golden eagle observations near the Project and within the state of Indiana, the golden eagle is unlikely to occur within the Permit Area.

Other Raptors

Nesting habitat for other raptors (including falcons and hawks) is limited within the Permit Area due to the predominance of cultivated agricultural lands. Suitable nesting habitat for most raptors at the Project consists of deciduous forest, which is limited to 8% of the Permit Area; because forested habitat is largely composed of smaller forested stands that are scattered throughout the Project, it is suitable for edge-tolerant raptor species (e.g., red-tailed hawk [*Buteo jamaicensis*]). This is consistent with the results of raptor nest surveys at the Project, which identified two occupied red-tailed hawk nests and six inactive raptor nests in 2019 (Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]). Foraging habitat within upland areas of the Project is available to raptors, and agricultural lands may contain a high prey density, especially immediately following crop harvesting activities, because mice and other small rodents and mammals may be attracted to forage on leftover grains. Raptor use and migration through the Permit Area is not expected to be heavily influenced by topography due to the lack of major ridgelines, rivers, or other features that can concentrate raptor movements.

Rare, Threatened, and Endangered Birds

Based on current information from our IPaC database, IDNR's Heritage Database, agency correspondence received for the Project, and site-specific surveys completed for the Project, no federally listed bird species are known to occur in or migrate through the Permit Area, and one federally listed endangered species (least tern, *Sterna antillarum*) has potential to occur in Greene County. One state-endangered species (northern harrier [*Circus hudsonius*]) and six state species of special concern (bald eagle, broad-winged hawk [*Buteo platypterus*], great egret [*Ardea alba*], northern bobwhite [*Colinus virginianus*], osprey [*Pandion haliaetus*], and sandhill crane [*Antigone canadensis*]) have been observed at the Project (Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]). In addition, the state-endangered American bittern (*Botaurus lentiginosus*), sedge wren (*Cistothorus platensis*), least bittern (*Ixobrychus exilis*), black-crowned night-heron (*Nycticorax nycticorax*), and barn owl (*Tyto alba*) are known to occur in Jay County (IDNR 2019c), although these species were not observed at the Project during surveys (Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]).

4.2.2.3 Bat Resources

Thirteen bat species are known to occur in Indiana (IDNR 2019a), 10 of which have geographic ranges that overlap with Jay County (Table 4-1). All of the bat species that could occur in Jay County utilize woodland habitats for feeding or roosting during some time of the year and are insectivorous (prey on insects). Additionally, many of these species forage along stream corridors or over water. The Project is not located within a karst region of Indiana, and there are no known bat hibernacula in Jay County.

Habitat Conditions for General Bats

<u>Roosting and Foraging</u>

When not hibernating, bats in the region roost in a variety of habitats including tree crevices or cavities, underneath loose tree bark, and sometimes in buildings or other structures. The farmsteads and outbuildings scattered across the Permit Area amongst the developed open space (approximately 5% of the Permit Area) provide potential roosting opportunities for species that may roost in anthropogenic structures in the region (Table 4-1). Deciduous forest habitat (8%) for tree roosting species (Table 4-1) is also scattered throughout the Permit Area, occurring as small woodlots, riparian corridors, and shelterbelts. A few small areas of woody wetlands (<1%) and evergreen forest (<1%) also occur within the Permit Area.

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; however, information on bat use of agricultural areas, which encompasses the majority of the Permit Area, is limited for the Midwest.

Table 4-1. Status and typical summer and winter habitats of bat species potentially occurring in Jay County, Indiana.

Common Name	Scientific Name	Status[1, 2]	Typical Summer Habitat	Typical Winter Habitat
Big brown bat	*Eptesicus fuscus*	No listing status	Roosts within tree cavities, buildings, and man-made roost structures (bat boxes); a generalist that forages in farm land on agricultural pests, urban areas, and edge habitat near water	Short-distance migrant; hibernates in caves, mines (preferably large with good airflow), and buildings
Eastern red bat	*Lasiurus borealis*	SSC	Roosts in dense foliage, and prefers mature stands near edges and water sources; thought to forage for insects around light sources	Long-distance migrant; tree-roosting
Eastern small-footed bat	*Myotis leibii*	SE, SSC	Roosts in buildings, bridges, caves, mines, hollow trees, tunnels, rock crevices, beneath rocks, and in rocky outcrops; often forages over water or dense forests	Short-distance migrant; often hibernates at the mouth of caves on the floor, or within cracks or crevices
Evening bat	*Nycticeius humeralis*	SE	Roosts in snags and mature trees within tree hollows or under loose bark, buildings; forages along edges of mature forests, in clearings, and over waterways	Probable long-distance migrant
Hoary bat	*Lasiurus cinereus*	SSC	Roosts solitarily, usually in tree foliage with dense leaf coverage above an open area below; forage above tree tops, along streams and lake shores, and in urban areas with many trees	Long-distance migrant; tree-roosting
Indiana bat	*Myotis sodalis*	FE, SE	Roosts and forages in wooded stream corridors and bottomland and upland forests and woods	Short-distance migrant; hibernates in caves and mines, swarming in surrounding wooded areas
Little brown bat	*Myotis lucifugus*	SSC	Roosts in buildings, trees, under rocks, and piles of wood; forages in forests near water	Short-distance migrant; hibernates in caves and mines
Northern long-eared bat	*Myotis septentrionalis*	FT, SSC	Roosts within cavities and under bark in snags and live trees; forages within upland forests and woods	Short-distance migrant; hibernates in caves and mines, swarming in surrounding wooded areas in autumn
Silver-haired bat	*Lasionycteris noctivagans*	SSC	Roosts under loose bark, willows (*Salix* spp.), maple (*Acer* spp.), and ash (*Fraxinus* spp.); forages in mature, coniferous, or deciduous forests near water	Long-distance migrant; hibernates in caves and rocky areas with shelter, tree cavities, and buildings

Table 4-1. Status and typical summer and winter habitats of bat species potentially occurring in Jay County, Indiana.

Common Name	Scientific Name	Status[1, 2]	Typical Summer Habitat	Typical Winter Habitat
Tri-colored bat	*Perimyotis subflavus*	SSC	Roosts in rock crevices, caves, buildings, and tree foliage; forages in open woods near the edges of water, as well as over water; not usually found in open fields or deep forests	Short-distance migrant; hibernates in caves, mines, and deep crevices

[1] FE – federally endangered; FT – federally threatened; SE – state endangered; SSC – state species of special concern

[2] Sources: Brigham 1991; Whitaker 1995; Jung et al. 1999; Myers and Hatchett 2000; Agosta 2002; Anderson 2002, Cryan 2003; Hamlin 2004; Broders et al. 2006, Havens 2006; Limpert et al. 2007, USFWS 2016a, 2017b; Bentley 2017; Wisconsin Department of Natural Resources 2017a; Texas Parks and Wildlife Department (no date).

Hibernation and Seasonal Migration

The bats that potentially occur in Jay County (Table 4-1) include both short-distance migrants that hibernate colonially within the region in winter (typically in caves or mines) and long-distance migrants that migrate out of the region in winter. Activity of most bat species is dramatically reduced, or absent from the landscape in the region of the Permit Area between November and March, and bats either emerge from hibernacula or migrate back to the region in spring (April and May). There are no known hibernacula within the Permit Area, though some species in the region (e.g., big brown bat [*Eptesicus fuscus*] and little brown bat [*Myotis lucifugus*]), may hibernate in buildings or other anthropogenic structures. Farmsteads and agricultural outbuildings located throughout the Permit Area and adjacent areas may provide possible overwintering habitat for these species.

Little is known about the migratory behavior of bats. Cave-hibernating bats disperse up to several hundred miles from hibernacula during summer, with females often dispersing further from hibernacula than males (Fleming and Eby 2003). Seasonal timing and species composition of bat mortality at wind farms 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. 2007a, 2007b). Due to the Permit Area being located within the ranges of the 10 bat species (Table 4-1) and the species' characteristic dispersal and transitory patterns, it is likely that common tree- and cave-roosting bat species pass through the Permit Area during spring and fall migration periods.

Rare, Threatened, and Endangered Bats

Indiana Bat

This section provides a brief description of Indiana bat, including a summary of its status, biology, behavior, and habitat requirements relevant to this EA and its analysis. For a more detailed description of the species, please refer to Section 3.2.1 of the HCP (BRWF 2019) and the *Indiana Bat (*Myotis sodalis*) Draft Recovery Plan* (Recovery Plan) (USFWS 2007).

Status

The USFWS originally listed the Indiana bat as in danger of extinction under the Endangered Species Preservation Act of 1966 (USFWS 1967) (32 FR 4001 [March 11, 1967]). The species remains listed as endangered under the ESA, as amended, and is listed also as state endangered in Indiana.

The estimated range-wide Indiana bat population for 2019 was 537,297 bats based on data for 223 hibernacula in 16 states (USFWS 2019a). This represents a 19.2% decline in the range-wide population of Indiana bat since 2007, when white-nose syndrome (WNS)[3] was first documented. The Project is located within the Midwest Recovery Unit (MRU) (USFWS 2007), which accounts for 45.7% of the 2019 Indiana bat range-wide population (USFWS 2019a). WNS was first documented in the MRU during the winter of 2008–2009 and was confirmed in Indiana in January 2011. Approximately 34% of the Indiana bat range-wide population (or 75% of the MRU population, Table 4-2) hibernates in Indiana (USFWS 2019a). In 2019, the Indiana bat population in Indiana was estimated as 184,611 bats, which represents a 2.3% increase since 2017 (USFWS 2019a). Despite the recent increase in population size, Indiana represents the state with the largest net loss of Indiana bats since 2007, with a decline of approximately 53,220 individual bats, or approximately 22% of the state population.

Table 4-2. Indiana Bat (*Myotis sodalis*) population estimates for the Midwest Recovery Unit.[1]

State	2011	2013	2015	2017	2019	% Change from 2017
Indiana	225,477	226,572	185,720	180,611	184,848	2.3%
Kentucky	70,626	62,018	64,599	58,057	55,946	-3.6%
Ohio	9,870	9,259	4,809	2,890	2,890	0.0%
Tennessee	1,791	2,369	2,401	1,587	1,561	-1.6%
Alabama	261	247	90	85	90	5.9%
Southwest Virginia	307	214	137	70	119	70.0%
Michigan	20	20	20	20	20	0.0%
Georgia	0	0	0	1	0	-
Total	**308,352**	**300,699**	**257,776**	**243,321**	**245,474**	**0.9%**

1. Estimates are based on winter surveys conducted in January and February of 2019 at known Priority 1 and 2 hibernacula throughout the species' range. Additional data from Priority 3 and 4 hibernacula were included when available.

Source: USFWS 2019a

A total of 37 Indiana bat hibernacula have been identified in Indiana, and of these, 34 have extant winter populations (USFWS 2007). Indiana contains four of the 10 largest hibernacula that have been documented to date; these hibernacula are primarily located in the southern part

3 WNS is a fungal (*Pseudogymnoascus destructans*) infection that causes bats to rouse more frequently during hibernation, which may lead to death as a result of the depletion of fat reserves needed to survive the hibernation period (Reeder et al. 2012). WNS was first discovered in eastern New York during the winter of 2006-2007 and has rapidly spread to 33 U.S. states and seven Canadian provinces as of the 2018-2019 winter survey season (White-nose Syndrome Response Team 2019). For additional information, visit https://www.whitenosesyndrome.org/.

of the state, and cumulatively represent approximately 33% of the range-wide population (USFWS 2019a).

The closest known Indiana bat hibernaculum to the Project is the Lewisburg Limestone Mine, which is designated as a Priority 2 hibernaculum in Preble County, Ohio, which is approximately 38 km (24 mi) southeast of the Project (USFWS 2007).

Hibernation and Seasonal Migration

Indiana bats typically begin fall migration during the first two weeks of August, and most bats leave their summer ranges by mid-September. The species is highly mobile during the fall, and congregates near hibernacula between August and October to swarm on a nightly basis. Although swarming occurs near cave entrances, the bats roost in trees during the day rather than in caves, and may travel long distances away from the hibernaculum, occasionally moving between hibernacula (USFWS 2007). The bats mate near the end of the swarming period. Females enter hibernation soon after mating and males typically remain active until later in the fall.

Indiana bats typically begin hibernation between mid-October and mid-November. Spring emergence varies with latitude and weather conditions. After emerging from hibernacula by late April, Indiana bats travel up to several hundred miles to their summer range, with females typically traveling greater distances than males (USFWS 2007, 2015a). Behavior and habitat needs of Indiana bats during spring migration are poorly understood, although they appear to move quickly to summer ranges.

Summer Habitat Requirements

Indiana bats roost primarily in trees during the summer, usually under exfoliating bark or narrow crevices and cracks in trees located in semi-open areas of forest with higher amounts of sun exposure (USFWS 2007). Maternity colonies focus on a small number of primary roosts, but may utilize up to 10 to 20 trees throughout the summer (USFWS 2007).

Indiana bats are nocturnal insectivores that feed exclusively on flying insects. The bats typically forage from 2 to 30 m (6 to 100 ft) above the ground and hunt primarily around, not within, the canopy of trees (Humphrey et al. 1977, USFWS 2007). Indiana bats preferentially forage in wooded areas including closed to semi-open forests and forest edges, though forest type varies among studies. Foraging habitat studies indicate floodplain forest is the most preferred habitat, followed by ponds, old fields, row crops, upland woods, and pastures (USFWS 2007).

Telemetry studies have documented nightly foraging distances for female Indiana bats from 0.5 to 9.3 km (0.3 to 5.8 mi) from roosts, with mean distances from 2.6 to 4.8 km (1.6 to 3.0 mi) (Murray and Kurta 2004, Sparks et al. 2005, USFWS 2007, Womack et al. 2013). The size of foraging areas likely depends on extent of suitable habitat, interspecific competition, and prey availability. Rather than crossing large areas of unsuitable habitat, Indiana bats tend to follow corridors of suitable habitat, even if it results in flying greater distances (USFWS 2007).

Northern Long-Eared Bat

This section provides a brief description of the northern long-eared bat, including a summary of its status, biology, behavior, and habitat requirements relevant to this EA and its analysis. For a more detailed description of the species, please refer to Section 3.3 of the HCP (BRWF 2019) and the final rule for listing northern long-eared bat (USFWS 2015b), final 4(d) rule (USFWS 2016a), and programmatic Biological Opinion (USFWS 2016b).

Status

The USFWS listed the species as threatened on April 2, 2015, due to the severe and ongoing decline of the species as a result of WNS (USFWS 2015b). On January 14, 2016, USFWS published a final 4(d) rule that removes or exempts prohibitions for incidental take of northern long-eared bat, including take resulting from operating wind turbines and the permanent conversion of forested lands to other uses (e.g., creation or expansion of rights-of-way and urban development) (USFWS 2016a).

The northern long-eared bat is a relatively wide-ranging bat, but appears to be unevenly distributed and is found in low numbers in both roosts and hibernacula (Amelon and Burhans 2006, Alberta Sustainable Resource Development and Alberta Conservation Association 2009). The USFWS categorizes the U.S. range of the species into four parts: eastern, midwestern, southern, and western populations (USFWS 2015b). The northern long-eared bat has been noted typically in small numbers within numerous hibernacula across its range, and insufficient data are available at this time to reliably estimate a range-wide population. However, the USFWS has calculated a rough estimate of the population size with limitations, as many of the data are from sampling efforts that occurred prior to WNS. In the Biological Opinion for the 4(d) rule (USFWS 2016b), the USFWS estimated there were 127,842 northern long-eared bats in Indiana and roughly 2.8 million in the Midwest region.

Hibernation and Seasonal Migration

Depending on the geographic area, the northern long-eared bat occupies summer habitats from approximately March through August and begins to swarm near their hibernacula in August or September. At Copperhead Cave in Indiana, Whitaker and Mumford (2009) observed the majority of bats enter hibernation during October and emerge between the second week of March and mid-April. Hibernation periods farther north may begin earlier and end later. The northern long-eared bat shares hibernacula with other bat species (Whitaker and Mumford 2009), but concentrations within these hibernaculum are usually low, consisting of less than 100 individuals. Individuals also may rouse and switch hibernacula throughout the winter, which makes it difficult to accurately estimate winter population numbers (Caceres and Barclay 2000).

Summer Roosting Habitat Requirements and Roosting Behavior

During the summer, the northern long-eared bat inhabits forested habitats where it roosts singly or in colonies in the cracks, crevices, and bark of both live and dead trees; this species has also been found roosting in structures (e.g., buildings, barns, sheds, and cabins). Foster and Kurta (1999) have indicated that northern long-eared bats do not depend on any particular species of tree for roosting, but tree characteristics, such as structure and decay, are important.

Northern long-eared bats have been found roosting below the canopy in forests with a variety of canopy cover percentages, but Perry and Thill (2007) found relatively open forests in Arkansas to be more important for female roosts as compared to male roosts.

Northern long-eared bats forage on a variety of insects, most commonly moths, beetles, and spiders. The species forages and commutes primarily in forested interiors (Jung et al. 1999, Broders et al. 2006), but show preference for forested hillsides and ridges, as opposed to riparian areas (Wisconsin Department of Natural Resources 2017b). Caceres and Pybus (1997) suggested that mature forests are important foraging habitat for northern long-eared bats. Recent capture efforts have also found northern long-eared bats in young stands and disturbed forests (Foster and Kurta 1999, Cryan et al. 2001, Henderson and Broders 2008, Henderson et al. 2008, Alberta Sustainable Resource Development and Alberta Conservation Association 2009).

Existing Conditions in the Permit Area

Bat species that are known or have the potential to occur in the Permit Area use various forested and open habitats, including riparian corridors and areas located near waterbodies. All bat species that could occur in the Permit Area use woodland habitats for feeding and/or roosting at some point during the year. Potentially suitable habitat for bats within the Permit Area is primarily associated with deciduous forest, which composes approximately 8% of the Permit Area; in addition, habitat potentially utilized by bats within the Permit Area includes developed open spaces and water sources (e.g., Brook's Creek, tributaries of the Mississinewa River, unnamed streams, and farm ponds).

<u>Bat Acoustic Survey</u>

The first bat acoustic survey was conducted in the Permit Area and surrounding vicinity from July 14 to 23, 2017, to assess the presence or probable absence of Indiana bats and northern long-eared bats during the summer season (Brown and Bishop-Boros 2018, which is appended to Attachment A [within the BBCS, see Appendix F – Bitter Ridge Wind Farm Bat Summer Presence/Absence Survey]). Acoustic detectors were deployed at 34 locations across 17 sites for two to three suitable nights per location. Surveys followed the USFWS *Range-Wide Indiana Bat Summer Survey Guidelines* (Summer Survey Guidelines) (USFWS 2017a). Data was collected for a total of 81 detector-nights, of which 78 detector-nights met the criteria laid out in the Summer Survey Guidelines. Acoustic review by bat call experts indicated probable presence of Indiana bats at seven detector locations, across 5 of the 17 survey sites. No northern long-eared bat calls were identified, indicating probable absence of the species in the Permit Area.

