**Indiana Bat and Northern Long-eared Bat**

**Habitat Conservation Plan**

**For the Project Name**

**County, State**

[Applicant to insert site picture here]

**Prepared by:**

**Applicant Name**

Street Address or P.O. Box, Suite Number

City, State (spell out) zip code

**In consultation with:**

**Third Party Entity**

Street Address or P.O. Box, Suite Number

City, State (spell out) zip code

**DRAFT – DATE**

Note from FWS: The yellow highlighting indicates that project-specific information needs to be inserted by the Applicant. The green highlighting indicates that the statement may not be applicable to the Applicant or there are multiple legitimate options that the Applicant needs to choose from (for example, language that refers to summer take will be highlighted in green. Applicants with projects that don't have summer take can remove the green highlighted language, while projects with summer take would keep that language).

The contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document contains template language that may be used voluntarily to draft a Habitat Conservation Plan. This template language is not the only acceptable means of complying with Endangered Species Act statutory requirements. Each application for an Incidental Take Permit based on a Habitat Conservation Plan will be evaluated individually for whether it meets permit issuance criteria.

**TABLE OF CONTENTS**

1 INTRODUCTION 1

1.1 Overview and Background 1

1.2 Purpose and Need 1

1.3 Plan Area/Permit Area 2

1.3.1 Permit Area 2

1.3.2 Plan Area 2

1.4 Permit Duration 2

1.5 Alternatives to Taking 2

1.5.1 Take Avoidance Alternative 2

1.5.2 Proposed Alternative 3

1.6 Permit Structure 3

1.7 Summary of Relevant Laws and/or Regulation 4

1.7.1 Federal Endangered Species Act 4

1.7.2 National Environmental Policy Act 6

2 PROJECT DESCRIPTION AND COVERED ACTIVITIES 6

2.1 Project Description 6

2.2 Covered Activities 7

3 COVERED SPECIES 7

3.1 Indiana Bat 7

3.1.1 Status 8

3.1.2 Range 8

3.1.3 Population Trend 9

3.1.4 Life History 11

3.1.5 Migration 13

3.1.6 Habitat Characteristics and Use 14

3.1.6.1 Winter Habitat 14

3.1.6.2 Spring Habitat 14

3.1.6.3 Summer Habitat 14

3.1.6.4 Fall Habitat 15

3.1.7 Occurrence in the Permit Area 15

3.2 Northern Long-Eared Bat 15

3.2.1 Status 15

3.2.2 Range 16

3.2.3 Life History 17

3.2.4 Habitat Characteristics and Use 18

3.2.4.1 Winter Habitat 18

3.2.4.2 Spring Habitat 18

3.2.4.3 Summer Habitat 18

3.2.4.4 Fall Habitat 19

3.2.5 Occurrence in the Permit Area 19

4 ENVIRONMENTAL SETTING AND BIOLOGICAL RESOURCES 20

5 POTENTIAL BIOLOGICAL IMPACTS AND TAKE ASSESSMENT 21

5.1 Anticipated Take of Each Covered Species 21

5.2 Anticipated Impacts of the Taking 21

5.2.1 Indiana Bat 21

5.2.2 Northern Long-Eared Bat 22

6 BAT CONSERVATION PROGRAM 25

6.1 Biological Goals and Objectives 25

6.2 Measures to Minimize Take 25

6.3 Measures to Mitigate Impacts from Unavoidable Take 27

6.4 Monitoring 31

6.4.1 Biological/Effectiveness Monitoring 31

6.4.2 Compliance Monitoring 31

6.5 Adaptive Management 33

6.6 Reporting 34

7 CHANGED AND UNFORESEEN CIRCUMSTANCES 36

7.1 Changed Circumstances 36

7.2 Unforeseen Circumstances 41

8 FUNDING 42

8.1 ITP/HCP Administration 43

8.1.1 Cost Basis 43

8.1.2 Funding Assurance 43

8.2 Compliance Monitoring 43

8.2.1 Cost Basis 43

8.2.2 Funding Assurance 43

8.3 Mitigation 44

8.3.1 Cost Basis 44

8.3.2 Funding Assurance 44

8.4 Changed Circumstance and Contingency Fund 45

9 ITP/HCP ADMINISTRATION 46

9.1 Administrative Changes 46

9.2 ITP Amendments 46

9.3 ITP Transfer 47

10 REFERENCES 48

10.1 Literature Cited 48

10.2 Laws, Acts, and Regulations 56

10.3 Personal Communications 59

10.4 List of Preparers 59

APPENDICES 60

**LIST OF TABLES**

Table 3.1. Indiana bat range-wide population estimates from [2009 to 2019] 10

Table 5.1. Summary of impacts to Covered Species by the Covered Activities at the [Project Name]. 24

Table 6.1. Operational Minimization Plan for the [Project Name] Habitat Conservation Plan. 26

Table 6.4 Year 1 Compliance Monitoring Protocol Designed to Provide a Probability of Detection of 0.2 at the [Project Name]. 32

Table 6.5 Adaptive Management Plan for the [Project Name]. 34

Table 7.1. Changed Circumstances and ITP holder response. 37

Table 8.1. Costs/Budget for the [Project Name] Habitat Conservation Plan implementation and bat conservation program. 42

**LIST OF FIGURES**

Figure 1.1 Location and overview of the [Project Name], located in [County name] County, [State]. 1

Figure 3.1. Indiana bat range including delineated Recovery Units 9

Figure 3.2. Indiana bat range-wide population estimates from [1981 to 2019] 11

Figure 3.3. Annual chronology for Indiana bats. 12

Figure 3.4. Northern long-eared bat range 16

**LIST OF APPENDICES**

Appendix A: Maps/Figures

Appendix B: Data Management Plan

Appendix C: Background Reports/Supporting Documents

Appendix D: REA Model Parameters for Mitigation

# INTRODUCTION

## Overview and Background

The [Project Name] (Project), located in [County Name] County, [State] (Figure 1.1), [consists/will consist] of [# of turbines] wind turbines with a total generating capacity of approximately [# of MW] megawatts (MW). The Project is owned [and operated] by [Applicant Company, LLC] (Applicant) [, a wholly owned subsidiary of [Parent company]]. The Applicant has prepared this Habitat Conservation Plan (HCP) in support of an application for an Incidental Take Permit (ITP) for the Project under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA; 16 United States Code [USC] 1531-1544, 1539 [1973]) and Federal Regulations (50 Code of Federal Regulations [CFR] 17.22(b)(1) [1985], and 17.32(b)(1) [1985]).

## Purpose and Need

The Applicant’s purpose for the Project is to maximize non-carbon emitting, energy production using reliable, low-cost wind resources. The Project [will help/helps] provide energy security to the United States by diversifying the electricity generation portfolio, protecting against comparatively volatile natural gas spikes, and utilizing a renewable, domestic source of energy. The Project [will also provide/also provides] economic benefits to the surrounding community in the form of jobs, local spending, and annual community investment.

The Applicant is developing this HCP as a mechanism for compliance with the ESA. To provide the Applicant with assurances that no unauthorized incidental take of the [federally-endangered Indiana bat (*Myotis sodalis*) and federally-threatened northern long-eared bat (*M. septentrionalis*], hereafter referred to [collectively] as the Covered Species) is expected to occur during the spring migratory period (April 1 – May 15), [the summer maternity season (May 16 – July 31),] and the fall migratory period (August 1 – October 15), the Applicant is requesting the issuance of an ITP. The implementing regulations for Section 10(a)(1)(B) of the ESA (50 Code of Federal Regulations [CFR] 17.22) identify the criteria by which a permit allowing the incidental take of listed species pursuant to otherwise lawful activities may be obtained. The purpose and need for the ITP is to ensure that incidental take resulting from the proposed operation will be minimized and mitigated to the maximum extent practicable and will not appreciably reduce the likelihood of the survival and recovery of the Covered Species in the wild. The ITP application requires the development and submission of an HCP, which is designed to ensure the continued existence and help in the recovery of the Covered Species while allowing for the limited incidental take of the species during the proposed operation.

This HCP, developed in support of the ITP application, serves to: 1) assess the impacts of the Project on the Covered Species, 2) provide measures to minimize and mitigate to the maximum extent practicable the impacts of the taking of the Covered Species, and 3) ensure that incidental take from the Project is not anticipated to appreciably reduce the likelihood that the Covered Species will survive and recover in the wild. In addition, this HCP describes the monitoring that will be used to confirm the effectiveness of the bat conservation program[[1]](#footnote-2) (Chapter 6) and identifies funding assurances to ensure implementation of monitoring, mitigation, and any Changed Circumstances. This HCP includes all elements necessary to meet the criteria for ITP issuance according to ESA Section 10(a)(2)(B) and 50 CFR 17.22(b)(2) (1985) and 17.32(b)(2) (1985).

|  |
| --- |
| [Insert Figure] |
| Figure 1.1 Location and overview of the [Project Name], located in [County name] County, [State]. |

## Plan Area/Permit Area

Project-specific information to be provided by the Applicant.

The lands considered within this HCP include the Permit Area and the Plan Area.

### Permit Area

The Permit Area is the geographic area where the impacts of the activities occur for which incidental take coverage is requested (i.e., the Covered Activities). Operation of the Project’s wind turbines is the only activity that may cause take of the Covered Species; therefore, the Permit Area includes the area in which all turbines will be located.

The total Permit Area covers approximately [# of hectares] hectares (ha; [# of acres] acres [ac]) within [County, State] as show on Figure (1.1).

### Plan Area

The Plan Area comprises all areas that will be used for any activities described in the HCP, including Covered Activities and the bat conservation program. The Plan Area for the HCP includes the Permit Area, as well as all areas influenced by the HCP’s biological goals and objectives, such as the mitigation, monitoring, and adaptive management measures associated with this HCP.

The Plan Area is located within [County, State – applicant to include a map of location].

## Permit Duration

The Applicant is seeking a 6-year ITP from the date of issuance.

## Alternatives to Taking

ESA implementing regulation 50 CFR 17.22 (b)(1)(iii)(C) (1985) states that an HCP submitted in support of an ITP application must describe “what alternative actions to such taking the Applicant considered, and the reasons why such alternatives are not proposed to be utilized.” The HCP Handbook (US Fish and Wildlife Service [USFWS] and National Marines Fisheries Service [NMFS] 2016) indicates that the Applicant “should focus on significant differences in project design that would avoid or reduce the take.”

### Take Avoidance Alternative

Under the Take Avoidance Alternative, all Project turbines would be feathered at wind speeds below [6.9 meters per second (m/s; 22.6 feet per second [ft/s]) from one half-hour before sunset to one half-hour after sunrise during the spring migratory period (April 1 – May 15) and during the fall migratory period (August 1 – October 15). All turbines within 305 meters (1,000 feet) of suitable habitat below wind speeds of 6.9 m/s during the summer active season (May 16 – July 31)]. In recently issued technical assistance letters in USFWS Region 3, the USFWS has indicated that by implementing these turbine operational adjustments, there is a reasonable expectation that take of the Covered Species would be avoided or unlikely to occur. Because take of the Covered Species would be considered unlikely, incidental take authorization under the ESA would not be necessary and an HCP would not be developed for the Project.

Operating under the above operational regime for a 6-year term will result in lost energy production from implementation of the Take Avoidance Alternative curtailment regime. The lost energy production subsequently results in lost revenues from the sale of energy and renewable energy attributes which is both undesirable and inconsistent with the goals of the Project. Lost revenues that occur in the initial operational period are more detrimental than planned costs that occur later in the project life cycle. Moreover, the Take Avoidance Alternative does not align with the Project’s purpose of contributing to the advancement of wind energy objectives set forth by the US Department of Energy (USDOE 2015), including generating clean and renewable energy to minimize the short- and long-term impacts associated with greenhouse gas emissions and carbon output emitted by non-renewable energy producers. Thus, the Take Avoidance Alternative was not considered further.

### Proposed Alternative

Under the Proposed Alternative, all Project turbines would be feathered at wind speeds below the manufacturer’s rated cut-in speed, down to a minimum of 3.0 m/s (9.8 ft/s), from sunset to sunrise for the entire bat-active season (March 15 through November 15) when the temperature is above 10 degrees (°) Celsius (C; 50 ° Fahrenheit [F]). Turbines within 305 meters of habitat occupied by covered species would be feathered below wind speeds of 5.0 m/s (16 ft/s) from sunset to sunrise from April 1 through July 31. In addition, all Project turbines would be feathered below wind speeds of 5.0 m/s (16 ft/s) from sunset to sunrise from August 1 through October 15, and when the temperature is above 10 °C. Mitigation to offset impacts of the taking of the Covered Species would be provided.

The Proposed Alternative was selected because it will minimize the impacts of take of the Covered Species and simultaneously limit the amount of lost energy production. Additionally, under the Proposed Alternative, the Project is projected to generate [X million kilowatts (kWh) of clean, renewable energy annually, enough electricity to power the homes of X residential utility customers]. It will also [reduce greenhouse gas emissions by X metric tons of carbon dioxide, a major contributor to global warming, by replacing fossil-fuel-based electricity production. This is equivalent to taking approximately X passenger vehicles off the road]. The Project will also reduce emissions of nitrogen oxide, which causes smog, and sulfur dioxide, which causes acid rain.

The Project will, furthermore, benefit the local economy through lease payments to landowners, paychecks to local workers, and tax revenue to the local township and county, as well as creating full-time jobs during construction and operations. These economic benefits to the local community would be lost or diminished if the Project were forced to operate under an avoidance alternative.

## Permit Structure

The Applicant is requesting a “Single Applicant” ITP structure per the HCP Handbook.

## Summary of Relevant Laws and/or Regulation

### Federal Endangered Species Act

The purpose of the ESA is to provide a means whereby the ecosystems upon which threatened and endangered species depend may be conserved, and to provide a program for the conservation of such threatened and endangered species (ESA Section 2(b), 16 USC 1531(b) [1973]).

Section 9(a)(1)(B) of the ESA prohibits the take of any fish or wildlife species listed as endangered. Under federal regulation, take of fish or wildlife species listed as threatened is also prohibited, unless a species-specific exemption is granted (50 CFR 17.31(a) [1978]). Take is defined as “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” The USFWS defines “harm” (50 CFR 17.3 [1975]) as “...an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.” The USFWS further defines “harass” as “...an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering” (50 CFR 17.3 [1975]).

Section 10(a) of the ESA allows, under certain terms and conditions, for the incidental take of species listed as threatened or endangered by non-federal entities that would otherwise be prohibited under Section 9 of the ESA. Incidental take is defined as take that is “incidental to, and not the purpose of, the carrying out of an otherwise lawful activity” (16 USC 1539(a)(1)(B) [1973]). To obtain this incidental take authorization, the Applicant must develop, fund, and implement a USFWS-approved HCP to minimize and mitigate to the maximum extent practicable the impact of the proposed taking.

Incidental take may be permitted through the issuance of an ITP by the USFWS under ESA Section 10(a)(1)(B). Per 50 CFR 17.22(b)(1) (1985) and 50 CFR 17.32(b)(1) (1985), an ITP application must include the following components:

* The common and scientific names of the species to be covered by the ITP, as well as the number, age, and sex of such species, if known;
* A complete description of the activity for which incidental take authorization is sought to be authorized;
* An HCP that specifies:
* The impacts that will likely result from such taking;
* What steps the Applicant will take to monitor, minimize, and mitigate such impacts, the funding that will be available to implement such steps, and the procedures to be used to deal with unforeseen circumstances;
* What alternative actions to such taking the Applicant considered, and the reasons why such alternatives are not proposed to be utilized; and
  + Such other measures that the USFWS Regional Director may require as being necessary and appropriate for the purposes of the plan.

In addition to these necessary HCP elements, the HCP Handbook describes five clarifying components that should be included in an HCP:

* Biological goals and objectives;
* Adaptive management;
* Monitoring;
* ITP duration; and
* Public participation.

An ITP can be issued only if the HCP meets the following six criteria listed in 50 CFR 17.22(b)(2) (1985), 50 CFR 17.32(b)(2) (1985) and 16 USC 1539 (1973).

* The taking will be incidental;
* The Applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
* The Applicant will ensure that adequate funding for the HCP and procedures to deal with Unforeseen Circumstances will be provided;
* The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild;
* The measures, if any, that the Director may require as being necessary or appropriate for the purposes of the plan, will be met; and
* The Director has received such other assurances as he or she may require that the plan will be implemented.

The issuance of the ITP is a federal agency action that must also comply with Section 7 of the ESA (16 USC 1536). Section 7(a)(2) of the ESA requires federal agencies to consult with the USFWS to ensure that actions that the federal agencies authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in destruction or adverse modification of designated critical habitat of such species. In order to issue an ITP, the USFWS is required to conduct an internal formal consultation process, which includes preparation of a Biological Opinion (BO) that evaluates the impacts of the proposed action and establishes an overall effects determination. The resulting BO will encompass issuance of the ITP and implementation of the HCP.

### National Environmental Policy Act

Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA; 42 USC 4321, 4322(2)(c)), as amended, requires federal agencies to evaluate and disclose the effects of their proposed actions on the natural and human environment. The purpose of the NEPA process is to ensure that the potential environmental impacts of any proposed federal action are fully considered and made available for public review. The issuance of an ITP by the USFWS constitutes a federal action subject to NEPA compliance and review (42 USC 4321-4347, as amended). To comply with the NEPA, the USFWS must conduct and publish an environmental review. This may consist of preparing an Environmental Impact Statement (EIS; 40 CFR 1502.4) or Environmental Assessment (EA; 40 CFR 1501.5) that includes a detailed analysis of all impacts to the human environment resulting from issuance of the ITP (40 CFR 1508.1(g)). In circumstances in which issuance of the ITP falls under a Categorical Exclusion (CATEX), a category of actions which do not individually or cumulatively have a significant effect on the human environment, the NEPA review may be concluded with a CATEX determination rather than preparation of an EIS or EA (40 CFR 1501.4]).

# PROJECT DESCRIPTION AND COVERED ACTIVITIES

## Project Description

Project-specific information to be provided by the Applicant

The Project consists of [# of turbines] wind turbines and associated facilities and has a total generating capacity of approximately [# of MW] MW. The Project is located on private land in [County] County, [State]. Commercial operation of the Project [began/will begin] in [Month] [Year].

The Project consists of [# turbines] [Turbine Brand and Type] [MW per turbine]-MW turbines. Turbine towers are approximately [height in meters] m ([height in feet] [ft]) in height and the rotor blade diameter is [rotor blade diameter in meters] m ([height in feet] ft). Therefore the maximum height of the turbines from tower base to highest blade tip is [total turbine height] m ([total turbine height] ft) above ground level.