The second bat acoustic survey was conducted in the Permit Area from July 18 to November 1, 2017, and from March 22 to May 14, 2018, to assess general levels of bat activity. Detectors were placed at two MET towers in the Permit Area (Brown and Matteson 2018, which is appended to Attachment A [within the BBCS, see Appendix E – Bitter Ridge Wind Farm Bat Acoustic Survey]). At one MET tower, two detectors were paired, with one detector being placed near the ground (approximately 3.0 m [9.8 ft] above ground level) and the other placed within the rotor-swept zone (approximately 45–50 m [147–164 ft] above ground level). At the second MET tower, one detector was placed near the ground (approximately 3.0 m [9.8 ft] above ground

level). Detectors were programmed to record activity from approximately 30 min before sunset to 30 min after sunrise.

The bat acoustic detectors recorded 3,479 bat passes on 454 detector nights for a mean (± standard error) of 7.50 ± 0.58 bat passes per detector-night. The two ground-level detectors recorded 3,027 bat passes on 316 detector-nights for a mean of 9.61 ± 0.88. The raised detector recorded 452 bat passes on 138 detector nights for a mean of 3.28 ± 0.36. At ground stations, approximately 78% of bat passes were classified as low frequency (LF) and approximately 22% were classified as high frequency (HF).[4] At the raised station, approximately 90% of bat passes were classified as LF and approximately 10% of bat passes were classified as HF. Overall bat activity was highest during the fall migration period (July 30 through October 14; 9.50 ± 0.64) and lowest during the spring (Mar 22 through May 14; 0.51 ± 0.10), though the peak of weekly activity occurred from July 18 to 22, immediately before the fall migration period. Patterns in bat activity were similar between the ground detectors and raised detector.

Bat activity recorded at the Project during the second bat acoustic survey was within the range of pre-construction bat activity recorded at other wind facilities in the Midwest, which range from 1.9 to 35.7 bat passes per detector-night. *Myotis* species are recorded less commonly than other species in the rotor-swept zone and as fatalities at most post-construction studies of wind energy facilities (Kunz et al. 2007b, Arnett et al. 2008), with a few notable exceptions (Kerns and Kerlinger 2004, Jain 2005, Brown and Hamilton 2006, Gruver et al. 2009). In total, 79.3% of bat passes recorded in the Project during the second acoustic survey were emitted by LF bats, suggesting higher relative activity of species such as big brown bats, silver-haired bats, and hoary bats. Given that hoary bats and silver-haired bats are among the most common bat fatalities at many facilities (Arnett et al. 2008, Arnett and Baerwald 2013), it is expected that these species would be the most common fatalities at the Project.

Mist-netting and Radio-telemetry Surveys

Mist-netting and radio-telemetry surveys were conducted within the Permit Area at the five sites where acoustic analysis indicated probable Indiana bat presence during the first round of bat acoustic surveys (Brown and Bishop-Boros 2018, which is appended to Attachment A [within the BBCS, see Appendix F – Bitter Ridge Wind Farm Bat Summer Presence/Absence Survey]). Mist-netting was conducted between August 1 – 9, 2017 within suitable forested habitat following the USFWS guidelines outlined in the *Indiana Bat Mist-Netting Guidelines* (Appendix 5 of the Recovery Plan; USFWS 2007).

A total of 14 bats were captured at the five sites, including eight big brown bats, four eastern red bats (*Lasiurus borealis*), and two Indiana bats. One captured Indiana bat was a juvenile female and the other was a non-reproductive adult male. No northern long-eared bats were captured. The

[4] LF – Low-frequency bats typically emit echolocation calls with minimum frequencies equal to or below 30 kilohertz, and include silver-haired bat (*Lasionycteris noctivagans*), big brown bat, Rafinesque's big-eared bat (*Corynorhinus rafinesquii*), and hoary bat (*Lasiurus cinereus*).
HF – High-frequency bats typically emit echolocation calls with minimum frequencies greater than 30 kilohertz, and include little brown bat, northern long-eared bat, Indiana bat, eastern small-footed bat (*Myotis leibii*), tri-colored bat (*Perimyotis subflavus*), eastern red bat, and evening bat (*Nycticeius humeralis*).

juvenile female Indiana bat was radio-tracked for seven days, from August 5 – 11, 2017, to determine where daytime roosts were located and to assess if maternity colonies were present. Two roost sites were identified. One roost site was a dead white ash (*Fraxinus americana*) in an isolated forest patch approximately 0.62 km (0.39 mi) southeast of the capture site; the juvenile bat utilized this roost for four days. Emergence counts at this roost included five bats, which were recorded on two separate nights. The second roost identified was a dead cottonwood (*Populus deltoides*) in a larger forest patch approximately 1.7 km (1.1 mi) northwest of the capture site. This roost was utilized for one day and only the tracked individual was recorded during the emergence count.

Spatial Analysis and Habitat Assessment

Based on the results of the 2017 presence/probable absence surveys, Indiana bats occur within the Permit Area during the summer season. Land cover and analysis of potential summer habitat within the Permit Area, as conducted by the USFWS (personal communication from Marissa Reed, April 23, 2018), indicate that potential summer roosts for the Indiana bat could be found within 305 m (1,000 ft) of up to 39 of the 52 turbine locations. Because the Permit Area is within the overall range of Indiana bats, individuals could also pass through the Project during the spring and fall migration periods; therefore, Indiana bats are anticipated to be present April 1 through October 15.

Results from acoustic monitoring and mist-net captures did not confirm the presence of northern long-eared bats during the summer season (Brown and Bishop-Boros 2018, which is appended to Attachment A [within the BBCS, see Appendix F – Bitter Ridge Wind Farm Bat Summer Presence/Absence Survey]), indicating probable absence of northern long-eared bats at the Project during the summer. However, because the Permit Area is within the overall range of northern long-eared bats, individuals could pass through the area during the spring and fall migration periods. Therefore, northern long-eared bats may be present from April 1 through May 14, and from August 1 through October 15.

4.3 Physical Environment

4.3.1 Air Quality and Climate

The Clean Air Act of 1970 (CAA) (42 USC § 7401 et seq. [1970]) is a comprehensive federal law that regulates air emissions from stationary and mobile sources. The CAA authorizes the USEPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare, and to regulate emissions of six hazardous air pollutants (i.e., carbon monoxide, particulate matter, lead, nitrogen dioxide, ozone, and sulfur dioxide). However, it is the responsibility of each state to develop and implement a plan for maintaining and enforcing the USEPA's established NAAQS.

We utilized data from the Indiana Department of Environmental Management (IDEM) air quality website (IDEM 2019a, 2019b, 2019c, 2019d) to assess existing air quality conditions in the vicinity of the Project. The Permit Area is currently in compliance with each of the NAAQS; the nearest non-attainment area to the Project is approximately 24 km (15 mi) southwest of the Permit Area in Delaware County, which currently exceeds the 2008 Lead Standard (IDEM 2019a).

4.3.2 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 (e.g., type of noise, its perceived importance, the time of day during which the noise occurs, duration, frequency, level, and attitude regarding the source of noise).

Sound energy is physically characterized by amplitude and frequency, which are measured in decibels (dB) and hertz (Hz), respectively. As sound relates to human hearing, a three dB change in a continuous broadband noise is generally considered "just barely perceptible" to the average listener. A six dB change is generally considered "clearly noticeable," and a 10 dB change is generally considered a "doubling" (or "halving") of the apparent loudness. The typical human ear can hear frequencies ranging from approximately 20 to 20,000 Hz. Normally, the human ear is most sensitive to sounds in the middle frequencies (1,000 to 8,000 Hz) and is less sensitive to sounds in the low and high frequencies. As such, the A-weighting scale (expressed as dBA) was developed to simulate the frequency response of the human ear to sounds at typical environmental levels. The A-weighting scale emphasizes sounds in the middle frequencies and de-emphasizes sounds in the low and high frequencies.

There are no federal or state noise regulations that apply to the Project. Jay County regulations for noise that pertain to wind energy conversion systems are detailed in the Jay County Zoning Ordinance, Article 2, Chapter 217 ("Wind Farm" Standards – Commercial). The ordinance details the maximum permitted sound level that may be produced from wind energy conversion systems for specific octave bands at any time within 61 m (200 ft) of a primary residence (Jay County 2012). The maximum permitted sound level ranges from 41 dB to 75 dB for octave bands ranging from 8,000 Hz to 63 Hz, respectively (Jay County 2012).

The noise analysis in this EA is based on information from the scientific literature and the results of acoustical modeling of the operation of the 52 turbines proposed at the Project (Burns and McDonnell 2019a, 2019b). The results of pre-construction acoustic modeling determined that overall sound level at nearby residences will be 48.7 dBA or lower, and that operation of the Project will not exceed noise levels specified in the Jay County noise ordinance (Burns and McDonnell 2019a, 2019b).

4.4 Socioeconomic Environment

Operation of the Project will affect economic conditions in the region, largely through the payment of state and local taxes, lease and royalty payments to participating landowners, and creation of permanent jobs in the area. Three population centers are located in the vicinity of the Project. The city of Dunkirk and town of Redkey are both located in Jay County, and are adjacent to the western boundary of the Project; the town of Ridgeville in Randolph County is approximately 2 km (1 mi) south of the Project.

The 2017 income data for the state of Indiana, Jay County, Dunkirk, Redkey, and Ridgeville, as estimated by the U.S. Census Bureau, are provided in Table 4-3. In 2017, median household income was lower than both the county and state averages (U.S. Census Bureau 2017). For the period between July 2018 and August 2019, the estimated unemployment rate in Jay County was 3.3% (U.S. Department of Labor 2019).

Table 4-3. Income statistics in the region of the Bitter Ridge Wind Farm.

	Population	Median Household Income	Persons Below Poverty Level (%)
State of Indiana	6,614,418	52,182	14.6
Jay County	21,107	42,878	17.9
Dunkirk, Jay County	2,277	35,671	24.5
Redkey, Jay County	1,405	37,344	19.1
Ridgeville, Randolph County	566	36,719	21.7

Source: U.S. Census Bureau 2017

5 ENVIRONMENTAL CONSEQUENCES

5.1 Overview of the Effects Analysis

This section describes the environmental effects of each of the alternatives retained for detailed analysis. Each of the alternatives includes the operation of a 52-turbine wind project, implementation of the BBCS, and post-construction monitoring. The three alternatives differ with respect to operational adjustments and the extent of mitigation to be implemented to offset the impact of taking the Covered Species (Table 5-1).

The analysis presented in this section is commensurate with the estimated impacts associated with Project operations and focuses predominately on bird and bat resources. The USFWS estimates that effects on vegetation, non-flying wildlife, air quality and climate, noise, and socioeconomics (economics) resulting from operations and maintenance, as well as the proposed mitigation projects would be minor. Hence, limited analyses for these resources is provided.

As per the CEQ guidelines (CEQ 1997), resources that would be unaffected by the Proposed Action or other alternatives, experience beneficial effects, or are subject to temporary effects were excluded from our cumulative effects analysis. Upon using this screening process, the USFWS limited our cumulative effects analysis to avian and bat resources (provided in Sections 5.5.2 and 5.5.3, respectively).

Table 5-1. Comparison of the alternatives retained for detailed analysis.

Element	Alternative		
	1: No-Action Alternative	**2: Proposed Action - 9.8 feet/second (5.0 meters/second) cut-in speed**	**3: More Restrictive - 11.5 feet/second (6.5 meters/second) cut-in speed**
Operational minimization measures	**Spring migration (April 1 – May 15)**: below 5.0 m/s (11.2 mph) cut-in speed (manufacturer's default) **Summer (May 16 – July 31):** below 6.9 m/s (15.4 mph) at the 39 turbines within 305 m (1,000 ft) of summer habitat; AND below 3.0 m/s (6.7 mph) for the 13 turbines greater than 305 m (1,000 ft) from summer habitat **Fall migration (August 1 – October 15):** below 6.9 m/s (15.4 mph) cut-in speed **Winter (October 16 – March 31):** below 3.0 m/s (6.7 mph) cut-in speed	**Spring migration (April 1 – May 15)**: below 3.0 m/s (6.7 mph) cut-in speed **Summer (May 16 – July 31):** below 5.0 m/s (11.2 mph) at the 39 turbines within 305 m (1,000) of summer habitat when temperature is above 10 °C (50 °F); AND below 3.0 m/s (6.7 mph) for the 13 turbines greater than 305 m (1,000 ft) from summer habitat **Fall migration (August 1 – October 15):** below 5.0 m/s (11.2 mph) cut-in speed when temperature is above 10 °C (50 °F); below 3.0 m/s (6.7 mph) cut-in speed when temperature is below 10 °C (50 °F) **Winter (October 16 – March 31):** below 3.0 m/s (6.7 mph) cut-in speed	**Spring migration (April 1 – May 15)**: below 3.5 m/s (7.8 mph) cut-in speed when temperature is above 10 °C (50 °F) **Summer (May 16 – July 31):** below 6.5 m/s (14.5 mph) at the 39 turbines within 305 m (1,000 ft) of summer habitat when temperature is above 10 °C (50 °F); AND below 3.0 m/s (6.7 mph) for the 13 turbines greater than 305 m (1,000 ft) from summer habitat when temperature is above 10 °C (50 °F) **Fall migration (August 1 – October 15):** below 6.5 m/s (14.5 mph) cut-in speed when temperature is above 10 °C (50 °F) **Winter (October 16 – March 31):** below 3.0 m/s (6.7 mph) cut-in speed
Habitat Conservation Plan and Incidental Take Permit	No	Yes. Minimization and mitigation for summer habitat for both species, and fall staging/swarming habitat for Indiana bats	Yes. Minimization and mitigation for summer habitat for both species, and fall staging/swarming habitat Indiana bats
Bird and Bat Conservation Strategy	Yes	Yes	Yes

5.2 Biological Environment

5.2.1 Vegetation

5.2.1.1 Impact Criteria

Vegetation can be impacted at the individual, population, or community level. Major impacts to vegetation can occur when any of the following result:

- naturally occurring population reduced in numbers below levels for maintaining viability at local or regional level;
- substantial loss or degradation of soil stabilization services;
- substantial loss or degradation of habitat for a rare, threatened, or endangered animal species; or
- introduction of invasive species that results in substantial replacement of native species.

5.2.1.2 Direct and Indirect Effects

No-Action Alternative

Under the No-Action Alternative, vegetation would be mowed periodically as part of Project maintenance activities, including periodic mowing to retain previously cleared areas associated with Project infrastructure (roads, generator lead line) and rights-of-way. Periodic mowing may also be conducted to increase searcher efficiency during mortality monitoring associated with the BBCS (Attachment A) and Technical Assistance Letter. Under this alternative, no ITP would be issued and there would be no requirement for the Applicant to implement the mitigation projects proposed under Alternatives 2 and 3.

Alternatives 2 and 3

Under Alternatives 2 and 3, vegetation would be mowed periodically as part of maintenance activities, including periodic mowing to retain previously cleared areas associated with Project infrastructure (roads, generator lead line) and rights-of-way. Periodic mowing would also be conducted to increase searcher efficiency during mortality monitoring associated with the BBCS (Attachment A) and the HCP (BRWF 2019). Because ground disturbance is not proposed, periodic mowing is not expected to result in degradation of soil stabilization. The areas mowed associated with mortality monitoring are primarily located within cultivated croplands, and are not known to support rare, threatened, endangered, or invasive species. Therefore, adverse impacts to habitat for rare, threatened, or endangered species; and/or the introduction of invasive species are not expected.

Impacts to vegetation could potentially occur in association with the implementation of the summer and fall staging/swarming habitat mitigation associated with Alternatives 2 and 3. Vegetation impacts are expected to be limited to restoration activities, which would improve the quality of vegetation communities that provide habitat for Covered Species. Mitigation measures would not reduce any naturally occurring plant populations to numbers below levels for maintaining viability at the local or regional level. Substantial loss or degradation of soil

stabilization services; adverse impacts to habitat for rare, threatened, or endangered species; and/or the introduction of invasive species are not expected.

Increased temperatures and changing precipitation patterns are expected across the Midwest within the next 100 years, resulting in springs that are warmer and wetter, and the summer and fall months being both drier and hotter (Widhalm et al. 2018). As a result, there is potential for forest composition change within the mitigation sites over the course of the 35-year permit term (Swanston et al. 2018). However, restoration activities within summer and fall staging/swarming habitat would reduce the potential for adverse compositional change within these forest areas by removing invasive species and maintaining the overall health of the forest community. As a result, adverse impacts to forest vegetation are not anticipated.

5.2.1.3 Summary of Effects to Vegetation

Periodic mowing at the Project turbines associated with post-construction monitoring is not expected to cause reductions in the numbers of any naturally occurring plant populations; result in the loss or degradation of either soil stability or habitat for any rare, threatened, or endangered species; or introduce invasive species that could substantially displace native species. The protection of approximately 41 ha (102 ac) of forested habitat for Covered Species is likely to benefit vegetation resources at the mitigation sites. Overall, impacts to vegetation under each of the three alternatives would be minor.

5.2.2 Non-flying Wildlife Resources

5.2.2.1 Impact Criteria

Major impacts to non-flying wildlife and aquatic resources are those that substantially affect a species' population (locally, regionally, or range-wide) or reduce its habitat quality or quantity. Impacts may occur when any of the following result:

- disturbance, injury, or mortality of individuals;
- habitat loss, degradation, or alteration;
- a change or reduction in resources used by wildlife in different life stages (i.e., alterations to surface water or alterations to plant composition); or
- the creation of habitat edges and openings that favor a different mix of species, and may increase predation pressure and/or cause displacement or avoidance.

5.2.2.2 Direct and Indirect Effects

No-Action Alternative

Under the No-Action Alternative, effects to non-flying wildlife resulting from post-construction monitoring associated with the BBCS and Technical Assistance Letter, Project maintenance, and operations include disturbance or mortality due to increased vehicle traffic and human presence. Non-flying wildlife moving around the site to forage or scavenge would not be susceptible to collisions with turbines, but may be susceptible to vehicle collisions. Any vehicle-induced

fatalities or carcasses placed in the Project area to assess searcher success and scavenger removal rates during post-construction monitoring may attract local scavengers to the site.

Seasonal changes anticipated over the course of the 35-year operational life of the Project are expected to increase the potential for flooding in the spring and to lengthen the overall growing season (Widhalm et al. 2018). However, because the Project is primarily within actively cultivated cropland (roughly 82%), which predominantly supports generalist species, habitat impacts associated with climate change on non-flying wildlife within the Project area would be minimal.

The No-Action Alternative does not include any mitigation projects; therefore, there would be no effects to non-flying wildlife as a result of bat habitat mitigation.

Alternatives 2 and 3

Under Alternatives 2 and 3, post-construction monitoring associated with the BBCS and HCP, as well as Project operations and maintenance would have similar impacts as those described for the No-Action Alternative.

For both alternatives, any mitigation measures to protect summer maternity and fall staging/swarming habitat for bats would also be expected to benefit forest-dwelling mammals, reptiles, and amphibians. As described above (No-Action Alternative), seasonal changes over the 35-year permit term are expected to have a minimal impact on non-flying wildlife within the Project area. The protection and restoration of forested habitat in the mitigation areas may result in a minor beneficial impacts to non-flying wildlife by maintaining forested habitat.

5.2.2.3 Summary of Effects to Non-flying Wildlife

Activities associated with Project operations and maintenance are not expected to result in impacts to non-flying wildlife under any of the considered alternatives that would substantially affect a species' population (locally, regionally, or range-wide) or reduce its habitat quality or quantity. Impacts to non-flying wildlife resources under all three alternatives would be minor.

Implementation of the mitigation projects under Alternatives 2 and 3 would result in the preservation of 41 ha (102 ac) of forested habitat, which would not be expected to result in substantial adverse impacts to non-flying wildlife populations (locally, regionally, or range-wide) or significantly impact either habitat quality or quantity. Instead, the summer maternity and fall staging/swarming habitat mitigation projects would have long-term beneficial effects to non-flying wildlife at the local scale, including forested habitat preservation and enhancement.

5.2.3 Avian Resources

5.2.3.1 Impact Criteria

Birds can be affected at the individual and population level. Impacts to avian resources would be considered major should implementation of an Alternative result in any of the following:

- naturally occurring population reduced in numbers below levels for maintaining viability at local or regional level;
- substantial loss or degradation of habitat for a rare, threatened, or endangered bird species; or
- substantial change in habitat conditions producing indirect effects that cause naturally occurring populations to be reduced in numbers below levels for maintaining viability at local or regional levels.

5.2.3.2 Direct and Indirect Effects

Disturbance and Displacement

Potential sources of disturbance include Project structures (particularly operating turbines and the MET tower), human presence, vehicle traffic, noise and shadow flicker associated with spinning turbines, and habitat alterations.

Potential habitat disturbances are species-specific and the level of disturbance associated with habitat impacts at wind projects relates to the topography, baseline condition of habitat(s) present, amount of existing roads or infrastructure, and turbine layout (National Research Council of the National Academies [NRC] 2007). Studies of displacement impacts to birds from operating turbines are limited, and clear, consistent patterns have yet to be established (Poulton 2010). Available literature suggests that displacement effects can occur at distances from roughly 76 to 793 m (250 to 2,600 ft) from turbines, and impact migrating, breeding, and foraging birds (Strickland 2004), though impacts vary among species and habitat types.

For grassland species, studies have found a range of responses from slight avoidance of turbines (Leddy et al. 1999, Johnson et al. 2000, Kerlinger and Dowdell 2008, Poulton 2010) to possible attraction of some species to the bare ground surrounding turbine areas (Poulton 2010). Similarly, for raptors, some studies have found a variety of species foraging and perching in the vicinity of turbines (Stantec 2010), while other studies indicate a decrease in raptor activity and nesting near turbines (Johnson et al. 2000). Waterfowl species, in general, may become habituated to the presence of operating turbines, and studies have indicated that many waterfowl species continued to use the area in the vicinity of turbines for foraging and nesting (Osborn et al. 1998).

The Project largely consists of actively cultivated croplands with a small portion of deciduous forest, developed open space, and pasture and hay fields. The majority of birds documented during pre-construction surveys were members of common, disturbance-tolerant species, indicating that displacement effects are unlikely for most of the birds occurring at the Project. The Project area contains foraging habitat but limited nesting habitat for raptors. Bald eagles,

specifically, are known to nest within 16 km (10 mi) of the Project (four known nests), but were only observed on three occasions during two years of pre-construction surveys, and no golden eagles were observed. Bird species sensitive to disturbance currently account for a small percentage of bird use at the Project and suitable habitat for these species is limited within the Project area (Attachment A). If birds of these species are affected by displacement from the Project, it is unclear whether displacement impacts would persist for the life of the Project, given that some species may adapt to the presence of the turbines (The Ornithological Council 2007).

Turbines have not been sited in sizable wetlands that would attract migrant waterfowl or wading species. While operational turbines have the potential to obstruct the flight paths of migrants to the extent that birds may alter their flight path around the Project area, the turbines are widely spaced across the agricultural fields to allow flight paths between the turbines.

Turbine-related Mortality

In the U.S. and Canada, wind turbines are responsible for approximately 214,000 to 368,000 bird collisions each year, accounting for a small proportion of the human causes of mortality (0.01%) (Erickson et al. 2014a, 2014b). Publicly available fatality estimates for the Midwest currently range from 0.27 to 8.25 birds/MW/year and average 3.09 birds/MW/year (Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]). The Project is primarily located within agricultural land, and does not exhibit any environmental characteristics indicating a high level of collision risk (e.g., topographic relief that may concentrate migrating birds, large areas of high quality habitat); therefore, fatality rates over the life of the Project are expected to be within the range reported for other Midwestern sites.

Nocturnal migrating passerines represent the bird group most commonly involved in fatalities at wind facilities (NRC 2007, Erickson et al. 2014b), likely due to their abundance and migratory behaviors. Small passerines as a group comprise approximately 62.5% of the bird mortality at wind facilities in the U.S. and Canada (Erickson et al. 2014b); however, mortality estimates for passerine species result in continent-wide effects of much less than 1% (>0.001% to 0.043%) of any species' population annually (Attachment A; within the BBCS, see Appendix C – Bitter Ridge Wind Farm 2017 Raptor Nest Survey Report). At the Project, both resident and migrant passerines are likely to constitute the greatest number of fatalities because they represent the majority of mortalities at wind turbines in the U.S. and Canada and were the most frequently observed avian group during pre-construction surveys at the Project; this risk is expected to be low when assessed as a group, and negligible for individual species of passerine birds.

Waterbird (i.e., waterfowl, shorebirds, and seabirds) mortality at wind facilities has been highly variable, but national research has demonstrated that waterbirds rarely collide with inland turbines (Kingsley and Whittam 2005). Low to no waterbird mortality has been observed at Midwest wind facilities, including those with high waterbird use in the site or vicinity (Jain 2005). The Project contains limited waterbird habitat, although some waterbirds may forage in agricultural fields; therefore, the risk to waterbird species at the Project is expected to be low.

Raptor fatality rates at Midwest sites have been very low, generally one or two carcasses found per publicly available study, of which red-tailed hawks have accounted for approximately 64%

of Midwestern raptor mortality (USFWS 2017b). Similar to most other wind facilities in the Midwest, the Project landscape lacks major topographic features that are likely to concentrate raptor activity, and risk to raptors at the Project is expected to be low.

Raptor nest surveys completed in 2017 and 2019 did not identify any bald eagle nests within the Project. As described above, a total of four bald eagle nests are known to occur within 16 km (10 mi) of the Project, the closest of which is 10.3 km (6.4 mi) to the southwest (see Section 5.2.5.2 in Attachment A). Although bald eagle nests are within 16 km (10 mi) of the Project, low eagle activity (three observations) was recorded over two years of pre-construction surveys at the Project. The Project area lacks important physical habitat features that would support bald eagle, such as large mature forests and waters containing fish for foraging. Therefore, Project operation is not anticipated to result in turbine-related mortality or injury of bald eagles.

Mortality Associated with Other Project Structures

Birds are susceptible to other sources of mortality at wind projects beyond turbine collision, such as collision or electrocution from transmission lines and collisions with other project structures such as the MET tower. The risk of avian interaction with these structures would be the same under all three alternatives. To avoid the risk of transmission line collisions and electrocutions, BRWF minimized the amount of aboveground collection and transmission lines and buried collection and communication cables. In addition, power lines were constructed in accordance with the most current Avian Power Lines Interaction Committee Guidelines (Avian Power Lines Interaction Committee 2012) to protect birds from electrocution and collision. To minimize the risk of collision, the permanent MET tower, which is 100 m (328 ft) tall, is un-guyed (the tower does not have cables extending between the top of the structure and the ground for stability).

Vehicle Collisions

Birds may be susceptible to collision with vehicles when crossing roads within the Project area under all three alternatives. Avian-vehicle collisions have been reported at other operational projects, but likely represent a smaller proportion of fatalities in comparison to turbine collisions (Stantec, unpublished data). BRWF has implemented a speed limit of 40 kilometers per hour (25 mph) on all roads within the Project, which allows birds and other wildlife to better detect and avoid a vehicle and also allows drivers to slow when approaching birds on the roadways to minimize the risk of collision. In addition, vehicles will be restricted to pre-designated access routes. The risk to birds as a result of vehicle collisions under all three alternatives is considered low.

Wind Facility Lighting

Impacts to avian species resulting from nighttime lighting at the Project would be the same under all three alternatives. Nocturnal migrants aggregate at artificial light sources when they become disoriented or “trapped” by lights (Longcore et al. 2008). The potential for this phenomenon to occur increases when fog is present to reflect the light, and when inclement weather or topographic factors influence migrating birds to fly at lower heights above ground level (Longcore et al. 2008).

Potential nighttime lighting impacts would be minimized at the Project under all three alternatives. Required Federal Aviation Administration (FAA) lighting has been installed on the nacelles of selected wind turbines (FAA 2018). FAA lighting at the Project is not expected to result in a significant difference in the risk of collision to nocturnal migrants (Kerlinger et al. 2010). The O&M facility will have outside safety lights that may be operated manually or via motion detectors. Additionally, the O&M facility will have exterior security lighting on the building, as well as the parking lot, which are operated by dusk-to-dawn sensors. Lighting on the O&M facility and parking lot is directional, hooded and/or shielded, low-intensity, low-sodium lights to minimize the potential for birds to be attracted to the site at night. All internal turbine nacelle and tower lighting are extinguished when unoccupied.

Project Maintenance

Potential impacts to avian species due to Project maintenance would be the same under all three alternatives. The effect of maintenance activities on birds may include disturbance and possible mortality due to human activity from the presence of large equipment (e.g., cranes), nighttime lighting, and vehicle traffic. These impacts are expected to be minimal and temporary, occurring only when personnel are on-site conducting maintenance activities.

Habitat in the vicinity of the Project is relatively uniform, and therefore birds would be expected to utilize similar surrounding habitat if temporarily displaced by maintenance activities. The use of cranes or other large equipment may pose a risk of mortality to birds or decreased nesting success for birds breeding in the immediate vicinity of active work areas. However, the use of large equipment to maintain turbines is expected to occur infrequently. Most turbine maintenance happens by accessing the nacelle through the ladder located inside the tower; therefore, impacts associated with decreased nesting success are expected to be minimal.

If lighting at towers is required for nighttime maintenance activities during rain or fog conditions, there may be an increased risk of avian collisions with towers or nearby equipment. These risks would be short-term and temporary; therefore, impacts associated with collisions during maintenance are expected to be minimal. Birds also could collide with maintenance vehicles or flush as maintenance vehicles drive by. Slower traffic speeds would allow for birds to detect approaching vehicles from a greater distance, affording them more time to leave the immediate area. Slower speeds would also allow drivers to slow when approaching birds on roadways or when groups of birds fly across roadways. As such, the likelihood of bird collisions with maintenance vehicle is expected to be minimal.

Post-construction Monitoring

The primary potential impacts to birds resulting from post-construction monitoring include disturbance or fatality due to increased vehicle traffic and human presence, which are discussed above (see Vehicle Collisions and Project Maintenance, respectively). In addition, post-construction monitoring could also result in scavengers (i.e., mammals and birds) being attracted to the Project as a result of searcher efficiency and carcass persistence trials, which both place carcasses in the Project area to assess searcher success and removal by scavengers. Avian scavengers could collide with spinning turbine blades while attempting to scavenge a carcass, however, carcasses used for search efficiency trials are collected when found and carcasses used

for persistence trials are removed following the trial; therefore, the risk to avian species due to scavenger attraction would be temporary. Potential impacts to avian species due to post-construction mortality monitoring would be similar under all three alternatives.

Mitigation Projects

While the goal of the mitigation projects is to preserve summer maternity habitat for Indiana bats and northern long-eared bats and staging/swarming habitat for Indiana bats, the mitigation projects also would provide benefits to forest-dwelling birds. In the long term, these forested parcels would offer enhanced habitat for breeding birds, and also may provide high quality stopover habitat for migrants. Mitigation for taking of Covered Species would occur for Alternatives 2 and 3 only.

Climate Change

As stated above, increased temperatures and changing precipitation patterns are expected across the Midwest, resulting in habitat and bird community compositional change (Swanston et al. 2018, Widhalm et al. 2018, Gaüzère et al. 2020). Additionally, increased disturbance events from climate change (e.g., fire, flooding) have the potential to cause direct mortality of birds and or a reduction in nest success.

As described in Section 4.2.2.2, potential habitat for birds within the Project area is limited, and is largely composed of agricultural lands or fragmented areas of deciduous forest. Therefore, a compositional change to the bird community during the life of the Project is unlikely. Mitigation in the form of forest restoration that would occur under Alternatives 2 and 3 could result in minor beneficial impacts to bird by preserving and restoring areas of intact forest habitat despite changing precipitation patterns.

Population Level Impacts

Species considered at risk from population-level effects would include those with relatively small or unstable populations. To date, no significant population-level impact to any single species has been documented as a result of mortality from wind projects. However, as the number of wind facilities increase in North America, the number of individuals taken from each species is expected to increase proportionally (see additional discussion in Section 5.5.2).

State-listed Species

During Project planning and consultation with IDNR, six state-endangered species were identified as potentially occurring at the Project. These species included American bittern, northern harrier, sedge wren, least bittern, black-crowned night-heron, and barn owl. Of these, the northern harrier was the only state-listed species recorded (18 observations) during two years of pre-construction surveys at the Project.

Northern harriers require large undisturbed wetlands, pastures, old fields, marshes, and upland habitats for breeding, and there is limited potential nesting habitat for northern harriers at the Project. Observations of northern harrier at the Project occurred outside of the breeding season and likely represented individuals migrating through the area or over-wintering, as the species is

fairly common in Indiana and the Midwest during these seasons. The overall level of northern harrier fatalities is low when compared to the relative abundance of this species at other wind facilities (Erickson et al. 2001). Northern harriers observed at the Project were flying below the rotor-swept turbine height; this is consistent with the hunting habits of northern harriers, which typically involve low, coursing flights over grassland habitats (Cornell Lab of Ornithology 2015). This behavior likely decreases the potential for the species to collide with wind turbines.

In addition, six birds of special concern were recorded during pre-construction surveys, including the bald eagle (3 observations), broad-winged hawk (12 observations), great egret (*Ardea alba,* 3 observations), northern bobwhite (*Colinus virginianus,* 10 observations), sandhill crane (335 observations), and osprey (*Pandion haliaetus,* 2 observations). State birds of special concern were generally observed in low numbers. The most commonly observed species of special concern, the sandhill crane, has not been documented as a fatality at wind facilities in the Midwest, despite several hundred thousand sandhill cranes migrating through the region annually (Derby et al. 2018).

The habitat available and results of pre-construction field surveys indicate a low likelihood of bird species breeding in the Project area that are either state-listed as endangered or designated as special concern. However, it is possible that these species and other species of concern could occur within the vicinity of the Project, including the airspace around turbines, during migration.

USFWS Birds of Conservation Concern

Four birds listed as Birds of Conservation Concern (BCC) in this region of the U.S. (USFWS 2008) have been observed in the Project area during pre-construction surveys: bald eagle (3 observations), field sparrow (*Spizella pusilla,* 21 observations), northern flicker (*Colaptes auritus,* 14 observations), and red-headed woodpecker (*Melanerpes erythrocephalus,* 5 observations) (Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]). It is possible, but unlikely, that these species would collide with Project turbines, based on the low number of individuals observed in the Project area, publicly available fatalities for these species attributed to wind turbines, and the species' behavioral characteristics.

5.2.3.3 Summary of Effects to Avian Resources

Pre-construction avian surveys indicate bird use within the Project consists primarily of common, disturbance-tolerant species, and raptor use of the Project is moderate in comparison to other Midwest wind facilities. Injury or mortality of bald eagles is not anticipated from the Project, based on the habitat composition within the Project area, absence of known bald eagle nests within the Project, and the limited observations of the species during pre-construction surveys. No impacts to golden eagle are anticipated. Likely affected species will be those already discovered during pre-construction monitoring at the Project. The USFWS does not anticipate the Project would have adverse population-level impacts to individual species under any of the alternatives. Implementation of any of the three alternatives would not result in reducing any naturally occurring population to numbers below that for maintaining viability at the local or regional level. In addition, none of the alternatives would result in substantial changes in habitat conditions producing indirect effects that cause naturally occurring populations to be reduced in

numbers below levels for maintaining viability at local or regional levels. Potential cumulative impacts to bird populations from wind energy development are addressed in Section 5.5.2.

Among the three alternatives, it is not expected that Project operations, maintenance, or post-construction mortality monitoring would have significantly different effects on avian resources. Although no specific mitigation measures for birds would be implemented under any of the three alternatives, implementation of the mitigation projects under Alternatives 2 and 3 would be likely to have minor, but beneficial impacts to forest-dwelling avian species.

5.2.4 Bat Resources

5.2.4.1 Impact Criteria

Bats can be affected at the individual and population level. Major impacts may occur to bats should implementation of an Alternative result in any of the following:

- observed Project fatality rates greatly exceed the estimated rate for a wind project in the region;
- substantial loss or degradation of habitat; or
- substantial change in habitat conditions producing indirect effects that result in additive reductions in naturally occurring populations.

Additionally, major impacts to listed bats could occur should implementation of an alternative result in the reduction of naturally occurring populations below levels for maintaining viability at local or regional levels. Reductions in populations of listed bats could be caused by fatalities at wind turbines or substantial changes in habitat conditions.

5.2.4.2 General Bat Mortality Patterns at Wind Projects

Mechanisms for bat mortality at wind turbines include trauma associated with direct collision with spinning turbine blades and barotrauma.[5] Bats do not appear to be at risk of mortality when turbines are fully feathered (blades pitched to rotate at less than two revolutions per minute). Publicly available estimates for bat fatalities at operating wind facilities in the Midwest, for turbines operating normally (without an operational minimization strategy), currently range from 0.03 to 73.08 bats/MW/year (see Table B-4 in Attachment B).

The primary bat species affected by wind facilities are migratory, foliage- and tree-roosting species (Kunz et al. 2007b), which consistently account for the majority of fatalities in studies of wind farm mortality in the U.S. (Arnett and Baerwald 2013). Arnett and Baerwald (2013) compiled data from 122 studies from 73 wind facilities in the U.S. and Canada and found that 78% of the mortality were the migratory, foliage-roosting hoary bat, eastern red bat, and silver-haired bat. Some researchers have suggested that bats that roost in the foliage of trees for most of the year may be attracted to wind turbines because of their migratory and mating behavior

[5] Barotrauma is tissue damage to lungs and respiratory organs that occurs when bats fly through a wake of low pressure that follow immediately behind fast-moving turbine blades. Barotrauma can cause mortality even when bats do not physically collide with turbine blades.

patterns (Kunz et al. 2007b); however, the reasons for potential attraction are still not fully understood.