Each turbine includes a supervisory control and data acquisition operations and communications system that allows automated independent and remote operation of the turbine. [Turbine brand and type] turbines are designed to begin generating electricity when the wind speed reaches [#] m/s ([#] ft/s), known as the “manufacturer’s cut-in speed.” The turbines reach their maximum generation at approximately [#] m/s ([#] ft/s) at a rotational speed of approximately [#] revolutions per minute, above which point the blades pitch to catch less wind and remain rotating at this speed. At about [#] m/s ([#] ft/s) the turbine shuts down to prevent an overspeed scenario of the generator, known as the “cut-out speed.” To stop a wind turbine from spinning (at any wind speed), the turbine blades can be pitched parallel with the wind direction, causing them to spin at a very low rotation rate (approximately one to two rotations per minute), if at all; this is called “feathering.”

The [circular/rectangular] crane pad at each turbine site consists of an approximately [#]-square meter ([radius, or length x width in meters]-m) permanent gravel pad extending from the roadway to the turbine foundation. The access roads extending from the crane pads are [width]-m wide.

Additional Project components include the following: meteorological tower[s], operations and maintenance building, substation, and collection system.

## Covered Activities

The HCP Handbook states that an Applicant should “include in the HCP a description of all actions within the planning area that: (1) are likely to result in incidental take; (2) are reasonably certain to occur over the life of the ITP; and (3) for which the Applicant or landowner has some form of control.” These actions are the HCP’s Covered Activities. The Applicant has determined that operation of Project turbines during the 6-year ITP term may result in incidental take of the Covered Species and is an activity over which the Applicant has control; therefore, operation of the Project turbines is a Covered Activity under this HCP.

Commercial operation of the Project [is expected to begin/began] in [Year] and will continue for the duration of the 6-year ITP term. Project operation includes wind turbine operation during the spring and fall migratory periods [and the summer maternity season] that may result in take of Covered Species (Section 5.1).

# COVERED SPECIES

The Applicant is applying for an ITP for [Indiana and northern long-eared bats] for the Covered Activity described above. [The Indiana bat is listed as an endangered species under the ESA (32 Federal Register [FR] 4001 [March 11, 1967]) and the northern long-eared bat is listed as a threatened species under the ESA (80 FR 17974 [April 2, 2015]).] No land within the Permit Area is designated as critical habitat for the Covered Species (i.e., areas designated as essential to the conservation of the Covered Species [USFWS 2017]) under the ESA.

[Currently no take of other endangered species, threatened species, or candidate species under the ESA is expected to occur at the Project, and no adverse modification of critical habitat designated under the ESA is expected to occur within the Permit Area. The potential future listing of additional species that could be impacted by the Project is considered a Changed Circumstance and is addressed further in Chapter 7 of this HCP].

## Indiana Bat

This section provides a summary of the Indiana bat’s status, range, population trend, life history and habitat. Additional information on Indiana bat ecology can be found in the *Indiana Bat (Myotis sodalis) Draft Recovery Plan: First Revision* (2007 Draft Indiana Bat Recovery Plan; USFWS 2007) and the *Indiana Bat (Myotis sodalis) 5-Year Review* (USFWS 2009).

### Status

The Indiana bat was listed as being in danger of extinction in 1967 under the Endangered Species Preservation Act of 1966 (32 FR 4001 [March 11, 1967]). The species is currently listed as endangered under the ESA of 1973, as amended. At the time of listing, primary threats to the species were believed to include loss of habitat and human disturbance, especially at winter hibernacula, and potentially ineffective management due to a general lack of knowledge about the species’ biology and distribution (USFWS 1999). The 2007 Draft Indiana Bat Recovery Plan lists the following as threats to the species:

* Loss/degradation of hibernation habitat;
* Loss/degradation of summer, migration, and swarming habitat;
* Disturbance of hibernating bats;
* Disturbance of summering bats;
* Disease and parasites; and
* Natural and anthropogenic factors, including climate change.

White-nose syndrome (WNS) is currently the most severe threat facing Indiana bat populations range-wide (USFWS 2009). WNS was first discovered during the winter of 2006-2007 in four caves in New York (Coleman 2014) and has since spread steadily in all directions (see White-Nose Syndrome Response Team 2019). The disease infects hibernating bats and is caused by a fungal pathogen (*Pseudogymnoascus destructans*; Blehert et al. 2009, 2011; Minnis and Lindner 2013). As of 2015, more than 5.5 million bats of hibernating species are estimated to have died of WNS, primarily in the northeastern US (USFWS 2015b). [Insert status of WNS in the state the Project is in]

### Range

Indiana bats are found over most of the eastern half of the United States (Figure 3.1). The recovery program for the Indiana bat delineates four Recovery Units (RUs): the Ozark-Central, Midwest, Appalachian Mountains, and Northeast RUs (USFWS 2007). Delineation of these RUs relied on a combination of preliminary evidence of population discreteness and genetic differentiation (Hall 1962, Barbour and Davis 1969, Gardner and Cook 2002), differences in population trends, and broad-level differences in macrohabitats and land use (Lomolino and Channell 1995; Channel and Lomolino 2000a, 2000b).

|  |
| --- |
|  |
| Figure 3.1. Indiana bat range including delineated Recovery Units **(RUs; USFWS 2015a).** |

### Population Trend

Since the release of the first Indiana bat Recovery Plan (USFWS 1983), the USFWS implemented a biennial monitoring program at Priority 1[[2]](#footnote-3) and Priority 2[[3]](#footnote-4) hibernacula (USFWS 2007). The most recent population estimates derived from these monitoring efforts are shown in Table 3.1. In 1965, the overall population was estimated to be over 880,000 individuals. However, while variation in the data collection apparently has led to variable estimates, in general, there has been a relatively long-term declining population trend through 2001 (Figure 3.2). The population showed a gradual increase from 2002 to a peak in 2007, but has since declined (Figure 3.2). A high proportion of that decline (more than 50%) is likely due to the effects of WNS, such as that documented in Turner et al. (2011).

|  |
| --- |
| Table 3.1. Indiana bat range-wide population estimates from [2009 to 2019] **(USFWS [2019]).** To be updated by the Applicant with a screenshot of the latest population estimates provided by the USFWS at: <https://www.fws.gov/Midwest/endangered/mammals/inba/index.html>. |
|  |

|  |
| --- |
|  |
| Figure 3.2. Indiana bat range-wide population estimates from [1981 to 2019] **(USFWS [2019]).**  To be updated by the Applicant with a screenshot of the latest population estimates provided by the USFWS at: <https://www.fws.gov/Midwest/endangered/mammals/inba/index.html> |

### Life History

The 2007 Draft Indiana Bat Recovery Plan provides a comprehensive discussion of Indiana bat life history. A summary of the life history follows.

A generalized chronology of the annual cycle in Indiana bats is found in Figure 3.3. Note that this figure depicts peaks for each phase of annual chronology, but does not capture outliers.

|  |
| --- |
|  |
| Figure 3.3. Annual chronology for Indiana bats. |

In winter, Indiana bats hibernate in caves, mines or other cave-like structures, often with other species. Indiana bats generally hibernate between October and April, although hibernation may extend from September to May in northern parts of their range (Hall 1962, Clawson et al. 1980, Kurta et al. 1997, Hicks 2004). Indiana bats tend to hibernate in relatively large, dense groups that range in size from 3,300 to nearly 5,400 bats per square m (USFWS 2007, Boyles et al. 2008).

In spring, Indiana bats emerge from hibernation, with emergence dates ranging between late March and late May, depending on latitude and weather conditions (Figure 3.3, Hall 1962, Cope and Humphrey 1977, LaVal and LaVal 1980). Shortly after emerging from hibernation, females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (Guthrie 1933). Females migrate to traditional roost sites and join other members of the maternity colony. Members of the same maternity colony may come from many different hibernacula (USFWS 2007).

Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas; that is, they return to the same summer range annually to bear their young (Humphrey et al. 1977; Gardner et al. 1991a, 1991b; Gardner et al. 1996; Callahan et al. 1997; Whitaker and Sparks 2003; Whitaker et al. 2004). It is difficult to enumerate colony size because colony members are dispersed among various roosts at any given time (Kurta 2005). Although most documented maternity colonies contained 100 or fewer adult females (Harvey 2002), as many as 384 bats have been reported emerging from one maternity roost tree in Indiana (Whitaker and Brack 2002). Whitaker and Brack (2002) indicated that average maternity colony size in Indiana (prior to WNS) was approximately 80 adult female bats.

Fecundity is relatively low, with female Indiana bats producing only one pup per year in late June to early July (Easterla and Watkins 1969, Humphrey et al. 1977, Kurta and Rice 2002). Young bats can fly at about four weeks of age (Mumford and Cope 1958, Easterla and Watkins 1969, Cope et al. 1974, Clark et al. 1987, Gardner et al. 1991a, Humphrey et al. 1997, Kurta and Rice 2002, Whitaker and Brack 2002). Cohesiveness of maternity colonies begins to decline after young bats become volant (Kurta et al. 1996). A few bats from maternity colonies may commence fall migration in August, although at many sites some bats remain in the maternity colony area through September and even into October (Humphrey et al. 1977, Kurta et al. 1993). Members of a maternity colony do not necessarily hibernate in the same hibernacula, and may migrate to hibernacula that are over 322 kilometers (km; 200 miles) apart (Kurta and Murray 2002, Winhold and Kurta 2006). It is generally accepted that Indiana bats, especially females, are philopatric; that is, the females return annually to the same hibernacula (LaVal and LaVal 1980).

Indiana bats return to the vicinities of hibernacula in late summer and early fall where the bats exhibit a behavior known as “swarming” (Cope and Humphrey 1977). This involves large numbers of Indiana bats flying in and out of cave entrances from dusk to dawn, though relatively few Indiana bats roost in the cave during the day (Cope and Humphrey 1977). During the swarming period, most Indiana bats roost within approximately 2.4 km (1.5 mi) of the cave, suggesting that the forests around the caves provide important habitat prior to hibernation (Kiser and Elliot 1996, Gumbert 2001, Kurta 2000). Swarming is a critical part of the life cycle when Indiana bats converge at hibernacula, mate, and forage until sufficient fat reserves have been deposited to sustain the bats through the winter (Hall 1962).

### Migration

During spring migration, female Indiana bats can travel up to 563 km (350 mi) to the summer maternity colonies (Winhold and Kurta 2006), although individuals radio-tracked in the northeastern US appear to travel much shorter distances (less than 68 km [42 miles]; Butchkoski et al. 2008).

Studies indicate that Indiana bat migration in the spring is fairly linear and short-term, while in the fall it may be more dispersed and varied in duration (Butchkoski and Turner 2006, USFWS 2007). There is evidence that bat flight activity is correlated with temperature as well as season (Roby and Gumbert 2016a, Brooks et al. 2017). Roby and Gumbert (2016a, 2016b; P. Roby, Copperhead Environmental Consulting, pers. comm.) found that tagged and tracked Indiana bats did not forage or migrate when the ambient air temperature was below 10 °C (50 °F) in the spring (13 bats) or fall (two bats). Roby and Gumbert (2016b) further reported that the mean migration temperature for four Indiana bats ranged from 13 °C – 22 °C (56 °F – 72 °F).

Between 2002 and 2014 in Indiana, Petit and O’Keefe (2017) found that temperature was the second most important modeled parameter associated with Indiana bat spring arrival, colony formation, colony breakup, and fall migration (date of year, likely influenced by photoperiod, was the most important parameter). Temperature was correlated with migration in both the spring and fall, when bats arrived at maternity colonies as temperatures increased, and left maternity colonies when temperatures decreased. Fall migration was initiated when temperatures the week before departure averaged 22 °C, and every 1.0 °C (1.8 °F) decrease in average temperature the prior week increased the odds of fall departure by 20% (Petit and O’Keefe 2017).

### Habitat Characteristics and Use

#### Winter Habitat

Most hibernacula are in karst areas of the east-central US; however, Indiana bats are also known to hibernate in human-associated cave-like structures, such as abandoned mines, buildings, a railroad tunnel in Pennsylvania, and a hydroelectric dam in Michigan (Kurta and Teramino 1994, Butchkoski and Hassinger 2002, Hicks and Novak 2002, USFWS 2007).

Indiana bats typically need low, stable temperatures (3-8° C, 37-46° F) to successfully hibernate (Brack 2004, Tuttle and Kennedy 2002). Caves with the largest populations of Indiana bats are usually large, complex systems that allow for airflow, yet buffer or slow changes in temperature due to cave volume and complexity (Brack 2004).

#### Spring Habitat

Little is known about Indiana bat habitat requirements during spring migration. The bats may roost in multiple locations while migrating or may fly almost non-stop to summer habitat (Hicks et al. 2005, 2012; Britzke et al. 2006; Butchkoski and Turner 2006). Some male and non-reproductive female Indiana bats migrate shorter distances than reproductive females, and may stay in the vicinity of hibernacula during summer (Gardner and Cook 2002, Whitaker and Brack 2002).

#### Summer Habitat

In the summer, female Indiana bats predominantly roost under slabs of exfoliating bark and will occasionally use narrow cracks in trees; females tend not to use tree cavities, such as those created by rot or woodpeckers (Kurta 2005, Lacki et al. 2009, Timpone et al. 2010).

Maternity colonies use two types of roost trees: primary roosts and alternate roosts (USFWS 2007). Primary roosts are used throughout the summer, while alternate roosts are used less frequently and may be important during changing weather conditions (temperature and precipitation), or when the primary roost is no longer usable (Callahan et al. 1997). Primary roosts have been often found near clearings or woodland edges where the roosts received more solar radiation; this may be important for thermoregulation of reproductive females and young (Vonhof and Barclay 1996).

Kurta (2005) identified the species of tree for 393 roost trees in 11 states and found that 33 tree species were used, with ash (*Fraximus* spp.), elm (*Ulmus* spp.), hickory (*Carya* spp.), maple (*Acer* spp.), poplar (*Populus* spp.), and oak (*Quercus* spp.) making up about 87% of the roost trees documented. Linear distances between roosts and foraging areas for female Indiana bats range from 0.5 to 8.4 km (0.3 to 5.2 mi), although most distances were less than half the maximum distance (Murray and Kurta 2004, Sparks et al. 2005). Murray and Kurta (2004) and Sparks et al. (2005) speculated that the variation in distances to foraging areas were due to differences in habitat type, interspecific competition, and landscape terrain.

Most Indiana bat maternity colonies have been found in agricultural areas with fragmented forests. An important landscape characteristic for maternity roost sites is the presence of a mosaic of woodland and open areas (USFWS 2007). The average proportion of canopy cover is highly variable among studies, ranging from less than 20% to nearly 90% (USFWS 2007).

#### Fall Habitat

Little is known about Indiana bat habitat requirements during fall migration. Most of what is known about fall migration comes from band returns (i.e., individuals that are banded during the summer and subsequently documented during winter hibernacula counts), which provides information about migration distances and beginning and ending destinations, but not information about timing or migration routes.

During the swarming period, both sexes roost in wooded habitat around hibernacula. Data on roosts used by swarming Indiana bats are relatively limited; swarming Indiana bats in Kentucky roosted in trees of species similar to those used during the summer reproductive period, but the trees tended to be smaller in size than for summer roosts (Kiser and Elliot 1996, Gumbert 2001).

### Occurrence in the Permit Area

The Permit Area is located within the range of the Indiana bat. Migrating Indiana bats are expected to occur within the Permit Area during the spring and fall migration seasons. Indiana bats [are also/are not] expected to occur within the Permit Area during the summer maternity season based on the results of the presence/probable absence surveys and any other relevant surveys conducted by the Project (citation). Summary of all bat survey and/or telemetry results should be included here (Include acoustics, mist netting, tracking results, as applicable). Indiana bats [are also/are not] expected to occur within the Permit Area during the staging/swarming season based on the distance of the Permit Area from the nearest known Indiana bat hibernaculum (xx km [miles]; citation). Indiana bats are not expected to occur within the Permit Area during the winter hibernation season when the species is not active (Section 3.1.4).

## Northern Long-Eared Bat

This section provides a summary of the northern long-eared bat’s status, range, life history and habitat. Additional information on northern long-eared bat ecology can be found in the final rule listing the northern long-eared bat as a threatened species (80 FR 17974 [April 2, 2015]) and the final northern long-eared bat 4(d) rule (81 FR 1900 [January 14, 2016]).

### Status

The northern long-eared bat was listed as threatened under the ESA in 2015. The 2015 Final Rule (80 FR 17974 [April 2, 2015]) lists the following as threats to the species:

* Disease;
* Loss/degradation of hibernation habitat;
* Loss/degradation of summer habitat;
* Disturbance of hibernating bats; and
* Other natural and anthropogenic factors, including climate change

WNS is currently the predominant threat facing the northern long-eared bat (80 Federal Register [FR] 17974 [April 2, 2015]). Populations of the northern long-eared bat in the northeastern US and eastern Canada are estimated to have declined by up to 99% since the discovery of WNS (80 FR 17974 [April 2, 2015]). (Northern long-eared bat population numbers should be coordinated with the Field Office at the time of HCP preparation).

### Range

The northern long-eared bat range extends through 39 states in the eastern and north central United States, and across eastern and central Canada (Table 3.4; Nagorsen and Brigham 1993, Caceres and Pybus 1997, Environment Yukon 2011). The species occurs in a widespread, but irregular, patchy distribution, rarely occurring in large numbers (Barbour and Davis 1969).

|  |
| --- |
|  |
| Figure 3.4. Northern long-eared bat range **(USFWS 2018a).** To be updated by the Applicant with a screenshot of the latest northern long-eared bat range published by the USFWS at: <https://www.fws.gov/midwest/endangered/mammals/nleb/nlebRangeMap.html> |

### Life History

The final rule listing the northern long-eared bat as a threatened species (80 FR 17974 [April 2, 2015]) provides a comprehensive discussion of northern long-eared bat life history. A summary of the life history follows.

In winter, northern long-eared bats hibernate in underground caves and cave-like structures, such as abandoned or active mines and railroad tunnels. Northern long-eared bats generally hibernate between October and April, depending on local climate; in southern areas, hibernation may occur from November – December through March, with emergence as late as mid-May in some northern areas (Hall and Brenner 1968, Fenton 1969, Caire et al. 1979, Kurta et al. 1997, Lowe 2012). Northern long-eared bats tend to roost singly or in small groups, with hibernating population size ranging from a few individuals to around 1,000 (USFWS 2015, unpublished data).

In spring, northern long-eared bats emerge from hibernation, with emergence dates ranging between late March to early April (as late as May in some northern areas), depending on latitude and weather conditions (Caire et al. 1979, Kurta et al. 1997). Shortly after emerging from hibernation, females become pregnant via delayed fertilization from the sperm that has been stored in their reproductive tracts through the winter (Racey 1979, Caceres and Pybus 1997). After emergence, female northern long-eared bats actively form colonies in the summer (Foster and Kurta 1999). Relatively short migratory movements between 56 to 89 km (35 to 55 mi) from hibernacula to summer habitat are most common (Griffin 1945, Nagorsen and Brigham 1993), suggesting the species is a regional migrant. The longest recorded migration distance for the species is 97 km (60 mi), reported by Griffin (1945).