The majority of bat fatalities occur mid-summer through fall, during approximately the same timeframe as southward migration of migratory bats (Arnett et al. 2008). Typically, wind farm mortality records do not show a comparable spring peak in collision mortality despite the fact 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).

To date, post-construction studies at wind facilities have documented nine Indiana bat fatalities within the MRU. Of these, six occurred during fall migration, two in spring, and one in summer (see Table B-1 in Attachment B). Due to the infrequency of Indiana bat fatalities, risk factors for this species at wind projects are poorly understood. Patterns of fatalities in similar species, such as little brown bat, have been used to quantify potential Indiana bat fatality rates and to predict patterns.

A total of 50 northern long-eared bat fatalities have been documented by post-construction studies at wind facilities in the U.S. and Canada (see Table B-2 in Attachment B). Of these, 37 occurred during fall migration, five in summer, two in spring, and the season for two fatalities was unreported. Like the Indiana bat, due to the rarity of northern long-eared bat fatalities, risk factors are poorly understood for this species at wind projects.

5.2.4.3 Effectiveness of Turbine Curtailment at Reducing Bat Mortality

Turbine curtailment refers to increasing the cut-in speed at which turbines begin operating; when winds are below the cut-in speed, turbine blades are feathered so they spin very slowly (less than two revolutions per minute) or not at all. Studies conducted at wind projects in a variety of landscapes have demonstrated that curtailment effectively reduces bat mortality and that an inverse relationship exists between cut-in speed and bat fatality rates (Fiedler 2004, Kerns et al. 2005, Baerwald et al. 2009, Arnett et al. 2011, Good et al. 2011). Table 5-2 summarizes the results of curtailment studies conducted to date that are publicly available; Attachment C provides a more detailed summary of publicly available curtailment studies and bat fatality reductions at wind projects in the U.S. and Canada.

Table 5-2. Average reductions in bat mortality by curtailed cut-in speeds.

Cut-in Speed	Average % Reduction in Mortality
3.5 m/s (7.8 mph)	36.0 (n=1)
4.0 m/s (8.9 mph)	46.0 (n=2)
4.5 m/s (10.1 mph)	52.0 (n=2)
5.0 m/s (11.2 mph)	61.0 (n=5)
5.5 m/s (12.3 mph)	72.3 (n=3)
6.5 m/s (14.5 mph)	76.0 (n=4)

Sources: Baerwald et al. 2009; Arnett et al. 2010, Arnett and Baerwald 2013; Good et al. 2012; Hein et al. 2014

5.2.4.4 Estimating Bat Mortality

To estimate bat mortality across the three alternatives, data from the Project, curtailment studies, and wind projects in the region, particularly the nearby Fowler Ridge Wind Farm (hereafter referred to as Fowler Ridge), were reviewed. Because the Project is not yet operational, publicly available data gathered from post-construction monitoring at Fowler Ridge from 2010 and 2011 were used as proxy for Project-specific data. Fowler Ridge is located approximately 209 km (130 mi) west of the Project in a primarily agricultural landscape, similar to the Project. The Fowler Ridge post-construction monitoring studies provide robust data gathered and analyzed using sound scientific rigor. A detailed description of the approach used to develop take estimates is appended to the HCP (BRWF 2019, see Appendix A – Predicting Take Using a Species Composition Approach with Data from the Fowler Ridge Habitat Conservation Plan).

To quantify potential Covered Species fatality associated with operation of the Project, take estimates were developed for each of the three alternatives based on the estimated take levels presented in Section 4.1 of the HCP (BRWF 2019). As described above, these estimates utilize the Fowler Ridge data because the Project has not yet entered into operations and Project-specific data are not available.

The estimates from Fowler Ridge were also used to inform unlisted bat mortality estimates for the alternatives analyzed in Section 5.2.4.6. Based on data collected at Fowler Ridge in 2010 and 2011 at fully operational turbines, the average fall (August 1 to October 15) mortality estimate for all bats was 17.85 bats/MW (mean adjusted mortality based on empirical bias correction factor) (Good et al. 2012). Based on data collected at Fowler Ridge only in 2011 at fully operational turbines, the mortality estimate was 0.39 bat/MW in spring and 1.72 bats/MW in summer (mean adjusted mortality based on empirical bias correction factor) (Good et al. 2012). Combining the seasonal fatality rates equates to an annual fatality rate of 19.96 bats/MW.

To evaluate the estimated bat mortality for Indiana bats, northern long-eared bats, and unlisted bats expected under the three alternatives, the USFWS compared each alternative's operational minimization strategy to the results of publicly available curtailment studies in the Midwest (Attachment C). The average observed percent reduction in fatalities, considering each study's normal operating cut-in speed, was applied to determine the minimized take estimate for the Covered Species and unlisted bats under each alternative.

5.2.4.5 Habitat Impacts

Land use within the Project area is primarily agricultural crops (82% of area), with forest accounting for approximately 8% of land area. Because the Project is operational, no habitat impacts are associated with any of the alternatives.

5.2.4.6 Climate Change

Climate influences food availability, timing of hibernation, frequency and duration of torpor, rate of energy expenditure, reproduction, and development rates of juveniles for insectivorous bats, including Indiana bats and northern long-eared bats (Sherwin et al. 2012). The overall impact of climate change will likely be negative for Midwestern bats, due to a reduction in the suitability

of existing hibernacula (Humphries et al. 2002) and maternity roosts (Greenberg et al. 2014). In addition, disruption of the distribution and availability of insect prey necessary to provide energy for maintenance, growth, and reproduction is likely (Neuweiler 2000, Meretsky et al. 2006, Rodenhouse et al. 2009). More recently, global climate change has been identified as a threat to Indiana bats (USFWS 2007) and northern long-eared bats (USFWS 2015b).

Because the Project is operational, no habitat impacts are associated with any of the alternatives. However, impacts to bat populations occupying forested habitat within the Project area resulting from long-term climate change could influence Project-related impacts to bats (e.g., a reduction in the overall population could lead to a decrease in take associated with the Project).

5.2.4.7 Direct and Indirect Impacts

Alternative 1: No-Action Alternative

Under Alternative 1, all Project turbines would be feathered below 5.0 m/s (11.2 mph) during the spring migration season (April 1 – May 15) and below 6.9 m/s (15.4 mph) during fall migration (August 1 – October 15). During the summer maternity season (May 16 – July 31), the 39 Project turbines within 305 m (1,000 ft) of suitable habitat would be feathered below 6.9 m/s (15.4 mph), and turbine blades would be feathered below the manufacturer's cut-in speed of 3.0 m/s (6.7 mph) at the 13 remaining turbines. Regardless of temperature or distance from suitable habitat, turbines would be feathered below 3.0 m/s (6.7 mph) during the inactive season (October 16 – March 31). The Service has determined that this level of operational minimization is expected to reduce unlisted bat fatality rates by at least 80%, based on publicly available curtailment studies (Table 5-2; Attachment C), and is unlikely to pose a risk of collision mortality to Indiana bat or northern long-eared bat. The method for estimating take of Indiana bats, northern long-eared bats, and unlisted bats at the Project is explained in detail in Section 4.0 of the HCP (BRWF 2019).

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

The USFWS has concluded that the operational minimization strategy for Alternative 1 is unlikely to pose a risk of collision mortality for Indiana bat. Therefore, no Indiana bat mortality would be expected under Alternative 1.

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

The USFWS has concluded that the operational minimization strategy for Alternative 1is unlikely to pose a risk of collision mortality for the northern long-eared bat. Therefore, no northern long-eared bat mortality would be expected under the No-Action Alternative.

<u>Unlisted Bat Mortality</u>

Based on the combined seasonal fatality rate of 19.96 bats/MW described in Section 5.2.4.4, Alternative 1 could result in the mortality of up to 518.96 bats/year, or approximately 18,164 total bat fatalities over the 35-year life of the Project. This estimate includes Project-related mortality alone and does not attempt to account for lost reproductive potential.

Mitigation

Under Alternative 1, no ITP would be issued because operation of the Project is not expected to result in take of the Covered Species. Therefore, mitigation would not be required.

Alternative 2: 5.0 Meters per Second Cut-in Speed (Applicant's Proposed Operation)

Under Alternative 2, all Project turbines would be feathered below 3.0 m/s (6.7 mph) year round, including during the spring migration season (April 1 – May 15) and winter hibernation (October 16 – March 31). In addition, the 39 Project turbines within 305 m (1,000 ft) of suitable habitat would be feathered below 5.0 m/s (11.2 mph) when temperatures are above 10 °C (50 °F) during the summer maternity season (May 16 – July 31) and during fall migration (August 1 – October 15). This level of operational minimization is expected to reduce bat fatality rates by at least 60%, based on publicly available curtailment studies (Table 5-2; Attachment C).

Indiana Bat Take and Impact of the Taking

Based on the upper 80% confidence interval of predicted take rate, the Applicant estimates that operation of the Project could take approximately 4.88 Indiana bats per year in the absence of the proposed operational curtailment or minimization (BRWF 2019). Implementation of the proposed operational minimization measures is expected to result in a reduction in Indiana bat fatalities of at least 60%, resulting in an annual take estimate of 1.95 Indiana bats per year or 69 Indiana bats over the 35-year operational life of the Project, which is greater than that expected for Alternatives 1 and 3.

The Applicant, in coordination with the USFWS, has assumed that more female than male Indiana bats (3:1) migrate through the Project area based on the distance between the Project area and the nearest hibernaculum (approximately 38 km [24 mi] to the southeast in Preble County, Ohio) (USFWS 2007). Evidence suggests female Indiana bats may occur more frequently than males as distances from hibernacula increase (Gardner and Cook 2002, Whitaker and Brack 2002). Consequently, approximately 75% of the 69 Indiana bats taken at the Project are expected to be female, leading to an estimated take of 1.46 female bats per year, or 51 female bats over the expected 35-year operational life of the Project.

Based on the USFWS's Resource Equivalency Analysis Model (Version 7) for a declining population, the total predicted lost reproductive capacity during the permit term is 81 female pups. The total predicted impact of the Project under Alternative 2 is up to 133 Indiana bats (69 bats [total take] * 75% = 51 female bats [total female take] + 81 female pups [lost reproduction] = 133 bats [impact of take]) over the 35-year permit term.[6]

The impact of take for 133 Indiana bats represents <0.001% of the estimated 2019 population in the MRU (245,474 Indiana bats) (USFWS 2019a), where the Project is located. This take would

[6] Values derived using a spreadsheet application and reflect rounding. Applying straight arithmetic may result in slight variations in the results.

be distributed over 35 years and mitigated by the Applicant as described in Section 5.3 of the HCP.

Northern Long-eared Bat Take and Impact of the Taking

Based on the upper 80% confidence interval of predicted take rate, the Applicant estimates the Project could take approximately 3.19 northern long-eared bats per year in the absence of the proposed operational curtailment or minimization (BRWF 2019). From implementation of the operational minimization measures proposed for Alternative 2, a reduction in fatalities of at least 60% is anticipated, reducing the annual take estimate to 1.27 northern long-eared bats per year or up to 45 northern long-eared bats over the 35-year operational life of the Project (1.27 bats per year x 35 years = 44.45).

The Applicant, in coordination with the USFWS, has assumed that a 1:1 ratio of female to male northern long-eared bats migrate through the Project area. Unlike Indiana bat hibernacula, the locations of most northern long-eared bat hibernacula remain largely undocumented, due to the species' common status prior to the impact of WNS, the species' use of smaller hibernacula that are more dispersed on the landscape, and because northern long-eared bats hibernate singly or in small groups in hidden crevices. The closest known northern long-eared bat hibernaculum to the Permit Area is the Lewisburg Limestone Mine approximately 174 km (108 mi) to the southwest. Male and female northern long-eared bats are assumed equally likely to occur within the Project area because data that would prove otherwise are lacking.

Assuming approximately 50% of the 45 northern long-eared bats taken at the Project are female, the reproductive loss due to operation of the Project is expected to be 0.64 female bat per year, or up to 22 female bats over the life of the Project. Using the USFWS's Resource Equivalency Analysis Model (Version 1) for a declining population, the total predicted lost reproductive capacity during the permit term is 36 female pups. Therefore, the total predicted impact of the Project under Alternative 2 is up to 58 northern long-eared bats (45 bats [total take] * 50% = 22 female bats [total female take] + 36 female pups [lost reproduction] = 58 bats [impact of take]) over the 35-year permit term.

The impact of take for up to 58 northern long-eared bats represents <0.001% of the estimated range-wide population of 6.5 million individuals (USFWS 2016b). Similar to Indiana bats, take would be distributed over 35 years and mitigated by the Applicant as described in Section 5.3 of the Project HCP.

Unlisted Bat Mortality

The USFWS has concluded that the operational minimization strategy for the Alternative 2 is likely to result in the estimated take of 1,037.92 bats/year, or approximately 36,327 total bat fatalities over the 35-year life of the Project. This estimate includes Project-related mortality alone and does not attempt to account for lost reproductive potential.

Mitigation for Taking Covered Species

The Applicant plans to offset the taking of the Covered Species through protections of summer maternity habitat and fall staging/swarming habitat. The Applicant or their third-party contractor would secure and protect summer maternity habitat to the benefit of both species, and staging/swarming habitat for the benefit of Indiana bats. Because much of the landscape in Indiana is dominated by agricultural land use, protecting additional forested habitat would improve habitat diversity and would benefit all resident bats by increasing the extent and diversity of roosting and foraging habitat. Forest habitat in the region also would presumably provide stopover habitat for long-distance migratory species.

Alternative 3: 6.5 Meters per Second Cut-in Speed (More Restrictive)

Under Alternative 3, all Project turbines would be feathered below 3.5 m/s (7.8 mph) during spring migration (April 1 – May 15) and below 6.5 m/s (14.5 mph) during fall migration (August 1 – October 15) when temperatures are above 50 °F (10 °C). In addition, during the summer maternity season (May 16 – July 31), turbines within 305 m (1,000 ft) of summer habitat would be feathered below 6.5 m/s (14.5 mph) and the 13 remaining turbines would be feathered below 3.0 m/s (6.7 mph) when temperatures are above 10 °C (50 °F). The USFWS has determined that this level of operational minimization is expected to reduce bat fatality rates by at least 76%, based on publicly available curtailment studies (Attachment C).

Indiana Bat Take and Impact of the Taking

Under the operational minimization measures for Alternative 3, the Project is expected to take 1.17 Indiana bats annually, or up to 41 Indiana bats over the 35-year life of the Project. Using the methods described for Alternative 2, the removal of 31 female Indiana bats over the permit duration would result in a reproductive loss of 49 female pups. The combined take estimate and lost reproductive potential for this alternative (80 Indiana bats) would be greater than the estimated impact under Alternative 1 (no Indiana bats would be taken), but less than the estimated impact under Alternative 2 (133 Indiana bats).

Northern Long-eared Bat Take and Impact of the Taking

Under the operational minimization measures for Alternative 3, the Project is expected to take 0.77 northern long-eared bat annually, or up to 27 northern long-eared bats over the 35-year life of the Project. Using the methods described for Alternative 2 to estimate impacts associated with reproductive loss, the removal of 14 female northern long-eared bats over the permit duration would result in a reproductive loss of 22 female pups. The combined take estimate and lost reproductive potential for this alternative (36 northern long-eared bats) would be greater than the estimated impact under Alternative 1 (no northern long-eared bats would be taken), but less than the estimated impact under Alternative 2 (58 northern long-eared bats).

Unlisted Bat Mortality

From implementation of the proposed turbine operations for Alternative 3, the Project is expected to take 622.75 bats annually, or approximately 21,796 bats over the 35-year life of the Project, which is greater than that expected for Alternative 1, but less than expected under Alternative 2. This estimate includes Project-related mortality alone and does not attempt to account for lost reproductive potential.

Mitigation for Taking Covered Species

Under Alternative 3, the Applicant would be required to offset the impact of taking listed bats, as described for Alternative 2, but to a lesser degree because this alternative would result in less take of Covered Species. Listed and unlisted bats would benefit from summer maternity and fall staging/swarming habitat preservation carried out by the Applicant.

5.2.4.8 Summary of Effects to Bat Resources

Table 5-3 provides a summary of the effects of each Alternative, indicating the potential impacts unique to each Alternative (*italicized*). Fatality estimates under each alternative are provided in Table 5-4.

The USFWS predicts that the implementation of Alternative 1 would be unlikely to result in take of either of the Covered Species. Under Alternative 2, the Applicant is requesting a take limit of 69 Indiana bats and 45 northern long-eared bats over the 35-year life of the Project. The total impact of the taking would be 133 female Indiana bats and 58 female northern long-eared bats over the 35-year life of the Project. Take of listed bats would be reduced under Alternative 3, resulting in direct take of 41 Indiana bats and 27 northern long-eared bats (Table 5-4).

Under Alternatives 2 and 3, the Applicant would fully mitigate for the impact of the take of Covered Species through summer maternity and fall staging/swarming habitat preservation. This mitigation would not be required under the Alternative 1 because take of listed bat species would not be likely to occur.

The USFWS assumes the Project would result in mortality of unlisted bats under all three alternatives. Under Alternative 1, which has the most restrictive operational measures, the Project would result in at least an 80% reduction in unlisted bat mortality. Implementation of the operational measures proposed under Alternatives 2 and 3 would be expected to reduce unlisted bat mortality by 60% and 76%, respectively. Knowledge of populations is necessary to understand the implications of cumulative bat mortality. Unfortunately, little information is currently available to inform current population estimates for most bat species in North America at local, regional, or continental scales (O'Shea et al. 2004, Kunz et al. 2007a). Hence, there is insufficient information to understand the population-level effects associated with this level of mortality, particularly for migratory tree-roosting bat species. The ongoing monitoring required at the Project and other facilities would allow tracking of impacts, including the proportions of fatalities among the various species.

Table 5-3. Comparison of the effects to bats for each alternative; italics indicate effects are unique to that alternative.