Northern long-eared bats exhibit strong site fidelity to summer roosting and foraging areas; that is, the bats return to the same summer range annually to bear young (Foster and Kurta 1999, Jackson 2004, Johnson et al. 2009, Perry 2011). Northern long-eared bat maternity colonies range in size (reported range of seven to 100; Owen et al. 2002; Whitaker and Mumford 2009), although about 30-60 bats may be most common (Caceres and Barclay 2000, Whitaker and Mumford 2009).

Fecundity is low, with female northern long-eared bats producing only one pup per year in late May to early June (Easterla 1968, Barbour and Davis 1969, Caire et al. 1979, Whitaker and Mumford 2009). Young bats become volant between early July and early August (Kunz 1971, Krochmal and Sparks 2007).

Northern long-eared bats return to the vicinities of hibernacula in mid-August to mid-November, where the bats swarm (Lowe 2012). This involves large numbers of bats flying in and out of cave entrances from dusk to dawn, though relatively few roost in the cave during the day (Cope and Humphrey 1977). During the swarming period, most northern long-eared bats roost within approximately seven km (three mi) of the cave, suggesting that the forests around the caves provide important habitat prior to hibernation (Lowe 2012).

### Habitat Characteristics and Use

Northern long-eared bats have two distinct habitat requirements: 1) a stable environment for winter hibernation, and 2) deciduous forested habitat in the summer.

#### Winter Habitat

Suitable hibernacula for northern long-eared bats include underground caves and cave-like structures, such as abandoned or active mines or railroad tunnels. There may be other landscape features used by northern long-eared bats during the winter that have yet to be documented.

Hibernacula for northern long-eared bats typically have cracks and crevices for roosting; constant, cool temperatures (0-9 °C [32-48 °F]); high humidity; and minimal air currents (Fitch and Shump 1979, van Zyll de Jong 1985, Raesly and Gates 1987, Caceres and Pybus 1997, Brack 2007). Northern long-eared bats are typically found roosting in small crevices or cracks in cave or mine walls or ceilings, sometimes with only the nose and ears visible, and therefore may be overlooked during surveys (Griffin 1940, Barbour and Davis 1969, Caire et al. 1979, van Zyll de Jong 1985, Caceres and Pybus 1997, Whitaker and Mumford 2009).

#### Spring Habitat

Spring emergence occurs between March and May (Caire et al. 1979, Fenton 1969, Nagorsen and Brigham 1993, Whitaker and Rissler 1992), depending on region. Suitable spring habitat is typically located within eight km (five mi) of the hibernaculum and consists of a variety of forested habitats where the bats roost, forage, and travel (USFWS 2016b). Northern long-eared bats generally select roosts in the spring similar to roosts selected during the summer (USFWS 2016b; see also Section 3.2.4.3).

The direction of spring migration appears to radiate outward from hibernacula, with females migrating directly to the natal sites rather than moving primarily north or south (Davis and Hitchcock 1965, Fenton 1970, Griffin 1970, Humphrey and Cope 1976). Although little is known about the migration habits of male northern long-eared bats, males have been captured midsummer outside known hibernacula, suggesting that some male bats migrate relatively short distances from the hibernacula (Davis and Hitchcock 1965).

#### Summer Habitat

In the summer, northern long-eared bats predominantly roost singly or in colonies underneath bark or in cavities or crevices of both live trees and snags (Sasse and Pekins 1996, Foster and Kurta 1999, Owen et al. 2002, Carter and Feldhamer 2005, Perry and Thill 2007). Northern long-eared bats have also been observed roosting in colonies in human-made structures, such as in buildings, in barns, on utility poles, behind window shutters. and in bat houses (Mumford and Cope 1964, Barbour and Davis 1969, Cope and Humphrey 1972, Burke 1999, Sparks et al. 2004, Amelon and Burhans 2006, Whitaker and Mumford 2009, Timpone et al. 2010, Bohrman and Fecske 2013).

The northern long-eared bat appears to be somewhat flexible in tree roost selection, selecting varying roost tree species and types of roosts through its range (USFWS 2016a). Northern long-eared bats most likely are not dependent on certain species of trees for roosts; rather, many tree species that form suitable cavities or retain bark will be used by the bats opportunistically (Foster and Kurta 1999).

Linear distances between roosts and foraging areas for female northern long-eared bats were found to range from 0.06 to 1.70 km (0.03 to 1.06 mi) in New Hampshire (Sasse and Pekins 1996). Work on Prince Edward Island by Henderson and Broders (2008) found female northern long-eared bats traveling approximately 1.1 km (0.7 mi) between roosting and foraging areas.

Canopy coverage at northern long-eared bat roosts has ranged from 56% in Missouri (Timpone et al. 2010) to 66% in Arkansas (Perry and Thill 2007), to greater than 75% in New Hampshire (Sasse and Pekins 1996), and greater than 84% in Kentucky (Lacki and Schwierjohann 2001).

#### Fall Habitat

Little is known about habitat requirements for northern long-eared bats during fall migration. Fall migration likely occurs from mid-August to mid-October (USFWS 2016b). During the swarming period, relatively few bats are believed to roost in caves during the day (USFWS 2016b). Northern long-eared bats generally select roosts in the fall similar to roosts selected during the summer (USFWS 2016b; see also Section 3.2.4.2). Similar to spring, suitable fall habitat is typically located within eight km of the hibernaculum and consists of a variety of forested habitats where the bats roost, forage, and travel (USFWS 2016b, Roby et al. 2019).

### Occurrence in the Permit Area

The Permit Area is located within the range of the northern long-eared bat. Migrating northern long-eared bats are expected to occur within the Permit Area during the spring and fall migration seasons. Northern long-eared bats [are also/are not] expected to occur within the Permit Area during the summer maternity season based on the results of the presence/probable absence surveys and all other relevant surveys conducted by the Project (citation). Add details of bat surveys conducted here. Northern long-eared bats [are also/are not] expected to occur within the Permit Area during the staging/swarming season based on the distance of the Permit Area from the nearest known northern long-eared bat hibernaculum (xx km [miles]; citation). Northern long-eared bats are not expected to occur within the Permit Area during the winter hibernation season when the species is not active (Section 3.2.3).

# ENVIRONMENTAL SETTING AND BIOLOGICAL RESOURCES

Project-specific information to be provided by the Applicant

# POTENTIAL BIOLOGICAL IMPACTS AND TAKE ASSESSMENT

## Anticipated Take of Each Covered Species

Covered Species’ fatalities at wind energy facilities in USFWS Region 3 are rare (American Wind Wildlife Institute 2018) and appear to be somewhat stochastic events (i.e., there is an element of randomness to the events). Due to the rare occurrence of Covered Species fatalities at wind energy facilities, but acknowledging that Indiana bats and northern long-eared bats may migrate through the Permit Area in spring and fall [and occupy maternity colonies within/near the Permit Area during summer] ([Section(s) 3.1.6 and 3.2.5]), the Applicant estimates the potential take of [one Indiana bat and one northern long-eared bat] per year at the Project. However, to accommodate uncertainty in the level of take that may actually occur at the Project, the Applicant requests incidental take authorization for up to [three Indiana bats and three northern long-eared bats] per year, for a total of 18 bats [of each species] over the duration of the 6-year ITP term.

## Anticipated Impacts of the Taking

### Indiana Bat

Because female Indiana bats typically disperse farther from hibernacula (Sections 3.1.5 and 3.1.6.2), more female bats than male bats are expected to occur in the Permit Area. To account for this, 75% of the incidental take is anticipated to affect female Indiana bats, which would result in an expected annual take of 0.75 female Indiana bat, and approximately 2.25 of the three Indiana bats requested to be authorized annually. Using the REA and assuming a declining population due to the effects of WNS, the total predicted loss in reproductive capacity during the ITP term is seven to 22 female pups, resulting in a total predicted impact of take of 12 to 35 female Indiana bats. The bat conservation program’s mitigation projects will fully offset the impact of this take (Section 6.3), and thereby compensate for any impacts to the reproductive potential of Indiana bat populations.

Indiana bats occurring within the Permit Area would most likely be part of the [Midwest Recovery Unit (MRU); Ozark-Central Recovery Unit (OCRU)] population (USFWS 2007). The impacts of the taking are evaluated as they pertain to the Recovery Unit population, as well as to the range-wide population. The loss of Indiana bats and reproductive capacity from maternity colonies may reduce the productivity of the colony as a reproductive unit and, if losses are great enough, could potentially threaten the persistence of the colony on the landscape. The loss of Indiana bats from hibernacula may reduce the abundance of the [MRU; OCRU] population and, if losses are great enough, could potentially affect the growth rate of the hibernating population. However, [the loss of Indiana bats from summer maternity colonies in/near the Permit Area will be minimized through the implementation of turbine operational adjustments (Section 6.2) that have been demonstrated to effectively reduce bat mortality. Based on the [[number] hectares ([number] acres) of suitable summer habitat within the Permit Area and the 4.0-km (2.5-mile) Indiana bat maternity colony home range; [number] documented maternity colonies within the Permit Area], it is reasonable to assume that [number] colonies may be impacted by take during the summer season. If each colony consists of an average of [number] adult female bats, the loss of a female bat would represent [percentage] of the summer bat population within the Permit Area. However, because only 0.75 female Indiana bat is expected to occur annually, on average, and the requested authorized take would result in only up to 2 female Indiana bats annually, on average, and most of the take (of both male and female bats) over the permit term is expected to occur during the fall migration season, the loss of a female bat from the summer population within the Permit Area is unlikely to occur every year.

[Additionally,] because [most] of the requested take from the Project is expected to consist of individual Indiana bats migrating from various hibernacula and maternity colonies, and because take is expected to average one individual a year (and the requested take authorization is limited to no more than three individuals a year), take is not likely to have a concentrated or frequent impact on any single Indiana bat maternity colony or hibernaculum. The Project is located [number] km ([number] miles) from the nearest known Indiana bat hibernaculum and there are no known Indiana bat hibernacula [or maternity colonies] in close proximity to the Project where take may have a more concentrated impact. Rather, Indiana bats affected by take from the Project in the spring and fall migration seasons are likely to be individuals moving between numerous colonies and hibernacula on the landscape.

The average annual loss of up to three Indiana bats equates to a negligible reduction of the 2019 population of [245,474 Indiana bats in the MRU (USFWS 2019); 276,317 Indiana bats in the OCRU (USFWS 2019)], the population most likely to be impacted. This population is expected to continue to decline due to WNS, as the occurrence of WNS in the [MRU; OCRU] is newer and the geographic extent of the disease has not yet been as great as in the northeast or Appalachian regions (White-Nose Syndrome Response Team 2019.). However, even if the 2019 [MRU, OCRU] population of Indiana bats was reduced by 90% as a result of WNS, the loss of up to three Indiana bats per year, which would be even less likely due to the smaller population, would still represent much less than 1% of the WNS-reduced population. The loss to the range-wide population would be less than one-hundredth of 1%, based on the 2019 estimated range-wide population of 537,297 Indiana bats (USFWS 2019).

These losses represent small fractions of the [MRU; OCRU] and range-wide Indiana bat populations. Given the expected minimal impact of Project take on overall population levels, and because mitigation actions are designed to fully offset the impacts of the take, the Project is not expected to have an impact on the [MRU; OCRU] or range-wide populations of Indiana bats at their current population levels or under continued effects of WNS. A summary of the anticipated impacts to Indiana bats resulting from operation of the Project is presented in Table 5.1.

### Northern Long-Eared Bat

Northern long-eared bats do not migrate as far from hibernacula as Indiana bats and are more distributed on the landscape (Section 3.2.3), so both sexes may occur equally within the Permit Area. Therefore, 50% of the incidental take is anticipated to affect female northern long-eared bats, which would result in an expected annual take of 0.5 female northern long-eared bat, and approximately 1.5 of the three northern long-eared bats requested to be authorized annually. Using the REA and assuming a declining population due to the effects of WNS, the total predicted loss in reproductive capacity during the ITP term is five to 14 female pups, resulting in a total predicted impact of take of eight to 23 female northern long-eared bats. The bat conservation program’s mitigation projects will fully offset the impact of this take (Section 6.4), and thereby compensate for any impacts to reproductive potential of northern long-eared bat populations.

As discussed for Indiana bats in Section 5.2.1, [the loss of bats from summer maternity colonies in/near the Permit Area will be minimized through the implementation of turbine operational adjustments (Section 6.2) that have been demonstrated to effectively reduce bat mortality. Based on the [[number] hectares ([number] acres) of suitable summer habitat within the Permit Area and the 2.4-km (1.5-mile) northern long-eared bat maternity colony home range; [number] documented maternity colonies within the Permit Area], it is reasonable to assume that [number] colonies may be impacted by take during the summer season. If each colony consists of an average of [number] adult female bats, the loss of a female bat would represent [[percentage] of the summer bat population within the Permit Area. However, because only 0.5 female northern long-eared bat is expected to occur annually, on average, and the requested authorized take would result in only up to 1.5 female northern long-eared bats annually, on average, and most of the take (of both male and female bats) over the permit term is expected to occur during the fall migration season, the loss of a female bat from the summer population within the Permit Area is unlikely to occur every year.

[Additionally,] because [most] of the requested take from the Project is expected to primarily consist of individual northern long-eared bats from various hibernacula and maternity colonies, and is expected to average one individual a year (and the requested take authorization is limited to no more than three individuals a year), take is not considered likely to have a concentrated or frequent impact on any single maternity colony or hibernaculum. The Project is located [number] km ([number] miles)] from the nearest known northern long-eared bat hibernaculum and there are no known northern long-eared bat hibernacula [or maternity colonies] in close proximity to the Project where take may have a more concentrated impact. Rather, northern long-eared bats affected by take from the Project in the spring and fall migration seasons are likely to be individuals moving between numerous colonies and hibernacula on the landscape.

The [State] population of northern long-eared bats is most likely to be affected by take from the Project, given the species’ relatively short migration distances (Section 3.2.3). The average annual loss of up to three northern long-eared bats equates to a negligible reduction of the [State] population. As described for Indiana bats, the northern long-eared bat population is expected to continue to decline due to WNS; however, even if the [State] population were reduced by 90% as a result of WNS, the loss of up to three northern long-eared bats per year would still represent less than 1% of the [State] WNS-reduced population. The loss to the range-wide population would be likely less than one-hundredth of 1%. Given the expected minimal impact of Project take on overall northern long-eared bat population levels, and because mitigation actions are designed to fully offset the impacts of Project take, the Project is not expected to have a substantial impact on the [State] or range-wide populations of northern long-eared bats at the species’ current levels or under continued effects of WNS. A summary of the anticipated impacts to northern long-eared bats resulting from operation of the Project is presented in Table 5.1.

|  |  |  |
| --- | --- | --- |
| Table 5.1. Summary of impacts to Covered Species by the Covered Activities at the [Project Name]. | | |
| **Impact Metric** | **Indiana Bat** | **Northern Long-Eared Bat** |
| Expected Take  (Over the Permit Term) | 6 bats | 6 bats |
| Requested Authorized Take  (Over the Permit Term) | 18 bats | 18 bats |
| Rangewide Population | 537,2971 | 6,546,7182 |
| [Midwest; Ozark-Central] Recovery Unit Population | Midwest 245,4741  Ozark-Central 276,3171 | N/A |
| Impact on Maternity Colonies | Impacts are expected to be dispersed and negligible for any individual maternity colony. | Impacts are expected to be dispersed and negligible for any individual maternity colony. |
| Impact on Hibernaculum | Impacts are expected to be dispersed and negligible for any individual hibernaculum. | Impacts are expected to be dispersed and negligible for any individual hibernaculum. |
| Summary of Impact of Take | Project take is small and expected to have a minimal impact on overall population levels. If the population in the [Midwest; Ozark-Central] Recovery Unit becomes substantially reduced as a result of WNS, the Applicant will take corresponding action as described in the Changed Circumstances (Table 7.1). | There are limited data available to evaluate the population-level impact of take due to the species’ tendency to hibernate individually or in small groups; however, Project take is small and expected to have a minimal impact on overall population levels. |
| 1USFWS 2019 (check with FWS for most up to date estimates)  2USFWS 2016a (check with FWS for most up to date estimates)  USFWS = US Fish and Wildlife Service; WNS = white-nose syndrome | | |

# BAT CONSERVATION PROGRAM

The Applicant’s bat conservation program focuses on minimizing potential impacts to the Covered Species in the Permit Area and mitigating the impacts of the take through the protection or enhancement of high-quality bat habitat in the Plan Area. Monitoring will be used to verify the effectiveness of these measures in meeting the biological goals and objectives of this HCP and to provide information necessary to assess ITP compliance.

## Biological Goals and Objectives

The biological goals of an HCP are the broad, guiding principles for the operation of the bat conservation program described in the HCP and form the rationale behind the minimization and mitigation strategies employed. Per the HCP handbook, the biological objectives represent the steps through which the biological goals will be achieved, and provide a basis for measuring progress towards achieving the biological goals. The Applicant’s minimization and mitigation measures corresponding to each biological goal and objective are discussed in greater detail in Sections 6.2 and 6.3. The biological goals and objectives of this HCP are:

**Goal 1:** Contribute to maintaining the integrity of the Covered Species’ populations that migrate through [and occupy maternity colonies within] the Plan Area.

***Objective to achieve Goal 1:*** Minimize incidental take of the Covered Species within the Permit Area by implementing an operational strategy in each ITP year that has been demonstrated to substantially reduce bat mortality at wind energy facilities (Section 6.2).

**Goal 2:** Support the long-term persistence of the Covered Species populations.

***Objective to achieve Goal 2:*** Protect vulnerable habitat for the Covered Species within the Plan Area during the ITP term to protect Covered Species and the species’ habitats from disturbance or threats during important life history stages, such as fall swarming, winter hibernation, or summer reproduction (Section 6.3).

**Goal 3:** Offset demand for other energy generation technologies that produce carbon emissions that have been shown to contribute to global climate change, identified as a potential risk to both of the Covered Species (USFWS 2007; 80 FR 17974 [April 2, 2015]).

***Objective to achieve Goal 3:*** Implement an operational strategy at the Project in each ITP year that maximizes output of non-carbon-emitting, renewable energy (Section 6.2) and also meets Goal 1, the minimization of the incidental take of the Covered Species.