Alternative and Operational Adjustments[1]	Indiana Bat	Northern Long-eared Bat	Unlisted Bats
Alternative 1: No-Action • Spring migration (April 1 – May 15) – Feathered below 5.0 m/s (11.2 mph) cut-in speed • Summer maternity season (May 16 – July 31) – Feathered below 6.9 m/s (15.4 mph) cut-in speed at 39 turbines within 305 m (1,000 ft) of suitable habitat; below 3.0 m/s (6.7 mph) wind speed (manufacturer's default) at 13 remaining turbines • Fall migration (August 1 – October 15) – Feathered below 6.9 m/s (15.4 mph) cut-in speed • Inactive season (October 16 – March 31) – Feathered below 3.0 m/s (6.7 mph) wind speed (manufacturer's default)	• ***No mortality*** *of Indiana bats anticipated during summer or either spring or fall curtailment periods*	• ***No mortality*** *of northern long-eared bats anticipated during summer or either spring or fall curtailment periods*	• Bat mortality comparable to projects in the region • Migratory tree-roosting species primarily affected • ***~ 80% reduction in annual bat mortality[2]***
Alternative 2: Proposed Action • Spring migration (April 1 – May 15) – Feathered below 3.0 m/s (6.7 mph) cut-in speed (manufacturer's default) • Summer maternity season (May 16 – July 31) – Feathered below 5.0 m/s (11.2 mph) cut-in speed at 39 turbines within 305 m (1,000 ft) of suitable habitat when temperatures are above 10 °C (50 °F); below 3.0 m/s (6.7 mph) wind speed (manufacturer's default) at 13 remaining turbines • Fall migration (August 1 – October 15) – Feathered below 5.0 m/s (11.2 mph) cut-in speed when temperatures are above 10 °C (50 °F) • Inactive season (October 16 – March 31) – Feathered below 3.0 m/s (6.7 mph) cut-in speed (manufacturer's default)	• Substantially reduced mortality anticipated during summer maternity season and fall • ***Mortality of ~1.95*** *Indiana bats annually*	• No mortality anticipated during summer • Substantially reduced mortality anticipated during fall • ***Mortality of ~1.27*** *northern long-eared bats annually*	• Bat mortality during spring migration comparable to projects in the region • Substantially reduced mortality anticipated during summer and fall • Migratory tree-roosting species primarily affected • ***~ 60% reduction in annual bat mortality[2]***

Table 5-3 (Cont'd.). Comparison of the effects to bats for each alternative; italics indicate effects are unique to that alternative.

Alternative and Operational Adjustments[1]	Indiana Bat	Northern Long-eared Bat	Unlisted Bats
Alternative 3: More Restrictive Operations • Spring migration (April 1 – May 15) – Feathered below 3.0 m/s (6.7 mph) cut-in speed when temperatures are above 10 °C (50 °F) • Summer maternity season (May 16 – July 31) – Feathered below 6.5 m/s (14.5 mph) cut-in speed when temperatures are above 10 °C (50 °F) at 39 turbines within 305 m (1,000 ft) of suitable habitat; feathered below 3.0 m/s (6.7 mph) cut-in speed when temperatures are above 10 °C (50 °F) at the remaining 13 turbines • Fall migration (August 1 – October 15) – Feathered below 6.5 m/s (14.5 mph) cut-in speed when temperatures are above 10 °C (50 °F) • Inactive season (October 16 – March 31) – Feathered below 3.0 m/s (6.7 mph) cut-in speed (manufacturer's default)	• Minimal mortality anticipated during summer and fall • Substantially reduced mortality anticipated during spring • ***Mortality of ~1.17*** *Indiana bats annually*	• No mortality anticipated during summer • Reduced mortality during spring • Minimal mortality anticipated during fall • ***Mortality of ~0.77*** *northern long-eared bats annually*	• Reduced mortality during spring • Minimal mortality anticipated during summer and fall • Migratory tree-roosting species primarily affected • ***~ 76% reduction in annual bat mortality***[2]

1. All curtailment restrictions are applicable from 30 minutes before sunset until 30 minutes after sunrise.
2. Reduction in bat mortality derived from publicly available curtailment studies (Attachment C)

Table 5-4. Comparison of estimates of Indiana bat, northern long-eared bat, and unlisted bat species mortality across alternatives.

Species	Impact	Alternatives		
		1: No-Action Alternative	2: Proposed Action	3: More Restrictive
Indiana bat	Expected annual take	0	1.95	1.17
	Total expected take (annual x 35 years)	0	69	41
	Take of females (75% of take)	0	51	31
	Lost reproductive potential (lost female pups from every taken female)	0	81	49
	Impact of take to be mitigated (taken females + female pups)	0	133	80
Northern long-eared bat	Expected annual take	0	1.27	0.77
	Total expected take (annual x 35 years)	0	45	27
	Take of females (50% of take)	0	22	14
	Lost reproductive potential (lost female pups from every taken female)	0	36	22
	Impact of take to be mitigated (taken females + female pups)	0	58	36
Unlisted bats	Expected annual take[1]	518.96	1,037.92	622.75
	Total expected take (annual x 35 years)	18,164	36,327	21,796

Note: Values derived using a spreadsheet application and reflect rounding. Applying straight arithmetic may result in slight variations in the results.

1. Based on fatality rate of 19.96 bats per MW per year.

5.3 Physical Environment

5.3.1 Air Quality and Climate

5.3.1.1 Impact Criteria

The CAA and the CAA Amendments of 1990 established NAAQS for selected pollutants. The NAAQS established maximum levels of acceptable background pollution with a margin of safety to protect public health and welfare (see additional discussion in Section 4.3.1). NAAQS compliance in Indiana is monitored by the IDEM.

5.3.1.2 Direct and Indirect Effects

Air temperatures in Indiana have warmed by 1.2 °F since 1895, and are projected to rise about 5 °F to 6 °F above the state's average temperatures (recorded from 1971 to 2000) by the middle of the century (Widhalm et al. 2018). Rising temperatures could result in adverse impacts to air quality and amplify existing threats to human health (USEPA 2016). Increased temperatures can

also increase the production of ground-level ozone, which can cause lung and heart problems (USEPA 2016).

Regardless of the Alternative implemented, Project operations will not release pollutants into the atmosphere, result in major adverse effects to air quality, or exacerbate increased air temperatures in Indiana. Project operations require a small amount of vehicular traffic that will release carbon dioxide emissions and particulates, and Project maintenance and post-construction mortality monitoring will necessitate some increases in vehicular traffic and large equipment in and around the Project. However, this added impact to air quality is expected to be inconsequential and similar among all the alternatives. These emissions are not estimated to have a measurable effect on local or regional air quality or contribute greatly to the generation of greenhouse gas emissions.

5.3.1.3 Summary of Effects to Air Quality and Climate

No significant differences with regard to impacts to air quality are expected under the three alternatives. Under each of the alternatives, Project operations and maintenance would have minor effects on air quality. Project operations would not produce greenhouse gases or contribute to the problems generally associated with climate change issues. In addition, operation of the Project will offset demand for other energy generation technologies that produce carbon emissions that have been shown to contribute to global climate change. The proposed mitigation projects, which would preserve 102 ac of forested habitat are expected to have negligible effects to air quality and climate.

5.3.2 Noise

5.3.2.1 Impact Criteria

In Indiana, standards for wind projects, including those for noise, are defined at the county level. Within Jay County, the maximum sound level associated with a wind farm permitted within 61 m (200 ft) of a primary residence ranges from 41 dB to 75 dB for octave bands ranging from 8,000 Hz to 63 Hz, respectively (Jay County 2012).

5.3.2.2 Direct and Indirect Effects

Across the three alternatives, daytime operations are expected to have the same noise impacts. Turbines would operate at the manufacturer's cut-in speed of 3.0 m/s (6.7 mph), and would generate the same levels of noise. Project vehicles and maintenance repairs also would generate the same levels of noise regardless of alternative. Conversely, nighttime noise would vary among alternatives based on the operational restrictions implemented for bat mortality minimization. Noise resulting from implementation of the proposed mitigation projects (preservation of existing forested habitat) is expected to be negligible.

Acoustic modeling was conducted for the Project that assumed all turbines would be operating at maximum power output (and therefore, maximum sound levels) at all times to represent worst-case noise impacts from the wind farm. The results of the acoustic modeling determined that overall sound level at nearby residences would be 48.7 dBA or lower, and that operation of the Project would not exceed noise levels specified in the Jay County noise ordinance (Burns and

McDonnell 2019a, 2019b). Acoustic modeling was not conducted for each of the three alternatives considered; however, because the model assumed all turbines would be operating at all times, the results indicate that each of the three alternatives would meet noise levels specified in the Jay County noise ordinance.

Alternative 1: No-Action Alternative

The three alternatives operate at the same cut-in speed of 3.0 m/s (6.7 mph) during the winter (October 16 through March 31) and under certain conditions during the summer (May 16 through July 31) (see Table 5-1). However, Alternative 1 would utilize a higher cut-in speed than Alternatives 2 and 3 during the spring and fall migration seasons (April 1 through May 15 and August 1 through October 15, respectively), and during the summer (May 16 through July 31) at the 39 turbines within 305 m (1,000 ft) of suitable habitat. When wind speeds are less than the designated cut-in speeds, turbines would not operate and no noise would be emitted. Because this alternative uses a higher cut-in speed under certain conditions than Alternatives 2 or 3, turbines would be operating a lower percentage of the time, and therefore, Alternative 1 would result in the lowest nighttime noise levels.

Alternative 2: Proposed Action

Under Alternative 2, from 30 min before sunset to 30 min after sunrise, 39 of the turbines would have an increased cut-in speed when temperatures are above 10 °C (50 °F) from May 16 through July 31, and all turbines would have a higher cut-in speed when temperatures are above 10 °C (50 °F) from August 1 through October 15 (see Table 5-1). Although the results of the acoustic modeling determined that overall sound level at nearby residences would not exceed noise levels specified in the Jay County noise ordinance, Alternative 2 has the least restrictive nighttime operating regime, resulting in higher nighttime noise levels than Alternatives 1 or 3.

Alternative 3: More Restrictive Operations

Under Alternative 3, from 30 min before sunset to 30 min after sunrise when temperatures are above 10 °C (50 °F), turbines would have a higher cut-in speed than Alternative 2 from April 1 through May 15 and from August 1 through October 15, and 39 of the turbines would have higher cut-in speeds from May 16 through July 31 (see Table 5-1). This is a more restrictive nighttime operating regime than Alternative 2, and would result in reduced nighttime noise levels.

5.3.2.3 Summary of Effects to Noise

The results of the acoustic modeling determined that overall sound levels associated with each of the three alternatives would not exceed noise levels specified in the Jay County noise ordinance. Under certain conditions (based on the temperature and time of the year), nighttime noise levels would vary among alternatives, with Alternative 1 generating the lowest nighttime noise levels and Alternative 2 generating the highest noise levels; however, these differences are not expected to be significant.

5.4 Socioeconomic Environment

5.4.1 Impact Criteria

Effects would be considered significant if the following occurred as a result of implementing any of the three alternatives:

- decline in local or regional employment;
- decrease in local or regional property values;
- decline in valuable community services; or
- disproportionate share of adverse environmental effects placed on any minority or low-income community.

Impacts to the socioeconomic environment were examined for the state of Indiana; Jay County; and the cities of Dunkirk, Redkey, and Ridgeville. The proposed mitigation projects are expected to have negligible effects to social and economic conditions.

5.4.2 Direct and Indirect Effects

5.4.2.1 Project Operations and Maintenance

Implementation of any of the three alternatives is not expected to result in reduced valuation in properties within and proximal to the Project. At one project in Illinois, Hinman (2010) found an initial stigma associated with wind farms may have caused property values to diminish during the proposal and planning stage; however, property values rebounded and some increased around the facility once constructed. Similarly, Hoen et al. (2009) looked at data from roughly 7,500 homes situated within 16 km (10 mi) of wind facilities and found no consistent, measurable, or statistically significant effect on home sales prices relative to the view of a wind facility or the distance of the home to the facility. This is consistent with a study by Vyn and McCullough (2014) that suggested wind turbines at one of Ontario, Canada's oldest wind projects have not significantly impacted nearby property values.

Implementation of any of the three alternatives would result in payment of the same annual property taxes to Jay County, following the initial 10-year tax abatement. Implementation of any of the alternatives would result in similar benefits to those community services that receive funding derived from taxes paid by the Applicant. Expenditures made for equipment, energy, fuel, operating supplies, and other products and services are expected to benefit businesses.

Implementation of any of the three alternatives is not expected to affect community services such as water and wastewater services. All alternatives would have the same effect on those community-based services that derive funding from the tax revenue provided by the Project. Project operation and maintenance is not expected to impact other industries within the Project area and would have negligible impacts to the community-based services that derive funding from the tax revenue provided by the Project. Property taxes and the number of permanent jobs would be the same under each of the three alternatives.

Landowners with turbines receive royalty payments, which are in part based on the actual generation of the turbine on their land. As production is reduced, the landowner receives less income down to a minimum value. Energy production would be highest under the Alternative 2 (Proposed Action), followed logically by Alternative 3 (More Restrictive Operations) and Alternative 1 (No-Action Alternative). Insufficient data exist to characterize the extent of the effect that restricted operations under any individual Alternative would have on royalty payments to the landowners.

Impacts associated with Project maintenance would not vary among the three alternatives. The Project is expected to need the same level of maintenance in the event or absence of operational restrictions.

No minority or low-income communities would be disproportionately affected by operation of the Project. Redkey, the city closest to the Project has a slightly higher percentage of persons below the poverty level (19.1%) than Jay County as a whole (17.9%) (U.S. Census Bureau 2017); however, socioeconomic impacts to this community are expected to be minor, and the additional local revenue generated by operation of the Project may benefit this community.

5.4.3 Summary of Effects to the Socioeconomic Environment

Adverse effects to the socioeconomic conditions at the state or local levels are not anticipated as a result of any of the three alternatives. A disproportionate share of adverse environmental effects resulting from operations and maintenance would not be placed on any minority or low-income community. No specific mitigation measures for socioeconomics or environmental justice would be implemented under any of the three alternatives.

5.5 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 Proposed Action or action 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 for analyzing cumulative effects, we focus our analysis on potential impacts to birds, the Covered Species, and unlisted bat species, as these are the only resources on which Project operations would have potentially adverse effects. Furthermore, only bats would be affected to varying degrees by the alternatives considered in this EA as we have assumed based on the available studies that operational adjustments would have negligible impacts to bird mortality. Similarly, this analysis largely focuses on cumulative effects of current, proposed, and projected wind energy development on birds and bats. We also analyze impacts associated with WNS for bats and other mortality sources for birds.

This section analyzes cumulative effects of the three alternatives and other past, current, proposed, or reasonably foreseeable future actions on birds, Indiana bat, northern long-eared bat, and unlisted bat species. The spatial scope of analysis (analysis area) for birds is the Partners in Flight Physiographic Area 31 (Area 31) (Partners in Flight 2000). The analysis area for Indiana bat is the MRU. The analysis area for northern long-eared bats and unlisted bat species includes the states of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.[7] The 35-year operational life of the Project is the temporal scope for all animal resources.

5.5.1 Wind Energy Development

Growth in the wind sector has been rapid in recent years, and the U.S. Energy Information Administration's (USEIA) energy forecasts recently indicated a nationwide growth in capacity of 4% annually between 2018 and 2050 (USEIA 2016). We recognize that wind development is likely to vary among states in the analysis area. Also, we derived these estimates using only one method among several that could be implemented. Nonetheless, the method presented below represents a straightforward means of estimating reasonably foreseeable wind energy development in the region.

Area 31 stretches from northeastern Missouri, across much of Illinois and through the middle of Indiana into Ohio. Current wind energy development in Area 31 was estimated by adding the estimates for Indiana, Illinois, and Ohio. Although Area 31 includes the northeast corner of Missouri, no wind projects are currently operational in this part of the state. However, a 400-MW wind project is under construction in Adair and Schuyler counties that is expected to become operational in 2020 (prnewswire.com 2019); therefore, this project was included in the calculations for projected growth to 2055. Area 31 currently has 7,933 MW of installed capacity, and is expected to have 34,135 MW of installed capacity by 2055.

We estimated wind energy development in the MRU by adding the estimates for Indiana, Michigan, Ohio, and Tennessee. Although the MRU includes Kentucky, northern Alabama, and the southwest tip of Virginia, no wind projects occur in these areas. Currently, the MRU includes 2,777 turbines totaling 5,140 MW of installed capacity. Applying the same 4% annual growth rate to the installed capacity in the MRU yields an estimated 21,094 MW of installed capacity by 2055.

According to market report data compiled by the American Wind Energy Association for the third quarter of 2019, a total of 13,819 turbines capable of generating 24,504 MW are currently installed in the eight-state analysis area for northern long-eared bats and unlisted bats (American Wind Energy Association 2019) (Table 5-5). Applying this growth rate to installed capacity over the 35 years of the permit term, we estimate a total capacity of 102,141 MW in the analysis area for northern long-eared bats and unlisted bats by 2055.

[7] The analysis area for cumulative effects on northern long-eared bats and unlisted bats includes the eight states that previously comprised the USFWS Midwest Region, which differs from the six-state Interior Region 3.

Table 5-5. Installed and projected wind energy development in the cumulative effects analysis area.

State	Current Installed		Projected Growth to 2055 [1]	
	# Turbines	# MW	# Turbines	# MW
Illinois	2,778	4,887	11,401	20,056
Indiana	1,264	2,317	5,187	9,509
Iowa	4,859	8,965	19,941	36,759
Michigan	1,113	2,065	4,568	8,475
Minnesota	2,472	3,845	10,145	15,780
Missouri	499	959	2,738[2]	5,514[2]
Ohio	382	729	1,568	2,992
Tennessee	18	29	74	119
Wisconsin	452	737	1,855	3,025
Area 31 Subtotal[3]	4,424	7,933	18,846	34,135
Indiana Bat MRU Subtotal[4]	2,777	5,140	11,397	21,094
Northern Long-eared Bat and Other Bat Subtotal[5]	13,819	24,504	57,403	102,141

1. Year 2055 second quarter estimates, assuming 4% annual growth, the nationwide trend estimated for wind energy from 2018 to 2050 (USEIA 2016).
2. Includes the High Prairie Wind Power Facility, which is currently under construction in northeast Missouri and includes 175 turbines that will generate 400 MW.
3. Area 31 subtotal based on sums from Illinois, Indiana, Ohio, and northeast Missouri.
4. Indiana Bat MRU subtotal based on sums from Indiana, Michigan, Ohio, and Tennessee.
5. Northern Long-eared Bat and Unlisted Bat subtotal based on sums from Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

Sources: American Wind Energy Association 2019, prnewswire.com 2019

5.5.2 Avian Resources

Our cumulative effects analysis for birds primarily focuses on mortality attributable to the Project in the context of other existing and future wind facilities in Area 31. This analysis also considers some other anthropogenic sources of bird mortality. We briefly discuss on a national scale those elements that are known to cause avian mortality. Researchers typically use data at the national scale to provide estimates of bird mortality from an anthropogenic source.

This analysis includes past and present actions and reasonably foreseeable future sources of impacts to birds during the 35-year operation of the Project. Based on our analysis of direct and indirect effects to avian resources in Section 5.2.3.2, the Project will kill, disturb, and displace birds due to Project presence and operations. We recognize that birds are likely to sustain these same effects at all wind projects in Area 31.

5.5.2.1 Wind Project Mortality

Based on fatality rates reported for a total of 41 other wind projects in the Midwest (Brown and Schmitt 2019, which is appended to Attachment A [within the BBCS, see Appendix B – Bitter Ridge Wind Farm Baseline Avian Studies May 2017 – May 2019]), we applied the Midwestern regional average avian fatality rate of 2.63 birds/MW/year to estimate the Project's annual rate,

which results in approximately 342 bird fatalities per year, of which roughly 70% are expected to be passerines. Based on this average fatality rate, over the 35-year permit term, the Project may result in approximately 11,970 bird fatalities.

Using the same regional average avian fatality rate of 2.63 birds/MW/year to the current installed capacity of wind projects in Area 31 (7,933 MW), wind energy facilities in Area 31 currently kill roughly 21,000 birds each year. Again, approximately 70% of these fatalities are expected to be passerines (i.e., 14,700 passerines each year). As discussed, bird mortality at the Project is expected to be the same regardless of the alternative under which the Project operates, on average 342 birds per year. Therefore, the Project will contribute approximately 2.9% of the annual bird mortality from wind projects in Area 31 during the first year of Project operations, but the Project contribution will decline over the life of the Project as more wind capacity is installed in Area 31. Assuming a 4% increase in installed wind capacity per year, the rate estimated in USEIA (2016), 34,135 MW are expected to occur in Area 31 by 2055. Based on the average rate of bird mortality (2.63 birds/MW/year) and the expected annual increase in installed wind capacity (4%), wind projects in Area 31 may kill an estimated 1,512,500 birds over the permit term. The 11,970 birds expected to be killed at the Project over the permit term constitute 0.8% of the wind-related mortality in Area 31 expected over the 35-year permit term.

Four BCC species have been documented at the Project during pre-construction surveys (Section 5.2.3.2). Based on a review of fatalities documented during 166 fatality studies at wind farms in North America, collisions with wind turbines kill relatively small proportions (less than 0.05% annually) of passerine populations (Erickson et al. 2014b). We do not expect that wind projects in either Bird Conservation Region 22 or Area 31 will cause population-level effects to avian resources, including BCC species.

5.5.2.2 Climate Change

Climate change is a factor in past, present, and reasonably foreseeable future cumulative impacts on bird populations. Based on past and continuing trends, the potential for climate change to cumulatively contribute to changes in bird population numbers is high. Climate change is expected to result in long-term changes in North American bird distributions (King and Finch 2013) and loss of biodiversity (North American Bird Conservation Initiative 2016, Rosenberg et. al 2019). In addition to direct impacts from extreme weather events (e.g., fire, flooding, drought, heat waves), climate change has resulted in many birds' distributions shifting northwards over the past few decades (King and Finch 2013).

Project operations would not produce greenhouse gases or contribute to the problems generally associated with climate change issues. In addition, operation of the Project will offset demand for other energy generation technologies that produce carbon emissions that have been shown to contribute to global climate change. Therefore, the Project and expansion of wind energy in the region are not expected to contribute to incremental cumulative effects to avian species associated with climate change.

5.5.2.4 Other Anthropogenic Sources of Avian Mortality

Discussed below and included in Table 5-6 are estimates of anthropogenic sources of bird mortality for the U.S. in general. We recognize that 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 available.

Table 5-6. Estimated annual avian mortality from anthropogenic causes in the United States.

Source	Estimated Mean Annual Mortality	% of Overall Mortality
Depredation by domestic cats	100 million – 2.4 billion	17 – 71
Collisions with buildings	304 – 550 million	16 – 52
Automobiles	80 – 200 million	6 – 14
Collisions with power lines	25 – 130 million	2 – 11
Pesticides	67 million	4
Communication towers	6.5 – 50 million	1
Oil pits	750,000	<1
Wind turbines	174,000	<1
Total mortality	583 million – 25 billion	

Sources: Erickson et al. 2005, Dauphiné and Cooper 2009, Manville 2009, Loss et al. 2013

The leading anthropogenic sources of bird mortality in the U.S. are considered to be cat predation and collision with buildings, collectively resulting in between 404 million and nearly 3 billion bird mortalities annually (Table 5-6). Cat predation is considered the most significant anthropogenic source of bird mortality in the U.S. (Dauphiné and Cooper 2011). Domestic cats are considered as the primary cause for the extinction of 33 bird species since the 1600s (Winter and Wallace 2006). Publicly available estimates of avian collisions with buildings and windows vary widely, and suggest a range of 97 million to 1.2 billion bird deaths per year (Erickson et al. 2005, Loss et al. 2014). The vast majority of avian collisions with buildings and windows involve passerines (Erickson et al. 2005).

In addition to the sources described in Table 5-6, avian resources have experienced impacts in Area 31 due to land conversion (habitat loss) associated with oil and gas development, urbanization, agriculture, and residential development. All of these are likely to continue into the reasonably foreseeable future. Agriculture activities, urbanization, and residential development convert habitat for the length of time that the development is maintained. Conversely, some active agricultural lands may become inactive and revert to native habitats within the 35-year permit term. Reasonably foreseeable future actions in the Project area for the next 35 years that will affect avian resources include low-density development for residences. Development that includes pavement (asphalt, concrete) results in an extreme conversion of habitat with a very slow recovery rate unless pavement is removed. This will largely affect those birds that are likely to use agriculture lands.

5.5.2.5 Summary of Cumulative Effects to Avian Resources

The USFWS acknowledges that bird mortality at wind projects contributes to overall avian mortality. Compared to other anthropogenic sources of avian mortality (see Table 5-6), the effect of avian mortality at wind energy facilities is minor.

None of the alternatives considered are expected to cause naturally occurring populations of birds to be reduced to numbers below levels for maintaining viability at local or regional levels. Similarly, because the Project is currently operational, none of the alternatives would result in loss or degradation of habitat for avian species.

Project mortality would contribute cumulatively to other causes of mortality, specifically wind projects, other anthropogenic sources, and climate change as described above. Less than 0.1% of all anthropogenic bird mortality is attributed to wind projects (Table 5-6). The USFWS finds that this amount of bird mortality is not likely to result in population-level impacts to any avian species. The BBCS (Attachment A), which would be implemented under each of the three alternatives, includes a monitoring plan and adaptive management framework designed to monitor bird mortality and respond to significant events should they occur.

5.5.3 Bat Resources

The cumulative effects analysis for bats primarily focuses on mortality attributable to wind facilities in the MRU (Indiana bat) and the eight-state analysis area northern long-eared bats and unlisted bats. This analysis also considers the cumulative effects of WNS and habitat impacts to bats.

5.5.3.1 Wind Project Mortality

This analysis includes past and present actions and reasonably foreseeable future sources of impacts to bats during the 35-year operational life of the Project. Based on the analysis of direct and indirect effects to bat resources described in Section 5.2.4.6, operation of the Project has the potential to kill bats. The USFWS recognizes that bats will sustain similar effects at all wind projects in the analysis area.

Indiana Bats

Nine Indiana bat fatalities have been documented at wind projects in the MRU, with six of these fatalities occurring in fall, two in spring, and one in summer (see Table B-1 in Attachment B). Any project within the MRU has the potential to take an Indiana bat during the fall or spring migratory season. At Fowler Ridge, two years of monitoring led to a baseline mortality estimate of 0.03 Indiana bat per MW (0.05 Indiana bat per turbine) at fully operational turbines.[8] Applying this same estimate to the current installed wind energy capacity in the MRU (2,777 turbines and 5,140 MW) results in 154 Indiana bats taken per year within the MRU. By year 2055, the annual take estimate would be approximately 633 Indiana bats based on the projected wind development indicated in Table 5-5. This represents 0.26% of the 2019 Indiana

[8] The per turbine and per MW rates used here are based on mortality estimates from Fowler Ridge. Because the ratio of MW to turbines will change from project to project and within a group of projects, one will derive a range of mortality when applying both the per turbine and per MW rates simultaneously.

bat population in the MRU (245,474 bats). Summing the estimated mortality over the permit duration to year 2055 results in 12,599 Indiana bats taken by wind projects cumulatively in the MRU. This estimate assumes no operational curtailment, no mitigation benefit, and that baseline Indiana bat populations remain constant, none of which is a likely scenario. However, this represents a worst-case scenario for the purposes of assessing cumulative effects of wind projects and the contribution of each alternative to the cumulative impact.

Table 5-7 provides a summary of cumulative effects to bats from each of the analyzed alternatives and from the future installed capacity of wind projects in the MRU. The No-Action Alternative is not likely to take Indiana bats, and would therefore not contribute to cumulative impacts to Indiana bat. The Proposed Action (Alternative 2) would take an estimated 1.95 Indiana bats per year and 69 bats over the duration of the permit, accounting for 0.028% of the cumulative take estimated for the MRU during the same period. Alternative 3 is estimated to take 1.17 Indiana bats per year and 41 Indiana bats over the full permit duration. The action alternatives are not substantially different in the extent to which they contribute to cumulative impacts to Indiana bat, particularly considering that the Applicant would offset estimated take associated with Alternatives 2 and 3 using mitigation of summer maternity habitat and fall staging/swarming habitat.

Northern Long-eared Bats

Publicly available post-construction monitoring results for the analysis area reported eight northern long-eared bat fatalities (see Table B-2 in Attachment B). Any project within the species' range has the potential to take northern long-eared bat, particularly during the fall migratory season. Such was the case for the one documented fatality at Fowler Ridge where more than 3 years of monitoring lead to a baseline mortality estimate of 0.014 bat per MW (0.024 northern long-eared bat per turbine) at fully operational turbines. Applying this same estimate to the current installed wind energy capacity in the analysis area (24,504 MW) yields 343 northern long-eared bats taken each year. By year 2055, the annual take estimate would be approximately 1,430 northern long-eared bats based on the projected wind development indicated in Table 5-5. Summing the annual mortality over the operational life of the Project, through 2055, results in approximately 28,463 northern long-eared bats taken by wind projects cumulatively in the analysis area. This estimate assumes no operational curtailment and no mitigation benefit, neither of which is considered a likely scenario. Rather, this represents a worst-case scenario for the purposes of assessing the contribution of each alternative to the cumulative totals.

The USFWS estimates there are 2,785,032 northern long-eared bats in the analysis area (USFWS 2016b). An annual mortality of 1,430 northern long-eared bats is approximately 0.05% of the population within the analysis area. The cumulative mortality through 2055 of roughly 28,463 is 1.02% of the regional population. The USFWS concludes that this extent of mortality at the Project level and the regional level is not likely to lead to population-level declines of northern long-eared bat.

Table 5-7. Comparison of estimates of Indiana bat, northern long-eared bat, and unlisted bat species mortality across alternatives.

Species	Impact	Alternatives		
		1: No-Action Alternative	2: Proposed Action (5.0 m/s cut-in)	3: More Restrictive (6.5 m/s cut-in)
Indiana bat	Annual mortality	0	1.95	1.17
	35-year mortality	0	69	41
	Cumulative MRU fatalities through 2055[1]	12,599	12,599	12,599
	Project % contribution to MRU wind mortality	0%	0.028%	0.017%
Northern long-eared bat	Annual mortality	0	1.27	0.77
	35-year mortality	0	45	27
	Cumulative fatalities through 2055[2]	28,463	28,463	28,463
	Project % annual contribution to wind mortality within analysis area	0%	0.16%	0.09%
Unlisted bats	Annual mortality	519	1,038	623
	35-year mortality	18,164	36,327	21,796
	Cumulative fatalities through 2055[3]	40,336,132	40,336,132	40,336,132
	Project % contribution to wind mortality within analysis area	0.05%	0.09%	0.05%

1. Based on 5,140 MW of currently installed wind capacity in the USFWS MRU states (AWEA 2019), estimated 4% annual increasing wind capacity (USEIA 2016), and an Indiana bat fatality rate of 0.03 bat per MW (see Section 5.5.3.1).
2. Based on 24,504 MW of installed wind capacity in the eight-state analysis area (AWEA 2019), estimated 4% annual increasing wind capacity (USEIA 2016), and a northern long-eared bat fatality rate of 0.014 bat per MW (see Section 5.5.3.1).
3. Based on 24,504 MW of installed wind capacity in the eight-state analysis area (AWEA 2019), estimated 4% annual increasing wind capacity (USEIA 2016), and an unlisted bat fatality rate of 19.84 bats per MW, the average rate observed at nine wind projects over multiple years (see Table B-3 in Attachment B).

Table 5-7 provides a summary of cumulative effects to northern long-eared bats from each of the analyzed alternatives and from the future installed capacity of wind projects in the analysis area. The No-Action Alternative is not likely to take northern long-eared bats, and would therefore not contribute to cumulative impacts to the northern long-eared bat. The Proposed Action (Alternative 2) would take an estimated 1.27 northern long-eared bats per year and 45 bats over the course of the permit duration, accounting for 0.16% of the cumulative take estimated for the analysis area during the same period. Alternative 3 would take 0.77 northern long-eared bat per year and 27 bats over the permit duration, accounting for 0.09% of the cumulative take during this period.

The action alternatives are not substantially different in the extent to which they contribute to cumulative impacts to northern long-eared bat, particularly considering that the Applicant would offset estimated take associated with Alternatives 2 and 3 through protection of summer maternity habitat for northern long-eared bats.

Unlisted Bats

Rates of mortality of unlisted bats vary substantially among projects and depend to a large extent on operational decisions and turbine characteristics, both of which are subject to change over time as the wind industry grows and becomes more sophisticated. For the Project, we used a fatality rate of 19.84 bats per MW, which is based on data collected at Fowler Ridge (see Section 5.2.4.4). For the purposes of assessing cumulative impacts to unlisted bats, we use an average fatality rate of 19.84 bats per MW per year, which is based on publicly available information from nine wind projects in the eight-state analysis area (see Table B-3 in Attachment B). The bat fatality rates from these projects were based on uncurtailed operations, and roughly 84% of the fatalities were migratory tree-roosting bats (eastern red bat, hoary bat, and silver-haired bat). For the purposes of calculating cumulative impacts to unlisted bats, the USFWS assumed this rate is applicable for all wind projects in analysis area and that the rate would remain constant during the 35 years of Project operation.

Applying the 19.84 bats per MW fatality rate to the 24,504 MW of wind turbines currently installed in the analysis area yields a mortality estimate of roughly 486,159 unlisted bats, 408,374 (84%) of which would be migratory tree-roosting bats. Applying this rate to the projected installed capacity of 102,141 MW of wind turbines in year 2055 indicates annual mortality of approximately 2,026,481 unlisted bats, for a cumulative total of roughly 40 million bats taken during 35-year permit period, of which approximately 34 million would be migratory tree-roosting bats. The USFWS assumed that the rate of 19.84 bats per MW per year is the appropriate rate, but regional fatality rates for bats are likely to decrease based on wind projects implementing voluntary operational curtailment under certain conditions, which may significantly reduce unlisted bat mortality region-wide. Nonetheless, this value provides a reasonable fatality rate for estimating cumulative effects to unlisted bats in the analysis area.

Cumulative mortality for unlisted bats across the three alternatives ranges from roughly 18,000 bats to 36,000 bats over the 35 years the Project would operate, accounting for less than 1% of cumulative mortality for the eight-state analysis area, with the Proposed Action accounting for 36,327 bats or 0.09% of cumulative mortality (Table 5-7). The three alternatives are not substantially different in the extent to which they contribute to cumulative impacts to unlisted bats. Additionally, mortality of unlisted bats at the Project is not expected to be a significant addition to the cumulative bat mortality at wind energy facilities in the analysis area, particularly with implementation of operational adjustments.

Looking at future wind project development, it is impossible to determine to what extent the cumulative estimate of 40 million bat fatalities over 35 years would cause population-level impacts to unlisted bats because no baseline population estimates exist for unlisted species. This particularly applies to the migratory tree-roosting bat species, the species group most susceptible to wind turbine mortality. Operational decisions made by individual wind projects will have a substantial effect on cumulative bat mortality on a regional level. Because bats are relatively long-lived and reproduce at a slow rate, removal of a substantial number of adults from the population is more likely to have adverse effects on bat populations than similar impacts to a species group with higher fecundity (Kunz et al. 2007a, 2007b; NRC 2007).

Under Alternatives 2 and 3, the Applicant would offset estimated take of the Covered Species through protection of summer maternity habitat for Indiana bats and northern long-eared bats and staging/swarming habitat for Indiana bats. It is assumed that implementation of the mitigation projects would also provide some benefit to unlisted migratory tree-roosting bats.

5.5.3.2 White-nose Syndrome

WNS has emerged as the largest single source of mortality for cave-hibernating bats in recent years. As of August 2019, WNS has been confirmed in 33 states and seven Canadian provinces, with evidence of the fungus that causes the disease in five additional U.S. states (White-nose Syndrome Response Team 2019). The current estimate of total bat mortality since the discovery of the disease in 2006 is 6.7 million bats (USFWS 2012). 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). To date, WNS has not been documented in migratory tree-roosting bat species (hoary bat, silver-haired bat, eastern red bat), which account for the majority of wind turbine-related mortality.

The USFWS has estimated a decline of 19.2% in the number of Indiana bats range-wide since the discovery of the disease in 2007, with a decline of 4.4% estimated within the eight-state area since 2017 (USFWS 2019a). This decline is most likely attributed to WNS, and there have been some hibernacula studies that have documented a 100% mortality rate of Indiana bat due to WNS (Turner et al. 2011). The estimated decline throughout their range and within the Midwest does not necessarily represent the total decline due to WNS, as certain northeastern bat populations appear to be stabilizing or even increasing gradually several years following the initial discovery of WNS. As of winter 2019, the disease has been confirmed in multiple hibernacula in the MRU. Mortality associated with the disease in the MRU could be similar to that documented in the Appalachian MRU, which has seen an approximate 20% decline since 2017, based on USFWS data (USFWS 2019a). A 20% decline in Indiana bat population in the MRU from 2017 would amount to a loss of nearly 49,095 Indiana bats (USFWS 2019a). Such a decline in Indiana bat populations across the region would likely reduce the probability of Indiana bat mortality at wind projects, but also would increase the ecological impact of all sources of mortality.

As described in Section 8.2.6 of the HCP (BRWF 2019), if the USFWS determines that WNS declines for the Covered Species constitutes a changed circumstance, BRWF would reassess the degree to which the authorized take impacts the population, would determine whether additional minimization or mitigation measures are warranted, and may reduce the permitted level of take through an ITP amendment.

5.5.3.3 Climate Change

As described above, many aspects of bat life history may be affected by long-term changes in climate (Sherwin et al. 2012). Although caves are buffered against changes in ambient temperatures, long-term changes in climate may disrupt cave climates and render existing cave roosts less suitable or unsuitable for bats and could render currently unsuitable caves suitable for roosting. Loeb and Winters (2013) modeled the effects of climate change on the Indiana bat and

predicted that due to warming temperatures, the Indiana bat's main maternity areas would shift from the Midwest into the northeast and Appalachian mountains and potential even into areas that currently have no maternity records.

Project operations would not produce greenhouse gases or contribute to the problems generally associated with climate change issues. In addition, operation of the Project will offset demand for other energy generation technologies that produce carbon emissions that have been shown to contribute to global climate change. Therefore, the Project and expansion of wind energy in the region are not expected to contribute to incremental cumulative effects associated with climate change.

5.5.3.4 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. Wind projects in the Midwest typically result in minimal impacts to forested habitat and may even create or preserve 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 incremental cumulative effects of summer bat habitat loss.

Similarly, winter bat habitat (caves and mines) are relatively static features on the landscape and are typically not threatened by development. WNS may have drastic impacts on hibernating bat populations, but does not alter the physical characteristics of hibernacula.