## Measures to Minimize Take

The Applicant will minimize potential impacts to the Covered Species from the Project by implementing turbine operational adjustments (Table 6.1). Several operational adjustment experiments and comparisons have documented significant reductions in bat mortality through feathering and by increasing the wind speed at which turbines become operational (i.e., the cut-in speed).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 6.1. Operational Minimization Plan for the [Project Name] Habitat Conservation Plan. | | | | |
| **Dates** | **Turbines** | **Cut-in Speed** | **Temperature Threshold** | **Feathering Below Cut-in1?** |
| March 15 – July 31 | All [No summer risk] | Manufacturer’s rated, minimum of 3.0 m/s (9.8 ft/s)2 | 10° C (50° F) | Yes |
| [March 15 – March 31 | Summer risk3 | Manufacturer’s rated, minimum of 3.0 m/s (9.8 ft/s)2 | 10° C (50° F) | [Yes] |
| [April 1 – July 31 | Summer risk3 | 5.0 m/s (16.4 ft/s) | 10° C (50° F) | [Yes] |
| August 1 – October 15 | All | 5.0 m/s (16.4 ft/s) | 10° C (50° F) | Yes |
| October 16 – November 15 | All | Manufacturer’s rated, minimum of 3.0 m/s (9.8 ft/s)2 | 10° C (50° F) | Yes |
| November 16 – March 14 | All | Manufacturer’s setting | None | No |
| 1 Feathering means that turbine blades will be pitched into the wind such that they spin at approximately one rotation per minute.  2 Turbines will be feathered below the manufacturer’s rated cut-in speed, unless the manufacturer’s rated cut-in speed is less than 3.0 m/s in which case turbines will be feathered below 3.0 m/s.  3 Defined by the USFWS as all turbines located less than 305 meters (measured from the turbine blade tip) from occupied summer habitat for the Covered Species.  °= degree; C = Celsius; F = Fahrenheit; ft/s = feet per second; m/s = meters per second | | | | |

The Applicant will feather all turbines below the manufacturer’s rated cut-in speed, down to a minimum cut-in speed of 3.0 m/s, when the temperature is above 10 °C from sunset to sunrise from March 15 to July 31, and from October 16 to November 15 each year. Research suggests that feathering below the manufacturer’s rates cut-in speed can reduce all bat fatalities by approximately 35% to 57.5% (Baerwald et al. 2009, Young et al. 2011, Good et al. 2012) and activity of the Covered Species is comparatively minimal below 10° C (Roby and Gumbert 2016a, 2016b). Additionally, the Applicant will feather all turbines below a cut-in speed of 5.0 m/s, when the temperature is above 10 °C, from sunset to sunrise from August 1 to October 15 each year, during the higher risk fall migration period for the Covered Species. [At all turbines with summer risk (defined by the USFWS as all turbines within 305 meters[[4]](#footnote-5) of occupied summer habitat for the Covered Species), the Applicant will raise the cut-in speed to 5.0 m/s earlier in the season, beginning April 1 and continuing through October 15, extending the period of higher cut-in to include the period of risk for bat migrating to and occupying maternity colonies in/near the Permit Area.] Research suggests that feathering below a cut-in speed of 5.0 m/s (16.4 ft/s) can reduce all bat fatalities by approximately 47% to 82% (Arnett et al. 2010; Good et al. 2011; Hein et al. 2013, 2014). These measures will be implemented in all years of the ITP term unless adjusted based on adaptive management (Section 6.5).

Project turbines will be monitored and controlled based on wind speed on an [individual; Project-wide] basis (i.e., the [entire Project [will; will not] alter cut-in wind speed of all turbines at the same time, [but; and] cut-in speeds [will; will not] be altered based on wind speed conditions specific to each turbine). Turbine blades will be feathered when the 10-minute rolling average wind speed, [as monitored at individual turbines], is below the cut-in wind speed during the course of the night. Turbines will be released to run normally when the 10-minute rolling average wind speed rises above the cut-in wind speed. As with wind speed, turbines will be monitored and controlled based on temperature on an [individual; Project-wide] basis.

## Measures to Mitigate Impacts from Unavoidable Take

As described above, the Applicant will implement measures that are expected to reduce take of the Covered Species, and thereby minimize the impact of take on Covered Species’ populations; however, some incidental take of the Covered Species may still occur. To provide conservation benefits to the Covered Species, the Applicant will fund and implement mitigation that fully offsets the impact of the take. The Applicant will provide funding assurances for mitigation sufficient to offset the impact of the authorized take ([18 Indiana bats and 18 northern long-eared bats]) prior to take authorization becoming effective (Section 8.3). The Applicant will provide upfront mitigation sufficient to offset at least the impact of the expected take from implementation, one bat per year [per species] for the ITP term ([six Indiana bats and six northern long-eared bats]). A mitigation true-up to offset up to the authorized level of take will be implemented if triggered under adaptive management (Section 6.5). Alternatively, the Applicant may choose at their discretion to offset the impact of the full authorized amount of take ([18 Indiana bats and 18 northern long-eared bats]) through initial upfront mitigation.

The timeline for implementing mitigation varies by method and is identified for each option below. The Applicant, in some cases, may wish to secure mitigation in anticipation of and prior to issuance of an ITP for a final HCP. Such voluntary advance actions must be coordinated with the Field Office and meet all compensatory mitigation standards set forth below. Applicant will provide clear evidence that the voluntary action was undertaken to fulfill mitigation requirements for a particular HCP. Technical assistance provided by the Service related to voluntary advance mitigation actions does not guarantee that the Service will eventually issue an ITP or that the Project will fulfill mitigation requirements. The Service will determine at the time of permit issuance whether and how much to credit voluntary advance mitigation actions.

The four mitigation options outlined below are intended to provide streamlined and expeditious means to offset take. Regardless of the option selected, summer habitat mitigation lands will either include or be contiguous with a minimum of 46 protected acres per the parameters of the REA model.

1) Purchase of credits from a conservation bank for the covered species. The conservation bank must be approved by the USFWS and have sufficient credits available to meet the mitigation need. A Credit Sale Agreement will be completed with the bank sponsor prior to permit issuance and a copy provided to USFWS. The funds for the credit purchase will be transmitted to the bank sponsor within 90 calendar days of permit issuance. Once funds have been transmitted, a copy of the Bill of Sale will be provided to USFWS.

2) Contribution to an in-lieu fee (ILF) mitigation fund for the covered species. The ILF must be approved by the USFWS. A Verification Letter will be completed with the fund sponsor prior to permit issuance and a copy provided to USFWS. The funds being contributed to the ILF will be transmitted to the fund sponsor within 90 calendar days of permit issuance. Once funds have been transmitted, a copy of the receipt will be provided to USFWS.

3) Use of a Permittee-Responsible Mitigation (PRM) project. PRM projects must occur within the state or, in the case of Indiana bat, the recovery unit where the impacts are occurring; in this case [state] or the [recovery unit]. PRM projects must be pre-approved by the USFWS and include appropriate real estate assurances (i.e. conservation easement), financial assurances (i.e. management endowment), and a management plan approved by the local Field Office. Acceptable PRM projects can be summer habitat protection, summer habitat restoration, winter habitat protection, or a combination of these project types. A stand-alone PRM project must individually meet the 46-acre threshold for summer habitat, or, for projects that will provide less than 46 acres of mitigation, must be part of a suitable habitat complex that is at least 46 acres, for example established adjacent to existing conservation lands. If a stand-alone PRM project is developed that surpasses the mitigation need, the surplus may be used to true-up mitigation within the 6-year ITP term. The use of cave-gating or other measures to protect winter habitat/hibernacula of the Covered Species must be approved by the Service and must be conducted through a Service-approved mitigation entity (or entities).  Winter habitat protection measures should be designed and funded to be maintained by the mitigation entity in perpetuity. The PRM project will be completed within one year of permit issuance.

4) Contribution to a WNS treatment fund. [When contribution to a WNS treatment fund becomes an option for mitigation, insert details on USFWS-approved fund and treatment that will be supported through the contribution. The fund must be approved by the USFWS and provide support for a viable and validated WNS treatment for the covered species. The funds being contributed to the WNS treatment fund will be transmitted to the fund manager within X calendar days. Once the funds have been transmitted, a copy of the receipt will be provided to USFWS]

Mitigation requirements for PRM were calculated using the USFWS’s species-specific Resource Equivalency Analysis (REA) model(s) (Public Versions, December 2016) using the parameters and assumptions in Appendix D.

Upfront mitigation will be completed to offset the impact of taking one bat per year (or six total bats over the 6-year ITP term) [of each Covered Species]. Upfront mitigation acres [for Indiana bat; northern long-eared bat; Indiana bat plus northern long-eared bat using stacking ratios provided by the USFWS[[5]](#footnote-6)] are shown in Table 6.2.

|  |  |  |
| --- | --- | --- |
| **Table 6.2. Upfront mitigation acres (1 bat/year) for [Indiana bat; northern long-eared bat; stacked Indiana bat plus northern long-eared bat].** | | |
| **Covered Species** | **Summer habitat protection, hectares (acres)** | **Summer habitat restoration, hectares (acres)** |
| Indiana bat | 6.5 (16.0) | 5.3 (13.0) |
| Northern long-eared bat | 4.5 (11.0) | 4.9 (12.0) |
| Indiana bat + Northern long-eared bat | 6.9 (17.1) | 5.7 (14.2) |

Under the mitigation true-up (if needed), additional acres could be needed to mitigate for the impact of taking up two additional bats per year (12 additional bats beyond the initial 6, for a total of 18 bats over the 6-year ITP term) [of each Covered Species]. The total potential mitigation acres for the full authorized take for [Indiana bat; northern long-eared bat; Indiana bat plus northern long-eared bat using stacking ratios provided by the USFWS5]are shown in Table 6.3.

|  |  |  |
| --- | --- | --- |
| **Table 6.3. Total mitigation acres (maximum of three bats/year) for [Indiana bat; northern long-eared bat; stacked Indiana bat plus northern long-eared bat].** | | |
| **Covered Species** | **Summer habitat protection, hectares (acres)** | **Summer habitat restoration, hectares (acres)** |
| Indiana bat only | 19.4 (48.0) | 15.0 (37) |
| Northern long-eared bat only | 12.5 (31.0) | 13.8 (34.0) |
| Indiana bat + Northern long-eared bat | 20.8 (51.1) | 16.3 (40.4) |

The following information shall be contained within the Project Development Plan for each PRM Project, to be developed together with the Service once the mitigation parcel(s) is identified. The plan will include a description of the property and detail preservation or restoration measures needed on the site, including:

1. Goals and Objectives: A description of the habitat resource type(s) and amount(s) that will be provided in acres or other metrics where appropriate (e.g., cave gating) and the functions targeted for preservation or restoration.
2. Site Selection: An assessment of the factors considered during the site selection process with guidance from a provided checklist.
3. Site Protection Instrument: A description of the legal arrangements and instrument that will ensure the long-term protection of the compensatory mitigation site.
4. Determination of Habitat Acres: A description of the number of habitat acres to be provided from the Mitigation Project, including a brief explanation of the rationale for this determination. The area determined to provide the acreage must be clearly delineated. Delineation must also identify features that would not be considered for mitigation acres such as developed areas within the property, prior mitigation projects, and previously implemented restoration projects.
5. Cost and Timeline of Implementation: The Mitigation Project Provider will provide a full cost estimate for acquiring, restoring (if applicable), monitoring, and managing in the long-term and a timeline for completion.
6. Baseline Site Information: A description of the ecological characteristics of the proposed site, including last known occurrence of Covered Species on the site.
7. Performance Criteria: Assessment of which ecological and measurable standards will need to be reached to achieve functional habitat objectives.
8. Compensatory Mitigation Work Plan: If applicable, provide detailed written specifications and work descriptions for the Mitigation Project to reach suitable habitat function, including geographic boundaries; restoration methods, timing, and sequence of work; including methods for establishing the desired tree and plant community; and plans to control invasive plant species; etc.
9. Maintenance Plan: A description and schedule of maintenance requirements to ensure the continued viability of the habitat resource once initial construction is completed to meet ecological performance standards.
10. Monitoring Requirements: A description of parameters to be monitored in order to determine if the Mitigation Project is on track to meet Performance Standards and if Adaptive Management is needed. A schedule for monitoring and reporting on monitoring results will also be included.
11. Long-term Management Plan: A description of how the Mitigation Project will be managed after achievement of Performance Standards to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the Long-term Steward responsible for long-term management.
12. Adaptive Management Plan: A management strategy to address unforeseen changes in site conditions or other components of the project, including the party or parties responsible for implementing adaptive management measures. The Adaptive Management Plan will guide decisions for revising Project Development Plans and implementing measures to address changed circumstances that adversely affect the Mitigation Project’s success.
13. If the proposed Mitigation Project is less than 46 acres, other information, such as a.) nearby mitigation or restoration projects or other existing protected lands and how the proposed Mitigation Project may complement them; b.) adjacent (generally within 4.0 km or 8.0 km [5.0 miles]) land uses and potential effects of adjacent land uses on the Mitigation Project, or c.) other information as identified by the USFWS as necessary for inclusion in the Project Development Plan to demonstrate that the proposed Mitigation Project is contiguous with a minimum of 46 protected acres.

## Monitoring

The Applicant will conduct monitoring to track compliance with the HCP and the requested ITP. In addition, monitoring will allow the Applicant and USFWS to track progress being made towards the HCP’s biological goals and objectives, evaluate if the HCP’s bat conservation program is effective at minimizing and/or mitigating impacts to Covered Species, and evaluate the need for adaptive management measures to improve the HCP’s conservation strategy (USFWS and NMFS 2016).

### Biological/Effectiveness Monitoring

Effectiveness monitoring tracks the progress of the conservation strategy in meeting the HCP’s biological goals and objectives (USFWS and NMFS 2016). As a requirement of mitigation implemented through a contract with a mitigation provider or execution of an easement (i.e., PRM), a Project Development Plan acceptable to the USFWS will be developed prior to implementation of the mitigation. The Project Development Plan will describe: the mitigation project’s monitoring protocol, the entity responsible for periodic evaluation of the mitigation project according to the monitoring protocol, the frequency of periodic evaluation, adaptive management actions to be taken if the periodic evaluation indicates that the habitat quality of the mitigation project has been compromised by a natural disaster and no longer meets its success criteria, and the reporting process.

If mitigation is implemented through a USFWS-approved conservation bank, in-lieu fee fund, or WNS treatment fund, monitoring and reporting will be conducted by the managing entity according to the requirements established during the USFWS’s approval process for the bank or fund.

### Compliance Monitoring

Compliance monitoring tracks the ITP holder’s compliance with the requirements specified in the HCP and ITP (USFWS and NMFS 2016). The Applicant’s compliance monitoring protocol will consist of two components: 1) post-construction fatality monitoring in Years 1-3 of the ITP term designed to achieve a minimum detection probability (g) of 0.2 during the spring and fall seasons (April 1 – May 15, and August 1 – October 15); and 2) post-construction fatality monitoring in Years 4-6 of the ITP term designed to achieve a minimum probability of detection (g) of 0.08 during the spring and fall seasons (April 1 – May 15, and August 1 – October 15), unless adaptive management indicates otherwise. [Additionally, the subset of turbines located within 1.0 km (0.6 mile) of occupied summer habitat for the Covered Species will be monitored during the summer maternity season (May 16 – July 31) using a protocol designed to achieve a g of 0.2 across the entire bat monitoring season (April 1 – October 15) in Years 1-3 of the ITP, and a g of 0.08 in Years 4-6.] Table 6.4 provides the monitoring protocol for Year 1 of the ITP; monitoring protocols for Years 2-6 will be designed based on data from the previous years of monitoring using the EoA model to ensure the target g value will be achieved. In the event that the combined monitoring efforts in Years 1-3 falls short of a minimum average g of 0.2, monitoring effort in Year 4 will be increased to make up for the monitoring shortfall (the average g over the first 4 years of monitoring will be a minimum of 0.17).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 6.4 Year 1 Compliance Monitoring Protocol Designed to Provide a Probability of Detection of 0.2 at the [Project Name]. | | | | |
| **Monitoring Season** | **Number of Turbines Searched** | **Plot Radius** | **Plot Type1** | **Search Interval** |
| Spring (April 1 ‑ May 15) | [number] | [dimensions] | [cleared; road and pad] | [number of days] |
| Summer (May 16 July 31‑) | [number] | [dimensions] | [cleared; road and pad] | [number of days] |
| Fall (August 1 ‑ October 15) | [number] | [dimensions] | [cleared; road and pad] | [number of days] |

1 Cleared plots will be managed such that vegetation does not exceed 10 centimeters (4 inches) in height.

The Evidence of Absence (EoA) model and software (Huso et al. 2015, Dalthorp et al. 2017) will be used to assess take of the Covered Species and compliance with the requested ITP. Annual fatality monitoring will be designed to meet the target value of g and provide all necessary inputs required for EoA, including the total number of carcasses of the Covered Species found during searches; the results of searcher efficiency trials, carcass persistence trials, and an area correction model that will be used for bias correction; and annual weights that reflect the relative fatality rates from year to year, if appropriate. The annual weights (rho, in the EoA model) are usually all 1.0, but may differ from year to year if parts of the wind energy facility become inoperable during some years, or if additional operational adjustments to reduce bat fatality are implemented. Rho is the annual relative fatality rate of the wind energy facility in a given year. The EoA model will be used to estimate the 50th credible bound of the average annual take rate (lambda) for use in testing adaptive management triggers to ensure compliance with the ITP (Table 6.2). The average lambda value will be estimated in Year 3, 4, 5, and 6 of the ITP; lambda will not be estimated in Year 1 or Year 2 of the ITP because compliance with the low level of requested take cannot be assessed with precision before multiple years of data are available.

During the Project’s post-construction fatality monitoring, all bat carcasses located within the standardized search area will be recorded. The following information will be recorded for each carcass: a unique identification code; sex and age when possible; date and time collected: observer; carcass condition (i.e., intact, scavenged, dismembered, or injured); injuries; scavenging; estimated time of death; Universal Transverse Mercator location, distance and bearing from the turbine; and any relevant comments. All carcasses will be photographed as found and plotted on a map of the search area. Bat carcasses will be collected and species identification will be verified by bat biologists permitted by the USFWS to survey for Indiana bat and northern long-eared bat. Skin and tissue samples from bat carcasses too decomposed to be identified and that cannot be ruled out as a Covered Species by permitted bat biologists will be sent to a qualified lab for identification via deoxyribonucleic acid (commonly, DNA) sampling. All bat carcasses or genetic samples from all bat carcasses will be provided to USFWS, upon request. Carcasses found outside of the standardized search area will be recorded following the above protocol, but labeled as incidental finds and excluded from the EoA model.

Searcher efficiency and carcass persistence trials will be conducted to provide bias correction factors for the EoA model. The objective of the searcher efficiency trials is to estimate the proportion of available carcasses found by searchers. Searcher efficiency trials will be conducted in the same areas as carcass searches and will be estimated by search area type (cleared plot or road and pad) and season. Approximately [number] bat carcasses or bat surrogate carcasses will be placed in roughly even numbers across search area types (i.e., approximately [number] carcasses per search area type [cleared plots/roads and pads], per month). Carcasses of non-listed bat species found on-site, and carcasses of non-listed bat species that are available from labs or other sources, will be used in the trials. If an insufficient number of bat carcasses is available, brown or black mice (*Mus musculus*) carcasses may be used as surrogate bat carcasses. The person placing the carcasses will not inform the personnel conducting the searches when the trial is being conducted or where trial carcasses are placed.