5.5.3.5 Summary of Cumulative Effects to Bat Resources

The USFWS acknowledges that bat mortality at wind projects contributes to overall bat mortality, and the Project mortality will contribute cumulatively to mortality associated with other wind projects. Compared to the effects of WNS, cave-dwelling bat mortality at wind energy facilities is minor. However, wind energy facilities kill more migratory tree-roosting bats than any other known documented source.

All three alternatives would contribute cumulatively to the effects associated with bat mortality. The USFWS finds that the No-Action Alternative would result in the lowest level of bat mortality (Table 5-4), because the operational measures would be expected to reduce take of unlisted bats by at least 80% and avoid take of the Covered Species. Contribution to cumulative impacts would be similar for Alternatives 2 and 3, although Alternative 3 would contribute slightly less to cumulative bat mortality than Alternative 2. Under any of the three alternatives, operation of the Project would represent a minor (less than 1%) portion of the cumulative impact of wind projects on bat mortality.

As compared to the No-Action Alternative, the Applicant's Proposed Operation (Alternative 2) would increase annual mortality of unlisted bats by approximately 200%. The Applicant's Proposed Operation also includes mitigation to offset mortality to Indiana bats and northern long-eared bats, and would likely benefit unlisted bat species. The HCP, as part of the Applicant's Proposed Operation, and the BBCS, for all alternatives, both include a monitoring plan and an adaptive management framework designed to respond to significant bat mortality should it be identified.

By 2055, the cumulative impact of wind power projects in the analysis area is predicted to result in mortality of roughly 40 million unlisted bats, most of these being migratory tree-roosting bats (approximately 34 million bats). The effect of cumulative mortality on unlisted bat populations is highly uncertain because estimates of current population sizes are unknown. In addition, operational decisions made by individual wind projects to reduce impacts to bats are expected to have a substantial effect on cumulative bat mortality on a regional level.

The USFWS cannot assess completely the cumulative effect of wind mortality on the Indiana bat in the MRU and on the northern long-eared bat in the eight-state analysis area in combination with WNS and climate change. Possibilities include a synergistic effect of three stressors affecting the species at the same time. It also is possible that as the population of either species is reduced by WNS and/or climate change, the numbers of bats taken at wind facilities also would be reduced. However, the impacts of taking bats are likely to increase because each individual will become more important. Research into these questions is ongoing and will likely focus, in part, on how these new stressors will affect rare bat populations and ecology.

The HCP discusses changed circumstances and the Applicant's proposed measures for addressing them should they occur, including those circumstances surrounding WNS (BRWF 2019). The responses are designed to reduce the impact to the MRU population of Indiana bat and local population of northern long-eared bat if the USFWS finds reduced population numbers brought about by WNS. In addition, it is reasonable to assume that other wind projects regulated under the ESA would have similar measures in place. This would presumably lessen the cumulative impact of wind project mortality on the MRU population of Indiana bat and local population of northern long-eared bat.

6 CONSULTATION AND COORDINATION

6.1 Agency Coordination

In support of the application to build a wind farm in Jay County, Indiana, the Applicant consulted with the USFWS, IDNR, Indiana State Historic Preservation Agency (IHPA), and other state and local agencies. The Service has engaged the IDNR in discussions relating to potential sites for conducting projects suitable for mitigating the unavoidable impacts of taking Indiana bats and northern long-eared bats.

6.2 Distribution of the Draft Environmental Assessment

In accordance with NEPA the draft EA, as well as the HCP and other application materials, was circulated for public review and comment. The public review period was initiated with the publication of the Notice of Availability (NOA) in the Federal Register, and the public comment period extended for 30 days from the date of publication ending on April 28, 2021. Four submittals were received, including a total of 14 comments, which were taken into account in assessing Project impacts. Responses to comments on the Draft EA and Draft HCP can be found in Attachment E.

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Attachment A. Bitter Ridge Bird and Bat Conservation Strategy

Available online at
https://www.fws.gov/midwest/endangered/permits/hcp/r3hcps.html

Attachment B. Documented Bat Fatalities at Wind Projects in the United States and Canada

Table B-1. Documented Indiana bat fatalities at Wind Projects in the Midwest Recovery Unit.

Site	Location	Approximate Date	Reference
Anonymous	IN	9/17/2018	Pruitt and Reed 2018
Anonymous	IN	5/1/2018	Pruitt and Reed 2018
Anonymous	IN	7/1/2017	Pruitt and Reed 2018
Anonymous	IN	8/23/2015	Pruitt and Reed 2018
Anonymous	OH	4/14/2014	Pruitt and Reed 2018
Anonymous	OH	10/8/2013	Pruitt and Reed 2018
Blue Creek	OH	10/3/2012	Pruitt and Reed 2018
Fowler Ridge	IN	9/18/2010	Good et al. 2011
Fowler Ridge	IN	9/11/2009	Johnson et al. 2010a

Table B-2. Documented northern long-eared bat fatalities at wind projects in the United States and Canada.

Site	Location	Approximate Date	Reference
California Ridge	IL	unknown	K. Shank, IDNR, pers. comm.
California Ridge	IL	unknown	K. Shank, IDNR, pers. comm.
Anonymous	IL	9/2/2014	M. Seymour, USFWS, pers. comm.
Heritage Garden	MI	7/10/2014	Curry and Kerlinger, LLC 2014
Anonymous	IL	5/2014	M. Seymour, USFWS, pers. comm.
Anonymous	IL	9/25/2013	M. Turner, USFWS, pers. comm.
Pioneer Prairie	IA	8/22/2013	M. Turner, USFWS, pers. comm.
Pioneer Prairie	IA	8/10/2013	M. Turner, USFWS, pers. comm.
Pennsylvania Game Commission site unknown	PA	7/2012	J. Taucher, PGC, pers. comm.
Noble Wethersfield	NY	9/3/2011	Kerlinger et al. 2011
Noble Wethersfield	NY	9/2/2011	Kerlinger et al. 2011
Noble Wethersfield	NY	8/18/2011	Kerlinger et al. 2011
Noble Wethersfield	NY	8/6/2011	Kerlinger et al. 2011
Criterion	MD	7/22/2011	Young et al. 2013
Noble Wethersfield	NY	7/17/2011	Kerlinger et al. 2011
Bear Mountain	British Columbia	9/01/2010	Hemmera 2011
Bear Mountain	British Columbia	9/01/2010	Hemmera 2011
Bear Mountain	British Columbia	8-9/2010	Hemmera 2011

Table B-2. Documented northern long-eared bat fatalities at wind projects in the United States and Canada.

Site	Location	Approximate Date	Reference
Bear Mountain	British Columbia	8/2010	Hemmera 2011
Bear Mountain	British Columbia	8/2010	Hemmera 2011
Cohocton/Dutch Hills	NY	6/22/2010	Stantec 2011
Noble Wethersfield	NY	6/11/2010	Jain et al. 2011
Anonymous	MO	9/2009	M. Turner, USFWS, pers. comm.
Pennsylvania Game Commission site 2-14	PA	9/2009	J. Taucher, PGC, pers. comm.
Fowler Ridge	IN	8/25/2009	Johnson et al. 2010a
Ripley	Ontario	9/5/2008	Jacques Whitford 2009
Mount Storm	WV	8/26/2008	Young et al. 2009b
Ripley	Ontario	8/4/2008	Jacques Whitford 2009
Noble Ellenburg	NY	8/2008	Jain et al. 2009
Steel Winds	NY	9/24/2007	Grehan 2008
Steel Winds	NY	9/4/2007	Grehan 2008
Erie Shores	Ontario	8/30/2007	James 2008
Erie Shores	Ontario	8/28/2007	James 2008
Erie Shores	Ontario	8/27/2007	James 2008
Steel Winds	NY	8/24/2007	Grehan 2008
Steel Winds	NY	8/24/2007	Grehan 2008
Steel Winds	NY	8/3/2007	Grehan 2008
Steel Winds	NY	7/13/2007	Grehan 2008
Erie Shores	Ontario	6/12/2007	James 2008
Erie Shores	Ontario	6/11/2007	James 2008
Erie Shores	Ontario	5/25/2007	James 2008
Kingsbridge I	Ontario	10/5/2006	Stantec Ltd. 2007
Meyersdale	PA	9/13/2004	Arnett et al. 2005
Meyersdale	PA	9/11/2004	Arnett et al. 2005
Mountaineer	WV	9/8/2003	Kerns and Kerlinger 2004
Mountaineer	WV	8/18/2003	Kerns and Kerlinger 2004
Mountaineer	WV	8-9/2003	Kerns and Kerlinger 2004
Mountaineer	WV	8-9/2003	Kerns and Kerlinger 2004
Mountaineer	WV	8-9/2003	Kerns and Kerlinger 2004
Mountaineer	WV	8-9/2003	Kerns and Kerlinger 2004

Table B-3. Bat mortality estimates for wind projects in the Midwest with publicly available post-construction monitoring reports used in analysis.

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
Cedar Ridge	WI	67.6	50.5 (2009) 39.8 (2010)	Sep.–Nov. 2005 Mar.–May 2005 Aug. 2005	BHE Environmental, Inc. 2011
Crescent Ridge	IL	54.5	1.71	Sep.–Nov. 2005 Aug. 2006	Kerlinger et al. 2007
Top pf 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. 2011, 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.

Table B-4. Publicly available bat fatality estimates for turbines operating without curtailment at wind energy facilities in the Midwest.

Wind Energy Facility (Year)	Location	Bat Fatalities/MW/year	Reference
Bishop Hill (2014)	IL	0.03	Ritzert et al. 2014b
Buffalo Ridge I (2009-2010)	SD	0.16	Derby et al. 2010d
California Ridge I (2013)	IL	0.16	Ritzert et al. 2014a
Prairie Rose (2014)	MN	0.41	Chodachek et al. 2015
Wessington Springs (2010)	SD	0.41	Derby et al. 2011a
PrairieWinds SD1 (2013-2014)	SD	0.52	Derby et al. 2014
Buffalo Ridge (Phase I; 1999)	MN	0.74	Johnson et al. 2000
PrairieWinds SD1 (2012-2013)	SD	1.05	Derby et al. 2013
NPPD Ainsworth (2006)	NE	1.16	Derby et al. 2007
PrairieWinds SD1 (2011-2012)	SD	1.23	Derby et al. 2012c
PrairieWinds ND1 (Minot) (2011)	ND	1.39	Derby et al. 2012d
Big Blue (2014)	MN	1.43	Fagen Engineering 2015
Wessington Springs (2009)	SD	1.48	Derby et al. 2010c
Elm Creek (2009-2010)	MN	1.49	Derby et al. 2010e
Rugby (2010-2011)	ND	1.6	Derby et al. 2011c
Buffalo Ridge (Phase II; 2002/Lake Benton I)	MN	1.64	Johnson et al. 2004
Pleasant Valley (2016-2017)	MN	1.8	Tetra Tech 2017b
Buffalo Ridge (Phase III; 2002/Lake Benton II)	MN	1.81	Johnson et al. 2004
Fowler III (2009)	IN	1.84	Johnson et al. 2010b
Barton I & II (2010-2011)	IA	1.85	Derby et al. 2011b
Big Blue (2013)	MN	2.04	Fagen Engineering 2014
Grand Ridge I (2009-2010)	IL	2.1	Derby et al. 2010a
PrairieWinds ND1 (Minot) (2010)	ND	2.13	Derby et al. 2011d
Buffalo Ridge (Phase II; 1998)	MN	2.16	Johnson et al. 2000
Moraine II (2009)	MN	2.42	Derby et al. 2010f
Buffalo Ridge (Phase II; 1999)	MN	2.59	Johnson et al. 2000
Buffalo Ridge (Phase III; 1999)	MN	2.72	Johnson et al. 2000
Buffalo Ridge II (2011-2012)	SD	2.81	Derby et al. 2012a
Elm Creek II (2011-2012)	MN	2.81	Derby et al. 2012b
Fowler I, II, III (2012)	IN	2.96	Good et al. 2013a
Crescent Ridge (2005-2006)	IL	3.27	Kerlinger et al. 2007
Buffalo Ridge (Phase III; 2001/Lake Benton II)	MN	3.71	Johnson et al. 2004
Pioneer Prairie II (2013)	IA	3.83	Chodachek et al. 2014
Buffalo Ridge (Phase II; 2001/Lake Benton I)	MN	4.35	Johnson et al. 2004

Table B-4. Publicly available bat fatality estimates for turbines operating without curtailment at wind energy facilities in the Midwest.			
Wind Energy Facility (Year)	**Location**	**Bat Fatalities/MW/year**	**Reference**
Table B-4 (cont'd). Publicly available bat fatality estimates for turbines operating without curtailment at wind energy facilities in the Midwest.			
Wind Energy Facility (Year)	**Location**	**Bat Fatalities/MW/year**	**Reference**
Pioneer Prairie I (Phase II; 2011-2012)	IA	4.43	Chodachek et al. 2012
Winnebago (2009-2010)	IA	4.54	Derby et al. 2010a
Heritage Garden (2012-2013)	MI	5.9	Kerlinger et al. 2014
Rolling Hills (2014-2015)	IA	6.13	Bay et al. 2017a
Pomeroy (2015-2016)	IA	6.25	Bay et al. 2017b
Rolling Hills (2015-2016)	IA	6.3	Bay et al. 2017b
Kewaunee County (1999-2001)	WI	6.45	Howe et al. 2002
Victory (2014-2015)	IA	6.48	Bay et al. 2017a
Odell (2016-2017)	MN	6.74	Chodachek and Gustafson 2018
Top of Iowa (2003)	IA	7.16	Jain 2005
Crystal Lake II (2009)	IA	7.42	Derby et al. 2010b
Fowler I (2009)	IN	8.09	Johnson et al. 2010a
Heritage Garden (2013-2014)	MI	8.2	Kerlinger et al. 2014
Waverly Wind (2016-2017)	KS	8.2	Tetra Tech 2017a
Highland (2015-2016)	IA	8.63	Bay et al. 2017b
Lundgren (2015-2016)	IA	8.8	Bay et al. 2017b
Century (2015-2016)	IA	9.07	Bay et al. 2017b
Vienna I (2015-2016)	IA	9.09	Bay et al. 2017b
Eclipse (2014-2015)	IA	10.01	Bay et al. 2017a
Adams (2015-2016)	IA	10.08	Bay et al. 2017b
Top of Iowa (2004)	IA	10.27	Jain 2005
Vienna II (2015-2016)	IA	10.28	Bay et al. 2017b
Charles City (2015-2016)	IA	10.41	Bay et al. 2017b
Macksburg (2015-2016)	IA	10.79	Bay et al. 2017b
Rail Splitter (2012-2013)	IL	11.21	Good et al. 2013b
Carroll (2014-2015)	IA	11.71	Bay et al. 2017a
Wellsburg (2015-2016)	IA	12.3	Bay et al. 2017b
Top Crop I & II (2012-2013)	IL	12.55	Good et al. 2013c
Adair (2014-2015)	IA	14.05	Bay et al. 2017a
Laurel (2015-2016)	IA	14.22	Bay et al. 2017b
Forward Energy Center (2008-2010)	WI	18.17	Grodsky and Drake 2011
Intrepid (2015-2016)	IA	18.37	Bay et al. 2017b
Fowler I, II, III (2010)	IN	18.96	Good et al. 2011

Table B-4. Publicly available bat fatality estimates for turbines operating without curtailment at wind energy facilities in the Midwest.

Wind Energy Facility (Year)	Location	Bat Fatalities/MW/year	Reference
Lakefield Wind (2012)	MN	19.87	Minnesota Public Utilities Commission 2012
Fowler I, II, III (2011)	IN	20.19	Good et al. 2012

Table B-4 (cont'd). Publicly available bat fatality estimates for turbines operating without curtailment at wind energy facilities in the Midwest.

Wind Energy Facility (Year)	Location	Bat Fatalities/MW/year	Reference
Morning Light (2014-2015)	IA	20.19	Bay et al. 2017a
Walnut (2014-2015)	IA	21.69	Bay et al. 2017a
Cedar Ridge (2010)	WI	24.12	BHE Environmental 2011
Blue Sky Green Field (2008; 2009)	WI	24.57	Gruver et al. 2009
Lundgren (2014-2015)	IA	28.74	Bay et al. 2017a
Cedar Ridge (2009)	WI	30.61	BHE Environmental 2010
Macksburg (2014-2015)	IA	73.08	Bay et al. 2017a

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Attachment C. Publicly Available Operational Curtailment Studies from Wind Energy Facilities in North America

Table C-1. Publicly available curtailment studies from wind facilities in the United States and Canada.

Wind Energy Facility (Year)	Location	Normal Cut-in Speed (m/s)	Treatment Cut-in Speed (m/s)	Estimated Percent Reduction in Mortality	Study design	Reference
Fowler Ridge (2011)	IN	3.5	3.5	36	Control-treatment	Good et al. 2012
Anonymous Project 2 (2012)	USFWS Region 8[1]	3	4	20	Randomized block	Arnett et al. 2013
Summerview (2007)	AB	4	4	57	Before-after-control-impact	Baerwald et al. 2009
Mount Storm (2010)	WV	4	4	35	Control-treatment; 1st half vs 2nd half of night	Young et al. 2011
Mount Storm (2011)	WV	4	4	No significant reduction	Control-treatment	Young et al. 2012
Anonymous Project 1 (2010)	USFWS Region 3[1]	3.5	4.5	47	Control-treatment	Arnett et al. 2013
Fowler Ridge (2011)	IN	3.5	4.5	57	Control-treatment	Good et al. 2012
Wolfe Island (2011)	ON	4	4.5	48	Control-treatment	Stantec Consulting 2012
Anonymous Project 2 (2012)	USFWS Region 8[1]	3	5	35	Randomized block	Arnett et al. 2013
Anonymous Project 2 (2012)	USFWS Region 8[1]	3	5	33	Randomized block	Arnett et al. 2013
Pinnacle (2012)	WV	3	5	47	Control-treatment	Hein et al. 2013
Pinnacle (2013)	WV	3	5	54	Control-treatment; randomized design	Hein et al. 2014

Table C-1 (cont'd.). Publicly available curtailment studies from wind facilities in the United States and Canada.

Wind Energy Facility (Year)	Location	Normal Cut-in Speed (m/s)	Treatment Cut-in Speed (m/s)	Estimated Percent Reduction in Mortality	Study design	Reference
Casselman (2008)	PA	3.5	5	82	Control-treatment; randomized block	Arnett et al. 2011
Casselman (2009)	PA	3.5	5	72	Control-treatment; randomized block	Arnett et al. 2011
Fowler Ridge (2010)	IN	3.5	5	50	Control-treatment	Good et al. 2011
Fowler Ridge (2012)	IN	3.5	5	84	Before-after (between years)	Good et al. 2013
Fowler Ridge (2013)	IN	3.5	5	77	Before-after (between years)	Good et al. 2014
Fowler Ridge (2014)	IN	3.5	5	78	Before-after (between years)	Good et al. 2015
Fowler Ridge (2015)	IN	3.5	5	72	Before-after (between years)	Good et al. 2016
Fowler Ridge (2016)	IN	3.5	5	72	Before-after (between years)	Good et al. 2017
Fowler Ridge (2017)	IN	3.5	5	66	Before-after (between years)	Good et al. 2018
Wildcat (2017)	IN	3.5	5	74	Before-after/before	Stantec Consulting 2018
Criterion (2012)	MD	4	5	62	Before-after	Young et al. 2013
Anonymous Project 1 (2010)	USFWS Region 3[1]	3.5	5.5	72	Control-treatment	Arnett et al. 2013
Summerview (2007)	AB	4	5.5	60	BACI	Baerwald et al. 2009
Fowler Ridge (2011)	IN	4	5.5	73	Control-treatment	Good et al. 2012
Wolfe Island (2011)	ON	4	5.5	60	Control-treatment	Stantec Consulting 2012
Anonymous Project 2 (2012)	USFWS Region 8[1]	3	6	38	Randomized block	Arnett et al. 2013

Table C-1 (cont'd.). Publicly available curtailment studies from wind facilities in the United States and Canada.

Wind Energy Facility (Year)	Location	Normal Cut-in Speed (m/s)	Treatment Cut-in Speed (m/s)	Estimated Percent Reduction in Mortality	Study design	Reference
Casselman (2008)	PA	3.5	5	82	Control-treatment; randomized block	Arnett et al. 2011
Sheffield (2009)	VT	4	6	60	Control-treatment; randomized block	Arnett et al. 2013
Pinnacle (2013)	WV	3	6.5	76	Control-treatment; randomized design	Hein et al. 2014
Casselman (2008)	PA	3.5	6.5	82	Control-treatment; randomized block	Arnett et al. 2011
Casselman (2009)	PA	3.5	6.5	72	Control-treatment; randomized block	Arnett et al. 2011
Fowler Ridge (2010)	IN	3.5	6.5	78	Control-treatment	Good et al. 2011
Beech Ridge (2012)	WV	3.5	6.9	89	Qualitative comparison to fatality rates of other wind facilities at three spatial scales	Tidhar et al. 2013
Beech Ridge (2013)	WV	3.5	6.9	97	Qualitative comparison to fatality rates of other wind facilities at three spatial scales	Young et al. 2014
Wildcat (2017)	IN	5	6.9	51	Before-after	Stantec Consulting 2018

[1] Locations for these anonymous projects are based on the previously used USFWS Region Map (USFWS 2019; available online: https://www.fws.gov/endangered/regions/index.html), rather than the Interior Region Map issued on October 18, 2019 (U.S. Department of the Interior 2019; available online: https://www.doi.gov/employees/reorg/unified-regional-boundaries).

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Attachment D. Technical Assistance Letters

United States Department of the Interior
Fish and Wildlife Service

Indiana Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

September 9, 2020

Cara Gunderson
Scout Clean Energy
4865 Sterling Drive, Suite 200
Boulder, CO 80301
cara@scoutcleanenergy.com

Re: Bitter Ridge Wind Farm LLC, Bitter Ridge Wind Farm project, Jay County, IN

Dear Ms. Gunderson:

The purpose of this letter is to acknowledge and respond to Bitter Ridge Wind Farm LLC's (the Company's) request for technical assistance dated September 8, 2020 concerning the effects of the above-referenced project on Endangered Species Act (ESA)-listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).

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 USFWS has reviewed the information you have provided regarding the presence of Indiana bats and northern long-eared bats and their habitat in the vicinity of the Bitter Ridge Wind Farm site, and the measures set forth in the *Plan to Avoid Indiana Bat and Northern Long-Eared Bat Take at the Bitter Ridge Wind Farm during 2020 Fall Migration in Support of a USFWS Technical Assistance Letter*, dated September 8,2020. Bitter Ridge Wind Farm LLC will implement measures to avoid any potential take of such species and their habitat, including fully feathering the wind turbines below 6.9 meters per second during the fall migratory season (August 1 – October 15) between one half hour before sunset to one half hour after sunrise. Turbines will be feathered below the

specified seasonal cut-in speed based on a 10-minute rolling average and will resume operations once the 20-minute rolling average wind speed is above the specified seasonal cut-in speed.

Following USFWS' review of this information, these and the other measures set forth in the proposal will serve to address concerns of the USFWS until such time as an incidental take permit could be obtained. However, this determination is only valid for the fall 2020 migratory season as that is the only time period covered in the proposal. If this determination is needed beyond the fall 2020 migratory season, the Company must submit a new proposal describing measures to be implemented during the extended period. The USFWS recognizes that Bitter Ridge Wind Farm LLC is currently pursuing an incidental take permit, and if an incidental take permit is successfully obtained, the avoidance measures that the Company has committed to implement as the basis for this letter would be replaced by the avoidance, minimization, and mitigation measure and other provisions set forth in the Habitat Conservation Plan upon which the incidental take permit is based.

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 takes of listed species, even if such takes occur despite the implementation of appropriate take avoidance measures. However, the Office of Law Enforcement 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 takes. As of this date, the Indiana Field Office concludes that the proposed project will not or is unlikely to result in take of ESA listed species.

We appreciate Bitter Ridge Wind Farm LLC's efforts to coordinate with our office in determining what measures should be implemented to avoid take of any ESA-listed species or their habitat at the project site. Should any new information become available, we request that Bitter Ridge Wind Farm LLC promptly notify the USFWS. If new information becomes available to the USFWS that other measures could be implemented to avoid take that would not require additional commitment by the Company, USFWS will notify the Company as soon as possible.

Sincerely,

Marissa R Reed
for

Scott Pruitt
Field Supervisor

United States Department of the Interior
Fish and Wildlife Service

Indiana Field Office (ES)
620 South Walker Street
Bloomington, IN 47403-2121
Phone: (812) 334-4261 Fax: (812) 334-4273

March 31, 2021

Cara Gunderson
Scout Clean Energy
4865 Sterling Drive, Suite 200
Boulder, CO 80301
cara@scoutcleanenergy.com

Re: Bitter Ridge Wind Farm LLC, Bitter Ridge Wind Farm project, Jay County, IN

Dear Ms. Gunderson:

The purpose of this letter is to acknowledge and respond to Bitter Ridge Wind Farm LLC's (the Company's) request for technical assistance dated March 25, 2021 concerning the effects of the above-referenced project on Endangered Species Act (ESA)-listed species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).

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 USFWS has reviewed the information you have provided regarding the presence of Indiana bats and northern long-eared bats and their habitat in the vicinity of the Bitter Ridge Wind Farm site, and the measures set forth in the *Plan to Avoid Indiana Bat and Northern Long-Eared Bat Take at the Bitter Ridge Wind Farm during 2021 Spring Migration in Support of a USFWS Technical Assistance Letter*, dated March 25, 2021. Bitter Ridge Wind Farm LLC will implement measures to avoid any potential take of such species and their habitat, including fully feathering the wind turbines below 5.0 meters per second during the spring migratory season (April 1 – May 15) and fully feathering 37 turbines below 6.9 meters per second and 15 turbines below 3.0 meters per second during the summer (May 16 – July 31) between one half hour before sunset to one half

hour after sunrise. Turbines will be feathered below the specified seasonal cut-in speed based on a 10-minute rolling average and will resume operations once the 20-minute rolling average wind speed is above the specified seasonal cut-in speed.

Following USFWS' review of this information, these and the other measures set forth in the proposal will serve to address concerns of the USFWS until such time as an incidental take permit could be obtained. However, this determination is only valid for the spring 2021 migratory and summer 2021 seasons as that is the only time period covered in the proposal. If this determination is needed beyond the summer 2021 season, the Company must submit a new proposal describing measures to be implemented during the extended period. The USFWS recognizes that Bitter Ridge Wind Farm LLC is currently pursuing an incidental take permit, and if an incidental take permit is successfully obtained, the avoidance measures that the Company has committed to implement as the basis for this letter would be replaced by the avoidance, minimization, and mitigation measures and other provisions set forth in the Habitat Conservation Plan upon which the incidental take permit is based.

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 takes of listed species, even if such takes occur despite the implementation of appropriate take avoidance measures. However, the Office of Law Enforcement 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 takes. As of this date, the Indiana Field Office concludes that the proposed project will not or is unlikely to result in take of ESA listed species.

We appreciate Bitter Ridge Wind Farm LLC's efforts to coordinate with our office in determining what measures should be implemented to avoid take of any ESA-listed species or their habitat at the project site. Should any new information become available, we request that Bitter Ridge Wind Farm LLC promptly notify the USFWS. If new information becomes available to the USFWS that other measures could be implemented to avoid take that would not require additional commitment by the Company, USFWS will notify the Company as soon as possible.

Sincerely,

Scott Pruitt
Field Supervisor

Attachment E. Public Comments and Responses

Public Comments and Responses on the Draft Environmental Assessment and Draft Habitat Conservation Plan for the Bitter Ridge Wind Farm,

Jay County, Indiana

In accordance with the National Environmental Policy Act, the draft Environmental Assessment (EA) was circulated for public review and comment on March 29, 2021. 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 (86 Federal Register 16388), and the 30-day public comment period ended on April 28, 2021. Comments were received from the Indiana Department of Natural Resources (IDNR), U.S. Environmental Protection Agency (USEPA), Jean Publieee, and one comment was received anonymously from the public; these were taken into account in assessing project impacts. The U.S. Fish and Wildlife Service (USFWS) and/or Bitter Ridge Wind Farm, LLC (BRWF or the Applicant) responses to comments on the draft EA and draft HCP are below.

IDNR Comment: It is critical that the IDNR Division of Fish and Wildlife (DFW) receives the annual monitoring reports because many of the bat species that may be present at the project location are either state-listed endangered or special concern. The annual reports would allow the DFW to better monitor trends of bat species statewide. Getting all bats identified and reported to the agencies is important to understand overall impacts and changes in population trends. The DFW needs to be notified within 24 hours if a fatality of a listed species occurs. Any take of federally listed species also requires a State ITP.

Response: The monitoring contractor will submit to the IDNR the carcass database according to the requirements of its IDNR salvage permit. Additionally, the annual monitoring reports submitted to the USFWS will be made available to the public (including the DFW) on the USFWS's HCP website.

Document Changes: Section 5.4.4 of the HCP has been updated to state: "Additionally, the Applicant will notify the USFWS and IDNR if a federally listed species or an eagle fatality is documented, within 24 hours of positive identification."

IDNR Comment: In the EA, Alternative 2 aligns with previous decisions and seems to be a reasonable alternative that seeks to balance protection of bats and energy generation. The take calculation appears similar to the calculations associated with other recent EAs for wind power and bats.

Response: Thank you for your comment.

IDNR Comment: Page 37 of 328 in the Bird and Bat Conservation Plan (BBCS; indicated as page 31 in the document), indicates that the closest operating wind facility with publicly available post-construction mortality data is Fowler Ridge Wind Farm and 70 miles away. Fowler Ridge is in Benton County and Bitter Ridge is in Jay County. The two counties are at minimum 100 miles apart.

Response: As noted in the HCP, the Fowler Ridge Wind Farm is located approximately 130 miles from the Project.

Document Changes: The distance to the Fowler Ridge Wind Farm listed in the BBCS has been edited for consistency with the HCP, to indicate that "Fowler Ridge is located in Benton County, approximately 130 miles west of the Project"

IDNR Comment: In Section 6 of the Bat Habitat Mitigation Plan (BHMP; Appendix B of the HCP), the 20% understory invasive coverage should be cumulative, not 20% for each species. Otherwise, the understory could be choked with invasive species but not require any control. In addition, 20% coverage is a fairly significant amount of coverage.

Response: The USFWS determined that up to 20% invasive species cover would still provide suitable roosting and foraging habitat for Indiana and northern long-eared bats. The Applicant chose the 20% benchmark after extensive discussions with USFWS. Further, given that the plant species of concern are woody, the actual threshold is relatively low, since one individual could, in many cases, comprise a significant portion of the cover calculation.

Document Changes: Sentence 1, paragraph 2, Section 6 of the BHMP has been changed to read, "Should the cumulative area of woody invasive plant species listed exceed 20% cover in the understory, this invasive vegetation will be controlled to remove that threat within three years."

IDNR Comment: In Section 8 of the BHMP, conducting an invasive species survey every 7 years has the high potential to allow invasive species to spread significantly. Regular surveys and control are likely to be less labor intensive and result in better control of invasive species, which would benefit bats.

Response: The Mitigation Entity currently performs routine maintenance to control invasive plants. The 7-year survey period for invasive woody plant species is intended to accurately assess the results of annual maintenance and should not be construed as a substitute to diligent site management.

Document Changes: The BHMP and HCP have been edited to clarify that the Mitigation Entity has and will continue to perform annual invasive plant species control on the mitigation sites. The last sentence of paragraph 1, Section 7 of the BHMP has been changed to read, "Maintenance shall include annual or as-needed control of invasive species identified in Section 6: Mitigation Work Plan above, tree care, and mowing as appropriate to reduce competition from herbaceous weeds and invasive shrub establishment." The word "cumulatively" has been added to Section 8.2.6 of the HCP.

IDNR Comment: When conducting any habitat modification or restoration, the following recommendations should be implemented to further reduce impacts to fish and wildlife:

1. Revegetate all bare and disturbed areas with a mixture of grasses (excluding all varieties of tall fescue), legumes, and native shrub and hardwood tree species as soon as possible upon completion.
2. Do not cut any trees suitable for Indiana bat or northern long-eared bat roosting (greater than 5 inches diameter at breast height [dbh], living or dead, with loose hanging bark, or with cracks, crevices, or cavities) from April 1 through September 30.
3. Post "Do Not Mow or Spray" signs or similar around the habitat protection areas.
4. Erosion and sediment control measures must be appropriately designed and implemented to prevent sediment from entering the stream or leaving the construction site. These measures must be maintained until construction is complete and all disturbed areas are stabilized.
5. If erosion control blankets are used anywhere, they shall be heavy-duty, biodegradable, and net free, or use loose woven/Leno-woven netting to minimize the entrapment and snaring of small-bodied wildlife such as snakes and turtles (follow manufacturer's recommendations for selection and installation). Seed and apply mulch on all other disturbed areas.

Response: These recommendations will be incorporated into the Mitigation Entity's standard operating procedures for any habitat modifications proposed at the mitigation sites. Given that the sites are already highly functional, it is unlikely that restoration or modification of suitable habitat will be needed.

USEPA Comment: The HCPs for other Midwestern wind farms have, in recent years, set a goal of having a detection probability (g) between 0.25 (25%) and 0.30 (30%) during baseline monitoring. We support the Applicant's proposal of a 25% annual probability of detection, as that will provide consistency with ITPs already issued by the USFWS. We recommend that the final EA further explain the difficulties or inherent probability of error in calculating take for a smaller wind project such as this. We also recommend that the final EA provide more information on any inherent difficulties with using Evidence of Absence (EoA) software calculations for smaller wind projects.

Response: The size of the wind energy project, defined by the number of turbines or total megawatt capacity, does not directly impact take calculations or the use of the EoA software. Results from EoA are valid regardless of project size.

USEPA Comment: The USFWS should consider requiring the Applicant to implement a lower confidence level for the trigger of the short-term test (see Section 5.4.3 of the HCP). Use of the 95% confidence level (as currently proposed) may still set the bar so high for the triggering of adaptive management implementation that take rates could be unintentionally exceeded. Use of a lower confidence level would help avoid triggering the long-term test. The final EA would benefit from additional information on the benefits of modification of triggers and specifications, particularly for small wind projects such as Bitter Ridge Wind Farm.

Response: The USFWS has determined that the 95% confidence rate is appropriate to prevent unnecessary increases in curtailment. In addition, this confidence rate corresponds to the reversion trigger also, in which we want to be quite certain that take is lower than expected before reducing curtailment.

USEPA Comment: The final EA should provide additional discussion and context, in plain language, on the differences in take calculation and compliance for small wind projects versus large wind projects. If there is a demarcation between "small take estimates" and "larger take estimates," that information should also be provided and explained.

Response: Wind energy projects are required to use the EoA software to calculate take, and all projects must be in compliance with their authorized take limit. Wind energy projects with low estimated take (i.e., 1 or 2 bats per year) may need to increase the search effort to show authorized take is not exceeded if covered species carcasses are found during searches. This is true regardless of the size of the wind energy project.

USEPA Comment: Updated information on the Project's operational status should be provided in the final EA and corrected in the HCP. The Technical Assistance Letters from both 2020 and 2021 should be included with the final EA.

Response: The project became operational on September 30, 2020.

Document Changes: Section 1.1.1.2 of the EA has been updated to reflect that the Project is currently operational. Section 2.1 of the HCP has been updated with the Project commercial operation date (COD) of September 30, 2020, and future tense has been corrected to past tense, where appropriate.

USEPA Comment: Discrepancies on whether the meteorological (MET) towers are guyed should be reconciled in the final EA and HCP. EPA recommends that the towers be unguyed.

Response: There is only one permanent MET tower at the project and it is not guyed. It is a freestanding lattice tower.

Document Changes: Section 1.1.1.2 has been revised to reflect that the Project includes one permanent MET tower, and reference to plural MET towers has been removed throughout the EA. Section 5.2.3.2 (page 35 of the EA) has been revised to read, " ...the permanent MET tower, which is 100 m (328 ft) tall, is un-guyed (the tower does not have cables extending between the top of the structure and the ground for stability)." Section 2.1.2 of the HCP has been revised to read, "There is one permanent, freestanding (unguyed) meteorological tower in the Permit Area."

USEPA Comment: The final EA should acknowledge that bat mortality associated with wind energy facilities, in concert with other challenges faced by these species, could have a substantial cumulative effect on these species, including potentially substantial declines in populations. It is unknown whether tree bat populations can be sustained under wind energy development that may cause the loss of millions of bats over the next 30+ years.

Response: The EA states that cumulative mortality from wind energy projects may adversely affect bat populations. However, because no baseline population information is available for most

species, it is not possible to determine population-level impacts. In addition, operational regimes at individual projects will have a significant effect on cumulative bat fatalities.

Jean Publieee Comment: Deny this killing permit for bats. The fact is bats have been dying at a great rate and they are very beneficial animals because they eat mice and insects and are very valuable to the human race. We cannot afford to let this industry kill them in any way shape or form. This petition needs to be denied in total. It is not a decent plan and this species is very valuable, especially because of the virus that has decimated so many bats. We need bats. They are part of the ecological scheme. Deny this petition.

Response: The USFWS must issue a permit if the conservation plan meets issuance criteria, as this plan does. The Project is already constructed and operational. Take of bats will be minimized and mitigated to the maximum extent practicable.

Anonymous Comment: Please do not grant the Applicant this permit. Bats are already a vulnerable population with white-nose syndrome affecting them and 35 years is a long time. So please don't allow this for the bats' sake. Protect the bats. Thank you.

Response: The USFWS must issue a permit if the conservation plan meets issuance criteria, as this plan does. The Project is already constructed and operational. Take of bats will be minimized and mitigated to the maximum extent practicable.