The objective of carcass persistence trials is to estimate the average probability a carcass is available to be found after an interval of time. Carcasses will be placed within search area boundaries. Carcass persistence trials will be conducted throughout the monitoring period to incorporate the effects of varying weather, climatic conditions, and scavenger densities. Species used for carcass persistence trials will be the same as used for searcher efficiency trials. Approximately [number] bat carcasses or bat surrogate carcasses will be placed during the carcass persistence trials. Field personnel will monitor carcass persistence trials for [number] days. Trial carcasses will be checked every day for the first [number] days, and then on day [identify series of days] after placement. At the end of the [number]-day period, any remaining evidence of the carcass will be removed.

If new information becomes available to suggest improved methods for estimating bat mortality, the Applicant may consult with the USFWS regarding cost effective and logistically feasible changes to the protocol and implementation of applicable new methods, per the New Technology and Information Changed Circumstance (Section 7.1).

## Adaptive Management

Adaptive management is a method to address uncertainty in natural resources management. Broadly defined, it means to examine strategies for meeting biological goals and objectives, and then, if necessary, adjusting future conservation management actions according to what is learned. The Applicant will utilize adaptive management to ensure that the Project’s bat conservation program is effective in meeting the biological goals and objectives of this HCP and that the take of Covered Species at the Project does not exceed the permitted level of take (Table 6.5).

|  |  |  |
| --- | --- | --- |
| Table 6.5 Adaptive Management Plan for the [Project Name]. | | |
| **Trigger** | **Action** | **Monitoring** |
| The average annual take rate (lambda) is < 1 bat/year at Year 3. | Continue operational minimization as planned. | Continue to monitor at *g*=0.08 for the remaining 3 years. |
| The average annual take rate (lambda) is between 1 and 3 bats/year at Year 3. | Continue operational minimization as planned; conduct mitigation true-up according to projected\* 6-year take estimate. | Continue to monitor at g=0.08 for the remaining 3 years. |
| The average annual take rate (lambda) > 3 bats/year in Year 3 or any later year or two carcasses of [Indiana bats or northern long-eared bats] have been found in Years 1-2. | Begin feathering turbines below 6.9 m/s (22.6 ft/s) during the period(s) of risk\*\*; conduct mitigation true-up for any unmitigated take. | No monitoring because no take is expected to occur under the turbine operational adjustment. |
| The average annual take rate (lambda) is between 1 and 3 bats/year at Year 6. | Conduct a mitigation true-up for any unmitigated impact of take. | Not applicable. |
| An Indiana bat or northern long-eared bat carcass is found during the spring or during the summer. | Increase cut-in speed to 5.0 m/s during spring at all turbines if the carcass was found in the spring.  If the carcass was found during the summer at a turbine within 305 meters of this habitat, all turbines within 305 meters of occupied suitable habitat will be considered to have summer risk. If the carcass was found during the summer at a turbine greater than 305 meters of this habitat, all turbines within 1.0 km of occupied suitable habitat will be considered to have summer risk. All turbines considered to have summer risk will be operated at 5.0 m/s and also during the spring/summer seasons (April 1 through July 31) for the remainder of the permit. | Continue to monitor per Section 6.4. |
| \* Projected take will be estimated using the projection tool in the Multiple Years Module of EoA to calculate lambda for an alpha level of 0.5. Lambda will be multiplied by 6 to calculate the expected take at Year 6 and the corresponding mitigation true-up. | | |
| \*\* The Field Office will make a Project-specific determination about the periods of risk for this adaptive management measure. At minimum, the “periods of risk” are defined as the fall, and the season(s) in which the carcasses were recovered, if not during the fall. | | |

## Reporting

The Applicant will provide the USFWS with an HCP report by January 31 each year of the ITP term. The report will include, but will not be limited to, the following:

* Results of compliance monitoring conducted during the previous year, including data on all carcasses collected during searches and the bias trial results;
* Take estimates of the Covered Species and the methods and inputs used to calculate the estimates as described in Section 6.4.2;
* Representative data summarized to demonstrate turbine operations;
* Review of the adaptive management triggers and which trigger was met;
* Actions implemented or planned for implementation in response to adaptive management triggers;
* Description of mitigation implemented to date;
* Results of mitigation effectiveness monitoring conducted during the previous year;
* Description of adaptive management implemented at the mitigation project(s), if applicable; and
* Description of any Changed Circumstances triggered and the response implemented, if applicable.

If the average lambda is estimated to be greater than three bats/year in Year 4 or Year 5, between reporting years, the Applicant will implement the response identified in Table 6.5 and will notify the USFWS prior to the start of the next bat active season (March 15). Additionally, although permitted, in the event that a Covered Species fatality is documented during the compliance monitoring, the USFWS will be notified by phone and/or email within 24 hours once positive species identification has been determined. Carcasses of listed bat species will be provided to USFWS. The USFWS will also be notified by phone and/or email within 24 hours of positive species identification of an eagle or other ESA-listed species carcass.

The Applicant will also comply with reporting requirements for state permits relevant to the compliance monitoring; in this case, the Applicant will comply with salvage permit reporting requirements of the [state agency].

# CHANGED AND UNFORESEEN CIRCUMSTANCES

Implementing regulations for Section 10 of the ESA recognize that revisions to the original HCP may be required as circumstances and information may change.

## Changed Circumstances

Changed Circumstances are changes in circumstances affecting a listed species or geographic area covered by an HCP that can reasonably be anticipated by plan developers and the USFWS and that can be planned for (50 CFR 17.3 [1975]). Per the HCP Handbook, to the extent practicable, the Applicant should identify potential Changed Circumstances in advance and identify specific strategies or responses in the HCP for addressing them, so that adjustments can be made as necessary without the need to amend the HCP. Pursuant to the “No Surprises” Rule (63 FR 8859 [February 23, 1998]), if the USFWS determines that additional conservation and mitigation measures are necessary as the result of a Changed Circumstance and the circumstance has been addressed in this HCP, implementation of the response to the Changed Circumstance is required.

Foreseeable Changed Circumstances warranting planning considerations include the following:

* ESA listing of a new bat species as threatened or endangered that occurs within the Permit Area and is reasonably certain to experience take from the Project;
* New technology or information that improves monitoring bat mortality, estimating mortality and/or minimizing mortality;
* Change in Covered Species’ migration dates;
* New information indicates that there is a change in summer risk to Covered Species;
* Changes in a mitigation project’s ability to meet success criteria during the ITP term[[6]](#footnote-7); or
* Unavoidable delay of mitigation project implementation beyond 1 year of ITP issuance.

The specific triggers and responses for each of the above listed Changed Circumstances are presented in Table 7.1.

## 

| Table 7.1. Changed Circumstances and ITP holder response. | | | |
| --- | --- | --- | --- |
| **Changed Circumstance** | **Rationale** | **Trigger** | **Response** |
| ESA listing of a new bat species as threatened or endangered that occurs within the Permit Area and is reasonably certain to experience take from the Project. | As a result of current population declines due primarily to WNS, other bat species may become listed under the ESA as threatened or endangered during the ITP term. | The USFWS notifies the Applicant of a proposed rule to list under the ESA any bat species that occurs within the Permit Area and is reasonably certain to experience take from the Project, but is not covered by the HCP. | The Applicant may choose to modify its operations in coordination with the USFWS to ensure that incidental take of the species will be unlikely to occur. Alternatively, the Applicant may choose to seek to include the species under the ITP through an ITP Amendment (see Section 9.2). |
| New technology or information that improves monitoring bat mortality, estimating mortality and/or minimizing mortality | Over the course of the ITP term, new information on Covered Species and bat/wind power interactions may become available; new methods for monitoring and/or estimating mortality may be developed; or technological advancements (e.g., smart curtailment systems, deterrent systems) may be developed to minimize Covered Species mortality from wind turbines. The Applicant may wish to incorporate new information, methods, and/or technology into the operations and monitoring plans outlined in the HCP. | The Applicant notifies the USFWS of the intent to utilize alternative monitoring, mortality estimation, or minimization methods that have been demonstrated, based on the best available science, to be as effective as, or more effective than, the methods described in this HCP and available at equal or lower cost. New methods and technologies will only be considered if the methods have been demonstrated to be at least as effective as the methods in this HCP, are considered the best available science, will not require an increase in the take authorization for the Project, and are approved by the USFWS. | The Applicant will work with the USFWS to ensure that any new methods or technologies that are used are compatible with the Biological Goal and Objectives and requested authorized take rate in this HCP. If the Applicant decides to proceed with implementing the new measures, they will propose an administrative change (Section 9.1). |
| Change in Covered Species’ migration dates | Temperature increases associated with climate change may disrupt annual or seasonal events important to Covered Species by altering seasonal cues that trigger behaviors such as mating and migration. These changes could result in changes in the timing of spring and fall migration of the Covered Species. | The USFWS announces through an official, public medium (such as in a revised recovery plan, 5-year status review, or the USFWS Region 3 website) of a change in the dispersal and migration dates of a Covered Species, and notifies the Applicant of the documented change in migration patterns. | The Applicant will propose an administrative change to adjust the timing of minimization measures and monitoring such that the measures encompass the earlier migration start date and/or later migration end date for the Covered Species. Changes to the operational protocol and the monitoring will take effect in the first migration season after the USFWS notifies the Applicant. |
| Change in summer risk to Covered Species as indicated by forested habitat occupancy | Over the course of the ITP term, new occupied summer habitat may be documented in or near the Permit Area as a result of an independent mist-netting study. | Suitable bat habitat within or immediately adjacent to the Permit Area becomes occupied according to the most current USFWS guidelines. | Occurrence buffers ([for Indiana bat: 8.0 km from a capture/4.0 km from a roost tree; for northern long-eared bat: 4.8 km [3.0 miles] from a capture/2.4 km from a roost tree]) would be applied to the newly found record(s). Habitat within those occurrence buffers will be analyzed for connectivity to define what is “occupied suitable habitat,” All turbines within 305 meters of the newly defined occupied suitable habitat should be curtailed at 5.0 m/s as soon as possible after the habitat is found to be occupied and also during the remaining spring/summer seasons (April 1 through July 31) for the duration of the permit. In addition, all turbines within 1.0 km of occupied habitat should be also be monitored (such that the facility’s annual g=0.2 as calculated by EoA) during the summer season (May 16 through July 31) for three years or for the remainder of the permit, if fewer than 3 years. |
|  |  |  |  |
| Changes in a mitigation project’s ability to meet success criteria[[7]](#footnote-8) | One or more of a range of natural phenomena (such as tornadoes, drought, wildfire, floods, or invasive species), are reasonably foreseeable during the ITP term and may impact mitigation lands. | A natural disaster occurring within the mitigation area causes any mitigation success criterion [(tree density, snag size-class densities, understory composition)] to be >25% below the target values defined by the Project Development Plan. | Within one year of confirmation of the trigger, the Applicant will coordinate with the USFWS to calculate the remaining amount of take (i.e. the amount of take that is no longer being offset by the mitigation currently in place). The Applicant will then implement one of the following options to offset the remaining amount of take.   * Restore the mitigation project using one or more of the following restoration actions (Note: restoration actions will not be implemented during any ongoing natural disaster, such as in the case of prolonged drought): * Tree planting in areas where the tree density is >25% below the mitigation metric target value * Non-native woody invasive species control in areas where the native understory composition is >25% below the mitigation metric target value * Secure an additional mitigation project to offset the remaining amount of take * Purchase credits (in the amount of the remaining take) from a conservation bank or in-lieu fee fund approved by the USFWS |
| Unavoidable delay of mitigation project implementation beyond 1 year of ITP issuance | Despite the good-faith efforts of the Applicant to secure PRM, mitigation may not be in place within 1 year of ITP issuance due to circumstances outside of the Applicant’s control. A good-faith effort is demonstrated by written agreement from the Service Field Office that one or more areas under consideration may qualify as potential mitigation and active coordination between the Applicant and the Service to develop the Project Development Plan. | The Project Development Plan has not begun to be implemented within 1 year of the ITP being issued due to circumstances outside the Applicant’s control and despite the Applicant’s good-faith efforts. | The REA model will be used to recalculate the mitigation acreage using the new Project start year. A new PRM project will be implemented in Year 2 of the ITP with the newly calculated mitigation acreage. Alternatively, the Applicant may choose to pursue other mitigation options (i.e., paying into a Service-approved ILF program or buying credits from a Service-approved conservation bank). In that case, the Applicant has 90 calendar days from the changed circumstance trigger to secure mitigation. |
| ESA = Endangered Species Act of 1973; HCP = Habitat Conservation Plan; ITP = Incidental Take Permit; USFWS = US Fish and Wildlife Service; WNS = white-nose syndrome | | | |

## Unforeseen Circumstances

Unforeseen Circumstances are changes in circumstances affecting a listed species or the geographic area covered by an HCP that could not have been reasonably anticipated by plan developers and the USFWS at the time of development of the HCP, and that result in a substantial and adverse change in the status of the Covered Species (50 CFR 17.3 [1975]). The No Surprises Rule stipulates that if Unforeseen Circumstances arise, the USFWS will not require, without the consent of the ITP holder, the commitment of additional mitigation in the form of land, water, or funds, nor will it require additional restrictions on the use of land, water, or funds from any ITP holder who is adequately implementing or has implemented an approved HCP.

Notwithstanding these assurances, nothing in the No Surprises Rule will be construed to limit or constrain the USFWS, any federal agency, or a private entity from taking additional actions, at its own expense, to protect or conserve a species included in an HCP.

# FUNDING

Under Section 10(a)(2)(A)(ii) and Section 10(a)(2)(B)(iii) of the ESA, an HCP submitted in support of an ITP must establish “the funding that will be available to implement such steps the Applicant will take to monitor, minimize, and mitigate the impacts from the proposed taking” (16 USC 1531-1544, 1539 [1973], 50 CFR 17.22(b)(1) [1985], and 50 CFR 17.32(b)(1) [1985]). In order to issue an ITP, the Service must find that the applicant will ensure adequate funding for the HCP. 50 CFR 17.22(b)(2), 17.32(b)(2). The ITP is subject to full or partial suspension, or revocation, should the Applicant fail to ensure funding for mitigation and conservation measures, including Changed Circumstances and other measures, outlined in this HCP.

The implementation of this HCP will be funded through the Applicant’s annual budget. Costs to implement this HCP include the general ITP/HCP administration and management costs, mitigation, compliance and effectiveness monitoring, and the Changed Circumstances and Contingency Fund (Table 8.1).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 8.1. Costs/Budget for the [Project Name] Habitat Conservation Plan implementation and bat conservation program. Project-specific information to be provided by the Applicant | | | | |
| **Budget Item** | **ITP Year(s) 1** | **Annual Cost** | **Total Estimated Cost2** | |
| **ITP/HCP Administration** | | | | |
| Administration and Overhead | 1-6 | [$] | | [$] |
| **Mitigation** | | | | |
| Initial Upfront Mitigation | 1 | Indiana bat: $161,632 - $260,160; northern long-eared bat: $115,247 - $182,985; stacked: $171,838 - $277,140] | | [Indiana bat: $161,632 - $260,160; northern long-eared bat: $115,247 - $182,985; stacked: $171,838 - $277,140] |
| Mitigation True-up | 2, 3, 4 ,5 or 6 | Indiana bat: $359,468 - $587,910; northern long-eared bat: $230,394 - $373,170; stacked: $380,988 - $623,708] | | Indiana bat: $359,468 - $587,910; northern long-eared bat: $230,394 - $373,170; stacked: $380,988 - $623,708] |
| Changed Circumstance and Contingency Fund | 1 | [Indiana bat: $52,111 - $84,807; northern long-eared bat: $34,564 - $55,616; stacked: $55,283 - $90,085] | | Indiana bat: $52,111 - $84,807; northern long-eared bat: $34,564 - $55,616; stacked: $55,283 - $90,085]] |
| **Monitoring** | | | | |
| Compliance, g of 0.2 | 1-33 | [$] | | [$] |
| Compliance, g of 0.08 | 4-6 | [$] | | [$] |
| **Total** |  |  | | [$] |
| 1 The ITP year in which the costs are expected to be incurred.  2 Total estimated cost calculated based on [current year] estimates; average annual inflation of 3.0% was used to project cost estimates for future years.  3 Monitoring at a g of 0.2 may be continued in Years 4-6 per the adaptive management framework (Table 6.5).  HCP = Habitat Conservation Plan; ITP= incidental take permit | | | | |

Funding assurances for this HCP were structured based on the relationship between Project revenue production and take of the Covered Species. Specifically, the Project’s revenue-generating activity (i.e., operation of the Project turbines) is also the only Project activity that may result in take of the Covered Species. If the Project ceases operation, although the Project would cease to produce revenue, take of the Covered Species would also cease and therefore costs associated with the HCP/ITP would no longer be incurred. The basis of the cost estimates and the funding assurances for each of these items is described below.

## ITP/HCP Administration

### Cost Basis

ITP/HCP administrative costs for this HCP include bat conservation plan management and oversight, applicable staff training, reporting to the USFWS, travel costs for USFWS meetings, and other miscellaneous expenses additive to the Applicant’s normal (non-HCP) operational budget, calculated with 3%[[8]](#footnote-9) inflation over the 6-year ITP term. The Applicant intends to use existing staff to provide management and oversight for HCP and ITP compliance. Personnel costs associated with this HCP are included in the Applicant’s staff overhead expenses and are funded as annual operating expenditures.

### Funding Assurance

To provide assurance that HCP administration will occur, the Applicant will submit to the USFWS within 30 days of permit issuance, and by March 1 of each year following ITP issuance, a letter signed by a representative with authority to bind the Applicant stating that budget has been allocated for Project staff time to administer the HCP.

## Compliance Monitoring

### Cost Basis

Annual compliance monitoring costs were estimated assuming that monitoring will be conducted to a *g* of 0.2 in Years 1-3 and a *g* of 0.08 in Years 4-6, with 3% inflation applied for Years 2-6. The monitoring costs were based on [past post-construction monitoring conducted at the Project; past post-construction monitoring conducted at similar wind energy facilities; consultation with an independent consultant contracted to conduct post-construction monitoring at the Project].

### Funding Assurance

To provide assurance that compliance monitoring will occur, the Applicant will submit to the USFWS within 30 days of permit issuance, and by March 1 of each year following ITP issuance, a letter signed by a representative with authority to bind the Applicant stating that the Applicant has executed a contract(s) with a qualified party(s) to complete the year’s required compliance monitoring activities.

## Mitigation

### Cost Basis

Mitigation costs for this HCP include funding [to execute a contract with a mitigation provider, to execute an easement for a mitigation project and implement the Project Development Plan (i.e., PRM), contribution to a USFWS-approved conservation bank, contribution to a USFWS-approved in-lieu fee fund, contribution to a USFWS-approved WNS treatment fund]. The estimated mitigation costs include the cost of mitigation project implementation (including development and implementation of the Project Development Plan, mitigation effectiveness monitoring, mitigation adaptive management, and reporting) and Changed Circumstances impacting the mitigation. Funding assurances will be provided based on the estimated cost of mitigation that would fully offset the impact of the permitted amount of take (i.e., three bats of each Covered Species per year), assuming both the upfront mitigation and the true-up will be implemented, although mitigation may only be required for the expected level of take (i.e., one bat of each Covered Species per year) depending on the results of compliance monitoring. The mitigation costs were based on the range of costs provided for Region 3 states in the Range-Wide Indiana Bat In-Lieu Fee Program; actual mitigation costs may be less, particularly under the PRM mitigation option [update with Project-specific mitigation costs if available prior to ITP application]. An inflation rate of 3% was applied to the cost of mitigation for [12/24] bats (the total authorized take minus the total expected take) over six years to calculate the costs of the mitigation true-up because, if needed, the true-up may be implemented as late as Year 6 of the ITP if a true-up is not indicated prior (Table 6.5).

While it is difficult to accurately estimate the funds required to ameliorate an issue of mitigation project success criteria resulting from a Changed Circumstance, it is unlikely that a mitigation effort would fail and require complete replacement or restoration during a six-year permit term. Additionally, the early funding of the upfront mitigation aids early implementation of mitigation, which will help ensure that mitigation stays ahead of the impact of take. This makes it likely that the impact of only a fractional amount of take would remain to be offset after a Changed Circumstance, and the Applicant is already providing funding assurance for contingencies given that the mitigation funding assurance cost-basis includes the Range-Wide Indiana Bat In-Lieu Fee Program contingency costs. As such, the total cost estimated for the Changed Circumstance and Contingency Fund was calculated as a 10% buffer on the authorized mitigation cost over the 6-year ITP term. The 10% buffer will be maintained in the funding assurance mechanism for the duration of the permit (i.e., any withdrawal of this 10% would be replenished). However, if a conservation bank, in-lieu fee fund, or WNS treatment fund (if approved by the Service) is used to provide mitigation, the bank or fund, not the Applicant, will be responsible for ensuring that mitigation projects meet their success criteriaand the change in mitigation project ability to meet success criteria Changed Circumstance will not apply.

### Funding Assurance

Funding assurances will be provided for these mitigation costs (upfront, true-up, and Changed Circumstance and contingency fund) through [a letter of credit; a bond; execution of a mitigation contract or easement; the purchase of credits from a bank/ fund]. Bonds and irrevocable, non-transferable standby letters of credit must be issued by (i) a United States (U.S.) commercial bank or (ii) a U.S. branch of a foreign commercial bank with sufficient assets in the U.S., as determined by the USFWS, with either such bank having a credit rating of at least A from Standard and Poor’s (S&P) or A3 from Moody’s. The take authorization in the ITP will not become effective until the funding assurance has been provided to the Service. Implementation of the mitigation will then take place in accordance with the time frame specified in Section 6.3. If the primary funding assurance mechanism is the execution of a mitigation contract or easement or the purchase of credits from a bank or fund but the Applicant desires take authorization before such mitigation can be implemented, the Applicant can provide the Service a letter of credit or bond as an interim financial assurance, in an amount to be determined based on the Applicant’s mitigation plan. If the Applicant elects to provide upfront mitigation for less than the total authorized take, as discussed in Section 6.3, then the Applicant must also provide a letter of credit for the estimated costs of mitigation true-up that would offset the total authorized take. The amount of the funding assurances required will depend on the estimated costs of the proposed mitigation plan, including both upfront and true-up mitigation and financial assurances that are part of a Project Development Plan for a PRM Project, if any.

## Changed Circumstance and Contingency Fund

Per the HCP Handbook, the costs associated with additional contingency actions (e.g., default by the ITP holder, non-performance, etc.) are based on the size and complexity of the Project, the estimate required to remediate the proposed mitigation project(s), and monitoring requirements. These Contingency Funds would be used if the Project does not uphold its HCP funding commitments in regards to Changed Circumstances or HCP activities. For this HCP, the costs associated with the Changed Circumstance and Contingency Fund address scenarios when habitat mitigation projects have failed and need to be replaced or rectified. Although other Changed Circumstance responses may require additional analysis and/or monitoring costs, these costs are expected to be less than the response to failed mitigation. This response to failed mitigation is estimated as part of the mitigation costs and included in the funding assurance for mitigation (Section 8.3).

# 

# ITP/HCP ADMINISTRATION

## Administrative Changes

Administrative changes are internal changes or corrections to the HCP. The USFWS or the Applicant may propose administrative changes to the HCP by providing notice to the other party. Such notice must include a statement of the reason for the proposed changes, as well as any supporting documentation. The USFWS and the Applicant will use reasonable efforts to respond to proposed administrative changes within 30 days of receipt of such notice. Proposed administrative changes will become effective upon written approval of the USFWS and the Applicant. USFWS-approved changes will be documented in a note to the Project file.

The USFWS will not propose or approve administrative changes to this HCP if the USFWS determines that such modifications would:

* Result in effects to a Covered Species that are new or different than those analyzed in this HCP, NEPA review or the USFWS BO;
* Result in take beyond that analyzed in this HCP;
* Negatively alter the effectiveness of the HCP; or
* Have consequences to aspects of the human environment that have not been evaluated.

Administrative changes to the HCP processed pursuant to this subsection may include, but are not limited to the following:

* Correction of typographic, grammatical and similar editing errors that do not change the intended meaning;
* Correction of any maps or exhibits to correct minor errors in mapping or to reflect previously approved changes in the ITP or HCP; or
* Minor changes to survey, monitoring, or reporting protocols.

## ITP Amendments

An ITP Amendment is any proposed change or modification that does not satisfy the criteria for an administrative change.

The HCP and ITP may be modified upon the Applicant’s submission of a formal ITP Amendment application and the required application fee to the USFWS, which will be processed in the same manner as the original ITP application. Such application generally will require submittal of a revised HCP, and preparation of an environmental review document in accordance with NEPA. The specific document requirement for the application may vary based on the substance of the amendment.

Upon submission of a complete application package, the USFWS will publish a notice of the receipt of the application in the FR, initiating the NEPA and HCP Amendment public comment process. After the close of the public comment period, the USFWS may approve or deny the proposed amendment application.

## ITP Transfer

In the event of a sale or transfer of ownership of the Project during the ITP term, the following will be submitted to the USFWS by the new owner(s): 1) a new ITP application, 2) the ITP application fee, 3) and written documentation providing assurances pursuant to 50 CFR 13.25 (b)(2) (1999) that the new owner will provide sufficient funding for the HCP and will implement the relevant terms and conditions of the ITP and HCP, including any outstanding minimization and mitigation. The new owner(s) will commit to all requirements regarding the take authorization and mitigation obligations of this HCP, unless otherwise specified in writing and agreed to in advance by the USFWS.

# REFERENCES

## Literature Cited

Amelon, S. and D. Burhans. 2006. Conservation Assessment: *Myotis septentrionalis* (Northern Long-Eared Bat) in the Eastern United States. Pp. 69-82. *In:* F. R. Thompson, III, ed. Conservation Assessments for Five Forest Bat Species in the Eastern United States. General Technical Report NC-260. US Department of Agriculture, Forest Service, North Central (NC) Research Station, St. Paul, Minnesota.

American Wind Wildlife Institute (AWWI). 2018. AWWI Technical Report: A Summary of Bat Fatality Data in a Nationwide Database. AWWI, Washington, D. C. July 25, 2018.

Arnett, E. B., M. M. P. Huso, M. R. Schirmacher, and J. P. Hayes. 2010. Effectiveness of Changing Wind Turbine Cut-in Speed to Reduce Bat Fatalities at Wind Facilities: Final Report. Annual report prepared for the Bats and Wind Energy Cooperative (BWEC) and the Pennsylvania Game Commission. Bat Conservation International (BCI), Austin, Texas. May 2010. Available online at: <http://www.batsandwind.org/pdf/Curtailment%20Final%20Report%205-15-10%20v2.pdf>

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

Barbour, R. A., and W. H. Davis. 1969. Bats of America. University Press of Kentucky, Lexington, Kentucky. 286 pp.

Blehert, D. S., A. Hicks, M. Behr, C. U. Meteyer, B. Berlowski-Zier, E. Buckles, J. D. Coleman, S.R., A. Gargas, R. Niver, J. Okoniewski, R. Rudd, and W. B. Stone. 2009. Bat White-Nose Syndrome: An Emerging Fungal Pathogen? Science 323: 227.

Blehert, D. S., J. M. Lorch, A. E. Ballmann, P. M. Cryan, and C. U. Meteyer. 2011. Bat White-Nose Syndrome in North America. Microbe 6(6): 267-273.

Bohrman, J. and D. Fecske. 2013. White-Nose Syndrome Surveillance and Summer Monitoring of Bats at Great Swamp National Wildlife Refuge. Final Report. US Fish and Wildlife Service, Great Swamp National Wildlife Refuge, Basking Ridge, New Jersey.

Boyles, J. G., J. J. Storm, and V. Brack, Jr. 2008. Thermal Benefits of Clustering During Hibernation: A Field Test of Competing Hypotheses on *Myotis sodalis*. Functional Ecology 22(4): 632-636.

Brack, V., Jr. 2004. The Biology and Life History of the Indiana Bat: Hibernacula. Pp. 7-14. In: K. C. Vories and A. Harrington, eds. Indiana Bat and Coal Mining: A Technical Interactive Forum. US Department of Interior, Office of Surface Mining, Alton, Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois, Louisville, Kentucky.

Brack, V., Jr. 2007. Temperatures and Locations Used by Hibernating Bats, Including *Myotis sodalis* (Indiana Bat), in a Limestone Mine: Implications for Conservation and Management. Environmental Management 40(5): 739-746.

Britzke, E. R., A. C. Hicks, S. L. von Oettingen, and S. R. Darling. 2006. Description of Spring Roost Trees Used by Female Indiana Bats (*Myotis sodalis*) in the Lake Champlain Valley of Vermont and New York. American Midland Naturalist 155(1): 181-188.

Brooks, M. E., K. Kristensen, K. J. van Benthem, A. Magnusson, C. W. Berg, A. Nielsen, H. J. Skaug, M. Martin Mächler, and B. M. Bolker. 2017. Modeling Zero-Inflated Count Data with glmmTMB. bioRxiv preprint bioRxiv:132753.

Burke, H. S., Jr. 1999. Maternity Colony Formation in *Myotis septentrionalis* using Artificial Roosts: The Rocket Box, a Habitat Enhancement for Woodland Bats. Bat Research News 40(3): 77-78.

Butchkoski, C. M. and J. D. Hassinger. 2002. Ecology of a Maternity Colony Roosting in a Building. Pp. 130-142. *In:* A. Kurta and J. Kennedy, eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International (BCI), Austin, Texas.

Butchkoski, C. M. and G. Turner. 2006. Indiana Bat (*Myotis sodalis*) Summer Roost Investigations. Project 06714. Annual Job Report. Pennsylvania Game Commission, Bureau of Wildlife Management Research Division, Harrisburg, Pennsylvania.

Butchkoski, C. M., J. Chenger, A. Hicks, and R. Reynolds. 2008. Spring Indiana Bat Migration Telemetry. Presentation at the Joint Meeting of 13th Annual Meeting of the Southeastern Bat Diversity Network, 10th Annual Meeting of the Northeast Bat Working Group. 18th Colloquium on Conservation of Mammals in the Southeastern United States, Blacksburg, Virginia.

Caceres, M. C. and M. J. Pybus. 1997. Status of the Northern Long-Eared Bat (*Myotis septentrionalis*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 3, Edmonton, Alberta.

Caceres, M. C. and R. M. R Barclay. 2000. *Myotis septentrionalis*. Mammalian Species 48(634): 1-4.

Caire, W., R. K. LaVal, M. L. LaVal, and R. Clawson. 1979. Notes on the Ecology of *Myotis keenii* (Chiroptera, Vespertilionidae) in Eastern Missouri. The American Midland Naturalist 102(2): 404-407.

Callahan, E. V., R. D. Drobney, and R. L. Clawson. 1997. Selection of Summer Roosting Sites by Indiana Bats (*Myotis sodalis*) in Missouri. Journal of Mammalogy 78(3): 818-825.

Carter, T. C. and G. A. Feldhamer. 2005. Roost Tree Use by Maternity Colonies of Indiana Bats and Northern Long-Eared Bats in Southern Illinois. Forest Ecology and Management 219(2-3): 259-268.

Channel, R. and M. V. Lomolino. 2000a. Dynamic Biogeography and the Conservation of Endangered Species. Nature 403(6765): 84-86.

Channel, R. and M. V. Lomolino. 2000b. Trajectories to Extinction: Spatial Dynamics of the Contraction of Geographical Ranges. Journal of Biogeography 27(1): 169-179.

Clark, B. K., J. B. Bowles, and B. S. Clark. 1987. Summer Status of the Endangered Indiana Bat in Iowa. American Midland Naturalist 118: 32-39.

Clawson, R. L, R. K. LaVal, M. L. LaVal, and W. Caire. 1980. Clustering Behavior of Hibernating *Myotis sodalis*. Journal of Mammalogy 61(2): 245-253.

Coleman, J. 2014. White-Nose Syndrome the Devastating Disease of Hibernating Bats in North America. US Fish and Wildlife Publications. 453. Available online: [https://digitalcommons.unl.edu/ cgi/viewcontent.cgi?article=1457&context=usfwspubs](https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1457&context=usfwspubs)

Cope, J. B. and S. R. Humphrey. 1972. Reproduction of the Bats *Myotis keenii* and *Pipistrellus subflavus* in Indiana. Bat Research News 13: 9-10.

Cope, J. B. and S. R. Humphrey. 1977. Spring and Autumn Swarming Behavior in the Indiana Bat, *Myotis sodalis*. Journal of Mammalogy 58(1): 93-95.

Cope, J. B., A. R. Richter, and R. S. Mills. 1974. A Summer Concentration of the Indiana Bat, *Myotis sodalis*, in Wayne County, Indiana. Proceedings of the Indiana Academy of Sciences 83: 482-484.

Dalthorp, D., M. M. P. Huso, and D. Dail. 2017. Evidence of Absence (V2.0) Software User Guide. US Geological Survey (USGS) Data Series 1055. USGS, Reston, Virginia. 109 pp. doi: 10.3133/ds1055. Available online: <https://pubs.usgs.gov/ds/1055/ds1055.pdf>

Davis, W. H. and H. B. Hitchcock. 1965. Biology and Migration of the Bat, *Myotis lucifugus*, in New England. Journal of Mammalogy 46: 296-313.

Easterla, D. A. 1968. Parturition of Keen’s Myotis in Southwestern Missouri. Journal of Mammalogy 49(4): 770.

Easterla, D. A. and L. C. Watkins. 1969. Pregnant *Myotis sodalis* in Northwestern Missouri. Journal of Mammalogy 50(2): 372-373.

Environment Yukon. 2011. Yukon Bats. Government of Yukon, Environment Yukon, Whitehorse, Yukon.

Fenton, M. B. 1969. Summer Activity of *Myotis lucifugus* (Chiroptera: Vespertilionidae) at Hibernacula in Ontario and Quebec. Canadian Journal of Zoology 47(4): 597-602.

Fenton, M. B. 1970. Population Studies of *Myotis lucifugus* (Chiroptera: Vespertilionidae) in Ontario. Life Sciences Contributions, Royal Ontario Museum 77: 1-34.

Fitch, J. H. and K. A. Shump. 1979. *Myotis keenii*. Mammalian Species 121: 1-3

Foster, R. W. and A. Kurta. 1999. Roosting Ecology of the Northern Bat (*Myotis septentrionalis*) and Comparisons with the Endangered Indiana Bat (*Myotis sodalis*). Journal of Mammalogy 80(2): 659-672.

Gardner, J. E. and E. A. Cook. 2002. Seasonal and Geographic Distribution and Quantification of Potential Summer Habitat. Pp. 9-20. *In:* A. Kurta and J. Kennedy, eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International (BCI), Austin, Texas.

Gardner, J. E., J. D. Garner, and J. E. Hofmann. 1991a. Summary of *Myotis sodalis* Summer Habitat Studies in Illinois: with Recommendations for Impact Assessment. Report Prepared for Indiana/Gray Bat Recovery Team Meeting, Columbia, Missouri.

Gardner, J. E., J. D. Garner, and J. E. Hofmann. 1991b. Summer Roost Selection and Roosting Behavior of *Myotis sodalis* (Indiana Bat) in Illinois. Unpublished Report to US Fish and Wildlife Service, Region 3, Fort Snelling, Minnesota.

Gardner, J. E., J. E. Hofmann, and J. D. Garner. 1996. Summer Distribution of the Federally Endangered Indiana Bat (*Myotis sodalis*) in Illinois. Final Report: Project E-3. Endangered Species Act Section 6 Report, Illinois Department of Conservation.

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

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

Griffin, D. R. 1940. Notes on the Life-Histories of New England Cave Bats. Journal of Mammalogy 21(2): 181-187.

Griffin, D. R. 1945. Travels of Banded Cave Bats. Journal of Mammalogy 26(1): 15-23. doi: 10.2307/1375028.

Griffin, D. R. 1970. Migration and Homing of Bats. Pp. 233-264. *In*: W. A. Wimsatt, ed. Biology of Bats. Academic Press, New York.

Gumbert, M. W. 2001. Seasonal Roost Tree Use by Indiana Bats in the Somerset Ranger District of the Daniel Boone National Forest, Kentucky. M.S. Thesis, Eastern Kentucky University, Richmond, Kentucky.

Guthrie, M. J. 1933. The Reproductive Cycles of Some Cave Bats. Journal of Mammalogy 14(3): 199-216.

Hall, J. S. 1962. A Life History and Taxonomic Study of the Indiana Bat, *Myotis sodalis*. Reading Public Museum and Art Gallery Publication 12: 1-68.

Hall, J. S. and F. J. Brenner. 1968. Summer Netting of Bats at a Cave in Pennsylvania. Journal of Mammalogy 49(4): 779-781.

Harvey, M. J. 2002. Status and Ecology in the Southern United States. Pp. 29-34. *In:* A. Kurta and J. Kennedy, eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International (BCI), Austin, Texas.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2013. Effectiveness of an Operational Mitigation Experiment to Reduce Bat Fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2012. Bat Conservation International, Austin, Texas, and ABR, Inc., Forest Grove, Oregon. April 2013.

Hein, C. D., A. Prichard, T. Mabee, and M. R. Schirmacher. 2014. Efficacy of an Operational Minimization Experiment to Reduce Bat Fatalities at the Pinnacle Wind Farm, Mineral County, West Virginia, 2013. Final Report. An annual report submitted to Edison Mission Energy and the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas. February 2014.

Henderson, L. E. and H. G. Broders. 2008. Movements and Resource Selection of the Northern Long-Eared Myotis (*Myotis septentrionalis*) in a Forest-Agriculture Landscape. Journal of Mammalogy 89(4): 952-963.

Hicks, A. 2004. Indiana Bat (*Myotis sodalis*): Protection and Management in New York State. Endangered Species Investigations Performance Report. Prepared for Project Number W-166-E Segment 2003-2004. New York Department of Environmental Conservation.

Hicks, A. and P. G. Novak. 2002. History, Status, and Behavior of Hibernating Populations in the Northeast. Pp. 35-47. *In:* A. Kurta and J. Kennedy, eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International (BCI), Austin, Texas.

Hicks, A. C., C. J. Herzog and M. Clark. 2005. Indiana Bat (*Myotis sodalis*) Protection and Management in New York State. Annual Report on New York Department of Environmental Conservation Activities.

Hicks, A. C., M. Cooper, W. Skinner, R. von Linden, A. Bailey, J.A. Kath, and M. Sailor. 2012. Spring Migratory Behavior in Female Indiana Bats (*Myotis sodalis*) from the Blackball Mine Complex, LaSalle County, Illinois. Final Report prepared by Vesper Environmental LLC, Invenergy LLC, US Fish and Wildlife Service, and the Illinois Department of Natural Resources. Prepared for Invenergy LLC, Chicago, Illinois.

Humphrey, S. R. and J. B. Cope. 1976. Population Ecology of the Little Brown Bat, *Myotis lucifugus*, in Indiana and North-central Kentucky. American Society of Mammalogists Special Publication No. 4.

Humphrey, S. R., A. R. Richter, and J. B. Cope. 1977. Summer Habitat and Ecology of the Endangered Indiana Bat, *Myotis sodalis*. Journal of Mammalogy 58(3): 334-346.

Huso, M. M. P., D. Dalthorp, D. Dail, and L. Madsen. 2015. Estimating Wind-Turbine-Caused Bird and Bat Fatality When Zero Carcasses Are Observed. Ecological Applications 25: 1213-1255. doi: 10.1890/14-0764.1.

Jackson, J. L. 2004. Effects of Wildlife Stand Improvement and Prescribed Burning on Bat and Insect Communities: Buffalo Ranger District, Ozark-St. Francis National Forest, Arkansas. M.S. Thesis. Arkansas State University.

Johnson, J. B., J. W. Edwards, W. M. Ford, and J. E. Gates. 2009. Roost Tree Selection by Northern Myotis (*Myotis septentrionalis*) Maternity Colonies Following Prescribed Fire in a Central Appalachian Mountains Hardwood Forest. Forest and Ecology and Management 258(3): 233-242.

Kiser, J. D. and C. L. Elliott. 1996. Foraging Habitat, Food Habits, and Roost Tree Characteristics of the Indiana Bat (*Myotis sodalis*) during Autumn in Jackson County, Kentucky. Report Prepared for Kentucky Department of Fish and Wildlife Resources, Nongame Program, Frankfort, Kentucky.

Krochmal, A. R. and D. W. Sparks. 2007. Timing of Birth and Estimation of Age of Juvenile *Myotis septentrionalis* and *Myotis lucifugus* in West-Central Indiana. Journal of Mammalogy 88(3): 649-656.

Kunz, T. H. 1971. Reproduction of Some Vespertilionid Bats in Central Iowa. American Midland Naturalist 86(2): 477-486.

Kurta, A. 2000. The Bat Community in Northwestern Lower Michigan, with Emphasis on the Indiana Bat and Eastern Pipistrelle. Report Submitted to US Forest Service, Huron-Manistee National Forests, Cadillac, Michigan.

Kurta, A. 2005. Roosting Ecology and Behavior of Indiana Bats (*Myotis sodalis*) in Summer. Pp. 29-42. *In:*K. C. Vories and A. Harrington, eds. The Indiana Bat and Coal Mining. Office of Surface Mining, US Department of the Interior, Alton, Illinois.

Kurta, A. and J. A. Teramino. 1994. A Novel Hibernaculum and Noteworthy Records of the Indiana Bat and Eastern Pipistrelle (Chiroptera: Vespertilionidae). American Midland Naturalist 132(2) 410-413.

Kurta, A. and S. W. Murray. 2002. Philopatry and Migration of Banded Indiana Bats (*Myotis sodalis*) and Effects of Radio Transmitters. Journal of Mammalogy 83(2): 585-589.

Kurta, A. and H. Rice. 2002. Ecology and Management of the Indiana Bat in Michigan. Michigan Academician 33: 361-376.

Kurta, A., J. Kath, E. L., R. Foster, M. W. Orick, and R. Ross. 1993. A Maternity Roost of the Endangered Indiana Bat (*Myotis sodalis*) in an Unshaded, Hollow, Sycamore Tree (*Platanus occidentialis*). American Midland Naturalist 130(2): 405-407.

Kurta, A., K. J. Williams, and R. Mies. 1996. Ecological, Behavioural, and Thermal Observations of a Peripheral Population of Indiana Bats (*Myotis sodalis*). Pp. 102-117. *In:* R. M. R. Barclay and R. M. Brigham, eds. Bats and Forests. Research Branch, Ministry of Forests, Province of British Columbia, Victoria, British Columbia, Canada.

Kurta, A., J. Caryl, and T. Lipps. 1997. Bats and Tippy Dam: Species Composition, Seasonal Use, and Environmental Parameters. Michigan Academician 29(4): 473-490.

Lacki, M. J. and J. H. Schwierjohann. 2001. Day-Roost Characteristics of Northern Bats in Mixed Mesophytic Forest. Journal of Wildlife Management 65(3): 482-488.

Lacki, M. J., D. R. Cox, and M. B. Dickinson. 2009. Meta-Analysis of Summer Roosting Characteristics of Two Species of Myotis Bats. American Midland Naturalist 162(2): 318-326.

LaVal, R. K. and M. L. LaVal. 1980. Ecological Studies and Management of Missouri Bats, with Emphasis on Cave-Dwelling Species. Missouri Department of Conservation, Terrestrial Series 8: 1-52.

Lomolino, M. V. and R. Channell. 1995. Splendid Isolation: Patterns of Range Collapse in Endangered Mammals. Journal of Mammalogy 76(2): 335-347.

Lowe, A. J. 2012. Swarming Behaviour and Fall Roost-Use of Little Brown (*Myotis lucifugus*) and Northern Long-Eared Bats (*Myotis septentrionalis*) in Nova Scotia, Canada. M.S. Thesis, St. Mary’s University, Halifax, Nova Scotia.

Minnis, A. M. and D. L. Lindner. 2013. Phylogenetic Evaluation of *Geomyces* and Allies Reveals No Close Relatives of *Pseudogymnoascus destructans*, Comb. Nov., in Bat Hibernacula of Eastern North America. Fungal Biology 117(9): 638-649.

Mumford, R. E. and J. B. Cope. 1958. Summer Records of *Myotis sodalis* in Indiana. Journal of Mammalogy 39(4): 586-587.

Mumford, R. E. and J. B. Cope. 1964. Distribution and Status of the Chiroptera of Indiana. American Midland Naturalist 72(2): 473-489.

Murray, S. W. and A. Kurta. 2004. Nocturnal Activity of the Endangered Indiana Bat (*Myotis sodalis*). Journal of Zoology 262(2): 197-206.

Nagorsen, D. W. and R. M. Brigham. 1993. Northern Long-Eared Myotis (*Myotis septentrionalis*). Bats of British Columbia. Royal British Columbia Museum Handbook. University of British Columbia Press, Vancouver, British Columbia.

Owen, S. F., M. A. Menzel, W. M. Ford, J. W. Edwards, B. R. Chapman, K. V. Miller, and P. B. Wood. 2002. Roost Tree Selection by Maternal Colonies of Northern Long-Eared Myotis in an Intensively Managed Forest. General Technical Report NE-292. US Department of Agriculture, Forest Service, Northeastern Research Station, Newtown Square, Pennsylvania.

Perry, R. W. 2011. Fidelity of Bats to Forest Sites Revealed from Mist-Netting Recaptures. Journal of Fish and Wildlife Management 2(1): 112-116.

Perry, R. W. and R. E. Thill. 2007. Roost Selection by Male and Female Northern Long-Eared Bats in a Pine-Dominated Landscape. Forest Ecology and Management 247(1-3): 220-226.

Petit, J. L. and J. M. O’Keefe. 2017. Day of Year, Temperature, Wind, and Precipitation Predict Timing of Bat Migration. Journal of Mammalogy 98(5): 1236-1248.

Racey, P. A. 1979. The Prolonged Storage and Survival of Spermatozoa in Chiroptera. Journal of Reproduction and Fertility 56(1): 391-402.

Raesly, R. L. and J. E. Gates. 1987. Winter Habitat Selection by North Temperate Cave Bats. American Midland Naturalist 118(1): 15-31.

Roby, P. L. and M. W. Gumbert. 2016a. Final Report. Bats and Wind Energy: A Comparison Between Spring and Autumn Migration Behavior. Service Award Number: F14AC00766.

Roby, P. L. and M. W. Gumbert. 2016b. Spring Migration of Indiana Bats (*Myotis sodalis*) and What It Means for the Wind Industry. Copperhead Environmental Consulting, Inc. Wind Wildlife Research Meeting XI, Broomfield, Colorado. Available online:<https://www.nationalwind.org/wp-content/uploads/2017/04/31_Roby.pdf>

Roby, P. L. M. W. Gumbert, and M. J. Lacki. 2019. Nine Years of Indiana Bat (*Myotis sodalis*) Spring Migration Behavior. Journal of Mammalogy 100(5): 1501-1511.

Sasse, D. B. and P. J. Pekins. 1996. Summer Roosting Ecology of Northern Long-Eared Bats (*Myotis septentrionalis*) in the White Mountain National Forest. Proceedings of the Bats and Forests Symposium of the British Columbia Ministry of Forests, Victoria, British Columbia, Canada.

Sparks, J. K. F., B. J. Foster, and D. W. Sparks. 2004. Utility Pole Used as a Roost by Northern Myotis, *Myotis septentrionalis*. Bat Research News 45: 94.

Sparks, D. W., J. O. Whitaker, Jr., and C. M. Ritzi. 2004. Foraging Ecology of the Endangered Indiana Bat. Pp. 15-27. *In:* K. C. Vories and A. Harrington, eds. Indiana Bat and Coal Mining: A Technical Interactive Forum. US Department of Interior, Office of Surface Mining, Alton, Illinois Coal Research Center, Southern Illinois University, Carbondale, Illinois. Louisville, Kentucky.

Timpone, J. C., J. Boyles, K. Murray, D. P. Aubrey, and L. W. Robbins. 2010. Overlap in Roosting Habitats of Indiana Bat (*Myotis sodalis*) and Northern Bats (*Myotis septentrionalis*). American Midland Naturalist 163(1): 115-124.

Turner, G. G., D. M. Reeder, and J. T. H. Coleman. 2011. A Five-Year Assessment of Mortality and Geographic Spread of White-Nose Syndrome in North American Bats and a Look to the Future. Bat Research News 52: 13-27.

Tuttle, M. D. and J. Kennedy. 2002. Thermal Requirements During Hibernation. Pp. 68-78. *In:* A. Kurta and J. Kennedy, eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International (BCI), Austin, Texas.

US Bureau of Labor Statistics. CPI Inflation Calculator. US Department of Labor, Bureau of Labor Statistics, Washington, DC. Available online: <https://www.bls.gov/data/inflation_calculator.htm>

US Department of Energy (USDOE) 2015. Wind Vision: A New Era for Wind Power in the United States. Available online: <https://www.energy.gov/sites/prod/files/WindVision_Report_final.pdf>

US Fish and Wildlife Service (USFWS). 1983. Recovery Plan for the Indiana Bat. USFWS, Washington, D. C. 80 pp.

US Fish and Wildlife Service (USFWS). 1999. Agency Draft Indiana Bat (*Myotis sodalis*) Revised Recovery Plan. US Department of the Interior, Fish and Wildlife Service, Region 3, Fort Snelling, Minnesota.

US Fish and Wildlife Service (USFWS). 2007. Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision. Region 3, US Fish and Wildlife Service, Fort Snelling, Minnesota. 260 pp. Available online: <http://ecos.fws.gov/docs/recovery_plan/070416.pdf>

US Fish and Wildlife Service (USFWS). 2009. Indiana Bat (*Myotis sodalis*) 5-Year Review: Summary and Evaluations. US Fish and Wildlife Service, Midwest Region, Region 3, Bloomington Ecological Field Office, Bloomington, Indiana. September 2009.

US Fish and Wildlife Service (USFWS). 2015a. Indiana Bat range Map. US Fish and Wildlife Service, Midwest Region, Bloomington, Minnesota. April 9, 2015. Available online:<https://www.fws.gov/mountain-prairie/pressrel/2015/WNS%20Fact%20Sheet%20Updated%2007012015.pdf>

US Fish and Wildlife Service (USFWS). 2015b. White-Nose Syndrome: The Devastating Disease of Hibernating Bats in North America. Available online:<https://www.fws.gov/mountain-prairie/pressrel/2015/WNS%20Fact%20Sheet%20Updated%2007012015.pdf>

US Fish and Wildlife Service (USFWS). 2016a. Programmatic Biological Opinion on the Final 4(d) Rule for the Northern Long-Eared Bat and Activities Expected from Take Prohibitions. Regions 2, 3, 4, 5, and 6. Bloomington, Minnesota. January 5, 2016.

US Fish and Wildlife Service (USFWS). 2016b. Region 3 Indiana Bat Resource Equivalency Analysis Model for Wind Energy Projects: Public V1, December 2016. Bloomington, Indiana.

US Fish and Wildlife Service (USFWS). 2016c. Region 3 Northern Long-Eared Bat Resource Equivalency Analysis Model for Wind Energy Projects: Public V1, December 2016. Bloomington, Indiana.

US Fish and Wildlife Service (USFWS). 2017. Critical Habitat: What is it? US Fish and Wildlife Service Endangered Species Program, Falls Church, Virginia. March 2017. Available online: <https://www.fws.gov/endangered/esa-library/pdf/critical_habitat.pdf>

US Fish and Wildlife Service (USFWS). 2018a. Northern Long-eared Bat Range Map. US Fish and Wildlife Service, Midwest Region, Bloomington, Minnesota. January 1, 2018. Available online: <https://www.fws.gov/midwest/endangered/mammals/nleb/nlebRangeMap.html>

US Fish and Wildlife Service (USFWS). 2018b. Wind HCP Guidelines for Non-REA Staging/Swarming Mitigation 2018. US Fish and Wildlife Service. Revised March 20, 2018.

US Fish and Wildlife Service (USFWS). 2019. 2019 Indiana Bat (*Myotis sodalis*) Population Status Update. USFWS Endangered Species Program: Midwest Region. Compiled by A. King, Ecological Services Field Office, USFWS, Bloomington, Indiana, from data gathered from bat biologists throughout the species' range. Revised June 27, 2019. Available online: [https://www.fws.gov/ Midwest/endangered/mammals/inba/pdf/2019\_IBat\_Pop\_Estimate\_6\_27\_2019a.pdf](https://www.fws.gov/Midwest/endangered/mammals/inba/pdf/2019_IBat_Pop_Estimate_6_27_2019a.pdf)

US Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 2016. Habitat Conservation Planning and Incidental Take Permit Processing Handbook. December 21, 2016. Updated January 18, 2018. Available online: <https://www.fws.gov/endangered/what-we-do/hcp_handbook-chapters.html>

van Zyll de Jong, C. G. 1985. Handbook of Canadian Mammals: Bats. National Museum of Canada, Ottawa, Ontario.

Vonhof, M. J. and R. M. R. Barclay. 1996. Roost-Site Selection and Roosting Ecology of Forest-Dwelling Bats in Southern British Columbia. Canadian Journal of Zoology 74(10): 1797-1805.

Whitaker, J. O. and R. E. Mumford, eds. 2009. *Myotis septentrionalis* / Northern Myotis. Pp. 207-214. In: Mammals of Indiana. Indiana University Press, Bloomington, Indiana.

Whitaker, J. O., Jr. and V. Brack. 2002. Distribution and Summer Ecology in Indiana. Pp. 48-54. *In:* A. Kurta and J. Kennedy, eds. The Indiana Bat: Biology and Management of an Endangered Species. Bat Conservation International (BCI), Austin, Texas.

Whitaker, J. O., Jr. and D. W. Sparks. 2003. 2002 Monitoring Program for the Indiana Myotis (*Myotis sodalis*) near the Site of the Future Six Points Interchange in Hendricks and Marion Counties, Indiana as Required under the Six Points Interchange Habitat Conservation Plan. 46 pp.

Whitaker, J. O., Jr. and L. J. Rissler. 1992. Winter Activity of Bats at a Mine Entrance in Vermillion County, Indiana. American Midland Naturalist 127(1): 52-59. doi: 10.2307/2426321.

Whitaker, J. O., Jr., D. W. Sparks, and V. Brack, Jr. 2004. Bats of the Indianapolis International Airport Area, 1991-2001. Proceedings of the Indiana Academy of Science 113(2): 151-161.

Winhold, L. and A. Kurta. 2006. Aspects of Migration by the Endangered Indiana Bat, *Myotis sodalis.* Bat Research News 47: 1-6.

White-Nose Syndrome Response Team. 2019. White-Nose Syndrome Spread Maps. Accessed July 2019. Information online: <https://www.whitenosesyndrome.org/resources/map>

Young, D. P., Jr., S. Nomani, W. Tidhar, and K. Bay. 2011. Nedpower Mount Storm Wind Energy Facility, Post-Construction Avian and Bat Monitoring: July - October 2010. Prepared for NedPower Mount Storm, LLC, Houston, Texas. Prepared by Western EcoSystems Technology (Applicant), Inc., Cheyenne, Wyoming. February 10, 2011.

## Laws, Acts, and Regulations

16 United States Code (USC) § 1531. 1973. Title 16 - Conservation; Chapter 35 - Endangered Species; Section (§) 1531 - Congressional Findings and Declaration of Purposes and Policy. 16 USC 1531. December 28, 1973. [Public Law (P.L.) 93-205, Section (§) 2, December 28, 1973, 87 Statute [Stat.] 884; P.L. 96-159, § 1, December 28, 1979, 93 Stat. 1225; P.L. 97-304, § 9(a), October 13, 1982, 96 Stat. 1426; P.L. 100-478, Title I, § 1013(a), October 7, 1988, 102 Stat. 2315.]. Available online: <https://www.gpo.gov/fdsys/pkg/USCODE-2011-title16/pdf/USCODE-2011-title16-chap35-sec1531.pdf>

16 United States Code (USC) §§ 1531-1544. 1973. Title 16 - Conservation; Chapter 35 - Endangered Species; Sections (§§) 1531-1544. 16 USC 1531-1544. Available online: <https://www.fws.gov/le/USStatutes/ESA.pdf>

16 United States Code (USC) § 1536. 1973. Title 16 - Conservation; Chapter 35 - Endangered Species; Section (§) 1536 - Interagency Cooperation. 16 USC 1536. December 28, 1973. [Public Law (P.L.) 93-205, § 7, December 28, 1973, 87 Statute (Stat.) 892; P.L. 95-632, § 3, November 10, 1978, 92 Stat. 3752; P.L. 96-159, § 4, December 28, 1979, 93 Stat. 1226; P.L. 97-304, §§ 4(a), 8(b), October 13, 1982, 96 Stat. 1417, 1426; P.L. 99-659, Title IV, § 411(b), (c), November 14, 1986, 100 Stat. 3741, 3742; P.L. 100-707, Title I, § 109(g), November 23, 1988, 102 Stat. 4709.]. Available online: <https://www.gpo.gov/fdsys/pkg/USCODE-2011-title16/pdf/USCODE-2011-title16-chap35-sec1536.pdf>

16 United States Code (USC) § 1539. 1973. Title 16 - Conservation; Chapter 35 - Endangered Species; Section (§) 1539 - Exceptions. 16 USC 1539. [Public Law (Pub. L.) 93–205, § 10, December 28, 1973, 87 Statute (Stat.) 896; Pub. L. 94–359, §§ 2, 3, July 12, 1976, 90 Stat. 911, 912; Pub. L. 95–632, § 5, November 10, 1978, 92 Stat. 3760; Pub. L. 96–159, § 7, December 28, 1979, 93 Stat. 1230; Pub. L. 97–304, § 6(1)–(4)(A), (5), (6), October 13, 1982, 96 Stat. 1422–1424; Pub. L. 100–478, Title I, Sections (§§) 1011, 1013 (b), (c), October 7, 1988, 102 Stat. 2314, 2315.]. Available online: <https://www.gpo.gov/fdsys/pkg/USCODE-2011-title16/pdf/USCODE-2011-title16-chap35-sec1539.pdf>

32 Federal Register (FR) 48: 4001. Endangered Species. Native Fish and Wildlife, Office of the Secretary. 32 FR 4001. March 11, 1967.

40 Code of Federal Regulations (CFR) § 1501.4. 1998. Title 40 – Protection of Environment; Chapter V – Council on Environmental Quality; Chapter V – Council on Environmental Quality; Part 1501 – NEPA and Agency Planning; Section (§) 1501.4 – Whether to prepare an environmental impact statement. 40 CFR 1501.4. July 1, 2018.

40 Code of Federal Regulations (CFR) § 1501.3. 1998. Title 40 – Protection of Environment; Chapter V – Council on Environmental Quality; Chapter V – Council on Environmental Quality; Part 1501 – NEPA and Agency Planning; Section (§) 1501.3 – When to prepare an environmental assessment. 40 CFR 1501.3. July 1, 2018.

40 Code of Federal Regulations (CFR) § 1508.4. 2018. Title 40 – Protection of Environment; Chapter V – Council on Environmental Quality; Part 1508 – Terminology and Index; Section (§) 1508.4 – Categorical Exclusion. 40 CFR 1508.4. July 1, 2018.

42 United States Code (USC) §§ 4321-4370h. 1970. Title 42 - the Public Health and Welfare; Chapter 55 - National Environmental Policy; Subchapters I (Policies and Goals) and II (Council on Environmental Quality); Sections (§§) 4321-4370h. Known as the National Environmental Policy Act of 1969. 42 USC 4321-4370h. January 1, 1970. [Public Law 91-190, § 2, January 1, 1970, 83 Statute 852.]. Available online: <https://www.gpo.gov/fdsys/pkg/USCODE-2016-title42/pdf/USCODE-2016-title42-chap55.pdf>

50 Code of Federal Regulations (CFR) § 13.25. 1999. Title 50 - Wildlife and Fisheries; Chapter I - United States Fish and Wildlife Service, Department of the Interior; Subchapter B Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 13 - General Permit Procedures; Subpart C - Permit Administration; Section (§) 13.25 - Transfer of Permits and Scope of Permit Authorization. 50 CFR 13.25. June 17, 1999. [64 Federal Register (FR) 32711, June 17, 1999, as amended at 64 FR 52676, September 30, 1999; 69 FR 24092, May 3, 2004; 78 FR 73725, December 9, 2013.].

50 Code of Federal Regulations (CFR) § 17.3. 1975. Title 50 - Wildlife and Fisheries; Chapter I - United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 17 - Endangered and Threatened Wildlife and Plants; Subpart A - Introduction and General Provisions; Section (§) 17.3. Definitions. 50 CFR 17.3 [40 Federal Register (FR) 44415, September 26, 1975, as amended at 42 FR 28056, June 1, 1977; 44 FR 54006, September 17, 1979; 46 FR 54750, November 4, 1981; 47 FR 31387, July 20, 1982; 50 FR 39687, September 30, 1985; 63 FR 8870, February 23, 1998; 63 FR 48639, September 11, 1998; 69 FR 24092, May 3, 2004; 71 FR 46870, August 15, 2006.].

50 Code of Federal Regulations (CFR) § 17.22. 1985. Title 50 - Wildlife and Fisheries; Chapter I -United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 17 - Endangered and Threatened Wildlife and Plants; Subpart C - Endangered Wildlife; Section (§) 17.22 - Permits for Scientific Purposes, Enhancement of Propagation or Survival, or for Incidental Taking. 50 CFR 17.22. September 30, 1985. [50 Federal Register (FR) 39687, September 30, 1985, as amended at 63 FR 8871, February 23, 1998; 63 FR 52635, October 1, 1998; 64 FR 32711, June 17, 1999; 64 FR 52676, September 30, 1999; 69 FR 24092, May 3, 2004; 69 FR 29670, May 25, 2004; 69 FR 71731, December 10, 2004].

50 Code of Federal Regulations (CFR) § 17.31. 1978. Title 50 - Wildlife and Fisheries; Chapter I - United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 17 - Endangered and Threatened Wildlife and Plants; Subpart D - Threatened Wildlife; Section (§) 17.31. Prohibitions. 50 CFR 17.31. [43 Federal Register (FR) 18181, April 28, 1978, as amended at 44 FR 31580, May 31, 1979; 70 FR 10503, March 4, 2005.].

50 Code of Federal Regulations (CFR) § 17.32. 1985. Title 50 - Wildlife and Fisheries; Chapter I -United States Fish and Wildlife Service, Department of the Interior; Subchapter B - Taking, Possession, Transportation, Sale, Purchase, Barter, Exportation, and Importation of Wildlife and Plants; Part 17 - Endangered and Threatened Wildlife and Plants; Subpart D - Threatened Wildlife; Section (§) 17.32 - Permits-General. 50 CFR 17.32. [50 Federal Register (FR) 39689, September 30, 1985, as amended at 63 FR 8871, February 23, 1998; 63 FR 52635, October 1, 1998; 64 FR 32714, June 17, 1999; 64 FR 52676, September 30, 1999; 69 FR 24093, May 3, 2004; 69 FR 29670, May 25, 2004; 69 FR 71731, December 10, 2004].

63 Federal Register (FR) 35: 8859-8873. 1998. Habitat Conservation Plan Assurances (‘‘No Surprises’’) Rule; Final Rule. 50 CFR Part 222. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 63 FR 8859. February 23, 1998. Available online: <http://www.gpo.gov/fdsys/pkg/FR-1998-02-23/pdf/98-4367.pdf>

80 Federal Register (FR) 63: 17974-18033. 2015. Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat with 4(d) Rule; Final Rule, and Interim Rule with Request for Comments. 50 CFR 17. Department of the Interior Fish and Wildlife Service. 80 FR 17974. April 2, 2015. Available online: [http://www.fws.gov/midwest/endangered/ mammals/nleb/pdf/FRnlebFinalListing02April2015.pdf](http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinalListing02April2015.pdf)

81 Federal Register (FR) 9: 1900-1922. 2016. Endangered and Threatened Wildlife and Plants; 4(d) Rule for the Northern Long-Eared Bat; Final Rule. 50 CFR 17. Department of the Interior, Fish and Wildlife Service. 81 FR 1900. January 14, 2016. Available online: [http://www.fws.gov/ Midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf](http://www.fws.gov/Midwest/endangered/mammals/nleb/pdf/FRnlebFinal4dRule14Jan2016.pdf)

Endangered Species Act (ESA). 1973. 16 United States Code (USC) §§ 1531-1544, Public Law (PL) 93-205, December 28, 1973, as amended, PL 100-478 [16 USC 1531 et seq.]; 50 Code of Federal Regulations (CFR) 402.

Endangered Species Act (ESA) § 2. 1973. Section 2 - Findings, Purposes, and Policy. [As amended by Public Law (P.L.) 94-325, June 30, 1976; P.L. 94-359, July 12, 1976; P.L. 95-212, December 19, 1977; P.L. 95-632, November 10, 1978; P.L. 96-159, December 28, 1979; P.L. 97-304, October 13, 1982; P.L. 98-327, June 25, 1984; and P.L. 100-478, October 7, 1988; P.L. 107-171, May 13, 2002; P.L. 108-136, November 24, 2003].

Endangered Species Act (ESA) § 7. 1973. Section 7 - Interagency Cooperation. [As amended by P.L. 94-325, June 30, 1976; P.L. 94-359, July 12, 1976; P.L. 95-212, December 19, 1977; P.L. 95-632, November 10, 1978; P.L. 96-159, December 28, 1979; P.L. 97-304, October 13, 1982; P.L. 98-327, June 25, 1984; and P.L. 100-478, October 7, 1988; P.L. 107-171, May 13, 2002; P.L. 108-136, November 24, 2003.].

Endangered Species Act (ESA) § 9. 1973. Section 9 - Prohibited Acts. [As amended by P.L. 94-325, June 30, 1976; P.L. 94-359, July 12, 1976; P.L. 95-212, December 19, 1977; P.L. 95-632, November 10, 1978; P.L. 96-159, December 28, 1979; P.L. 97-304, October 13, 1982; P.L. 98-327, June 25, 1984; and P.L. 100-478, October 7, 1988; P.L. 107-171, May 13, 2002; P.L. 108-136, November 24, 2003.].

Endangered Species Act (ESA) § 10. 1973. Section 10 - Exceptions. [As amended by P.L. 94-325, June 30, 1976; P.L. 94-359, July 12, 1976; P.L. 95-212, December 19, 1977; P.L. 95-632, November 10, 1978; P.L. 96-159, December 28, 1979; P.L. 97-304, October 13, 1982; P.L. 98-327, June 25, 1984; and P.L. 100-478, October 7, 1988; P.L. 107-171, May 13, 2002; P.L. 108-136, November 24, 2003.].

Endangered Species Preservation Act (ESPA). 1966. Public Law (PL) 89-669, Statute 926. October 15, 1966.

National Environmental Policy Act (NEPA). 1969. 42 United States Code Annotated (USCA) 4321-4370e. [Public Law 91-190, § 2, January 1, 1970, 83 Statute 852.]. Available online: <https://www.gpo.gov/fdsys/pkg/USCODE-2015-title42/pdf/USCODE-2015-title42-chap55.pdf>

## Personal Communications

|  |  |
| --- | --- |
| Last Name, First Initial. | Affiliation (Acronym) |
| Roby, P. | Copperhead Environmental Consulting |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

## List of Preparers

|  |  |
| --- | --- |
| Last Name, First Initial. | Affiliation (Acronym) |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# APPENDICES

Appendix A: Maps/Figures

Appendix B: Data Management Plan

**Data Management Plan**

**[Project Name] Habitat Conservation Plan**

**1. Types of Data Produced**

This project will result in the production of a database containing information about documented bat fatalities discovered during compliance monitoring conducted at the [Project Name] (Project) wind energy facility. The following information will be recorded for each documented carcass: a unique identification code, sex and age when possible, date and time collected, observer, carcass condition (i.e., intact, scavenged, dismembered, or injured), injuries, scavenging, estimated time of death, Universal Transverse Mercator location, distance and bearing from the turbine, and any relevant comments. Carcasses found outside of the standardized search area will be recorded following the above protocol, but labeled as incidental finds.

**2. Data and Metadata Standards**

Microsoft ® Access Database format will be used because the program is readily-accessible and compatible with ESRI ArcGIS, a Geographic Information System software package used by the Applicant and the US Fish and Wildlife Service (USFWS). Naming conventions will be consistent and include no spaces in table names or field names. The file naming convention will consist of the data *source\_data* type format for raw data files. Data reporting functionality will be built into the Visual Basic for Applications (VBA) processing programs to provide output in .txt file format for number of records per source when updateable data sources are refreshed.

Every effort will be made to go back to the authoritative source for an identified dataset. Quality control of the database will be performed using Structured Query Language (SLQ) statements that capitalize on the database structure to ensure relational database integrity. Appropriate primary keys will be assigned to manage possible data duplicated. Potential duplicate identification numbers (IDs) will be handled through automated procedures and the creation of alternative ID tables.

A data dictionary will be created that defines the table definition, table fields, and table fields data types. An entity-relationship diagram will be created that defines the relational structure of the database. A metadata record will be produced using the Federal Geographic Data Committee (FGDC) standard that describes the entire geodatabase.

The FGDC standard was chosen due to the required federal government standards.

**3. Policies for Access and Sharing**

The data are public and will be provided by [Applicant Name] (Applicant). Users of the data will primarily be the USFWS.

**4. Policies for Re-use, Distribution**

Access to the database and associated software tools generated under the project will be available for purposes relating to evaluating compliance with the [Project Name] Habitat Conservation Plan (HCP) and Incidental Take Permit.

Materials generated under the Project will be disseminated by [Applicant] to the USFWS in accordance with the HCP’s reporting plan.

**5. Plans for Archiving and Preservation**

All original raw data files and data source processing programs will be versioned over time and maintained in a date-stamped file structure with text files documenting provenance. The database will be preserved in perpetuity and housed initially at [location data will be stored], in addition to an off-site copy maintained at [location of off-site data storage]. In addition to archiving, each database table will be exported to a delimited text format to ensure accessibility of the data by other software programs. The data manager at [Parent Company or other entity] will be responsible for the management of long-term storage and archived data.

Appendix C: Background Reports/Supporting Documents

Appendix D: REA Model Parameters for Mitigation

**Calculations**

**Indiana bat REA inputs for expected and authorized take rate (1 to 3 bats per year):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Impacts Tab Parameter | Impacts Tab Input | Mit-SumHabRst Tab Parameter | Mit-SumHabRst Tab Input | Mit-SumHabPrt Tab Parameter | Mit-SumHabPrt Tab Input |
| Start year | 2020 | Project start year | 2020 | Project start year | 2020 |
| Injured adult females annually | 0.75/2.25 | Project end year (include 10 years beyond last monitoring year)\* | 2060 | Project end year (include 10 years beyond last monitoring year)\* | 2060 |
| Permitted Take Years | 6 | Habitat function | Roosting & Foraging | Habitat function served by the “to be protected” habitat | Roosting & Foraging |
| Lambda condition | Declining | Acres of “to be restored” roosting or foraging habitat | 13/37 | Acres “to be protected of occupied forest block/at terminus 1 | 16/48 |
| - | - | Existing % forest cover | 20% or less | Is the “to be restored” forest area >25 acres? | Yes (Assumes restoration acres are grouped) |
| - | - | “To be restored” forest area >5 acres | n/a | Level of threat | Habitat threatened |
| \* The REA user guide specifies that mitigation parcels need to be protected in perpetuity and that the benefits can reasonably be expected to accrue for 10 years from the last year that the mitigation is monitored. The Service is open to using the maximum years of credit if the Applicant ensures that mitigation monitoring and long-term management is adequately funded. It is up to the Applicant to provide evidence of sufficient funding to cover long-term monitoring and management. | | | | | |

**Northern long-eared bat REA inputs for expected and authorized take rate (1 to 3 bats per year):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Impacts Tab Parameter | Impacts Tab Input | Mit-SumHabRst Tab Parameter | Mit-SumHabRst Tab Input | Mit-SumHabPrt Tab Parameter | Mit-SumHabPrt Tab Input |
| Start year | 2020 | Project start year | 2020 | Project start year | 2020 |
| Injured adult females annually | 0.5/1.5 | Project end year (include 10 years beyond last monitoring year)\* | 2060 | Project end year (include 10 years beyond last monitoring year)\* | 2060 |
| Permitted Take Years | 6 | Habitat function | Roosting & Foraging | Artificial Habitat | No |
| Lambda condition | Declining | Acres of “to be restored” roosting or foraging habitat | 12/34 | Habitat function | Roosting & Foraging |
| - | - | Is the project a valid “fill gaps” restoration? | Yes | Acres of “to be protected of occupied forest block/at terminus 1 | 11/31 |
| - | - | Existing % forest cover? | 30% or less | Is the “to be restored” forest area >25 acres? | Yes (Assumes restoration acres are grouped) |
| - | - | Is the “to be restored” forest area >25 acres? | Yes (Assumes restoration acres are grouped) | Level of threat | Habitat is not managed for bats |
| \* The REA user guide specifies that mitigation parcels need to be protected in perpetuity and that the benefits can reasonably be expected to accrue for 10 years from the last year that the mitigation is monitored. The Service is open to using the maximum years of credit if the Applicant ensures that mitigation monitoring and long-term management is adequately funded. It is up to the Applicant to provide evidence of sufficient funding to cover long-term monitoring and management. | | | | | |

**REA model parameters for Indiana bat and northern long-eared bat.**

|  |  |
| --- | --- |
|  | Declining Population |
| Adult female breeding rate (pups/female/year) | 0.562 |
| Juvenile female breeding rate (pups/female/year) | 0.130 |
| Pup survival to juvenile  (annual rate) | 0.585 |
| Juvenile survival  (annual rate) | 0.674 |
| Adult survival  (annual rate) | 0.857 |

1. As appropriate, based on the type of mitigation provided (see Section 6.3). [↑](#footnote-ref-2)
2. Priority 1 hibernacula typically have a current and/or historically observed winter population of ≥10,000 Indiana bats (USFWS 2007). [↑](#footnote-ref-3)
3. Priority 2 hibernacula have a current or observed historic population of 1,000 to 10,000 Indiana bats (USFWS 2007). [↑](#footnote-ref-4)
4. Measured from the turbine blade tip. [↑](#footnote-ref-5)
5. Stacking ratios only apply to mitigation projects providing mitigation credit for both Covered Species; stacking is calculated as: X acres for Species A + (X acres for Species B \* 0.10) = total stacked acres, where Species A is the Covered Species with the higher mitigation requirement and Species B is the Covered Species with the lower mitigation requirement (if mitigation requirements are equal, either species may be Species A or Species B) [↑](#footnote-ref-6)
6. Note that this Changed Circumstance does not apply if mitigation is provided by a conservation bank or in-lieu fee fund. [↑](#footnote-ref-7)
7. Note that this Changed Circumstance does not apply if mitigation is provided by a conservation bank or in-lieu fee fund [or WNS treatment fund]. [↑](#footnote-ref-8)
8. Based on the Consumer Price Index Inflation Calculator’s average inflation rate of 2.55% over the past 20 years, rounded up (U.S. Bureau of Labor Statistics 2019) [↑](#footnote-ref-9)