FINAL

Environmental Assessment for Proposed Habitat Conservation Plan and Incidental Take Permit

California Ridge Wind Energy Project
Vermilion and Champaign Counties, Illinois

U.S. Fish and Wildlife Service
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Abbreviations

BGEPA	Bald and Golden Eagle Protection Act
BO	Biological Opinion
Btu	British thermal unit
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973, as amended
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
GHGs	Greenhouse gas emissions
HCP	Habitat Conservation Plan
ILDNR	Illinois Department of Natural Resources
IEC	Illinois Environmental Council
IEPA	Illinois Environmental Protection Agency
ITP	Incidental Take Permit
MBTA	Migratory Bird Treaty Act
mph	Miles per hour
m/s	Meters per second
MW	Megawatts
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
O&M	Operations and Maintenance
PM	Particulate Matter
USEIA	U.S. Energy Information Administration
USFWS	U.S. Fish and Wildlife Service

1.0 PROJECT OVERVIEW, BACKGROUND, PURPOSE AND NEED

1.1 INTRODUCTION

This Environmental Assessment (EA) has been prepared by the United States Fish and Wildlife Service (Service or USFWS) pursuant to the National Environmental Policy Act (NEPA) 42 U.S.C. § 4321 *et seq*. The EA evaluates the effects of issuing an Incidental Take Permit (ITP) pursuant to section 10(a)(1)(B) of the federal Endangered Species Act of 1973, as amended (ESA), 16 U.S.C. § 1531 *et seq.* for activities associated with the California Ridge Wind Energy Project (CRWE, Project) (see Section 1.3 for more details). Under section 10(a)(2)(A) of the ESA, any application for an ITP must include a conservation plan that details, among other things, the impacts of the take and the steps taken to minimize and mitigate such impacts.

The Project is owned and operated by California Ridge Wind Energy LLC (California Ridge or Applicant), a subsidiary of TerraForm Power Operating LLC, a Delaware limited liability company. The Project is located in areas that support the federally endangered Indiana bat *(Myotis sodalis)* and federally threatened northern long-eared bat (*Myotis septentrionalis*) during the spring and fall migratory periods and the non-listed little brown bat (*Myotis lucifugus*) and the non-listed tricolored bat (*Perimyotis subflavus*) during both migratory periods and the summer. The Applicant has decided to request take coverage for these species (referred to as "covered species" throughout) in their ITP.

The Service received an application on August 21, 2020 for an ITP from the Applicant. As part of this application, the Applicant has developed a Habitat Conservation Plan (HCP) to ensure that impacts to the covered species are minimized and mitigated to the maximum extent practicable in accordance with the requirements of section 10 of the ESA. The ITP, if issued, would authorize the incidental take of these species during the operations and implementation of mitigation measures for the Project for a term of 20 years. The Service has prepared this EA to inform the public of the Proposed Action, the effects of the Proposed Action, and its alternatives, as well as to seek information from the public and to use information collected and analyzed to ensure that information regarding environmental impacts is available to federal decision-makers before a decision is made on the ITP application.

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

Issuance of a section 10 ITP constitutes a discretionary federal action by the Service and is thus subject to NEPA, which requires federal agencies to assess the effects of their actions on the human environment by preparing an EA or an Environmental Impact Statement (EIS) to document the potential effects of the federal action (42 U.S.C. § 4332). Accordingly, the Service has prepared this EA to evaluate the potential impacts associated with issuance of an ITP and implementation of the HCP and to evaluate alternatives. Two alternatives to the Proposed Action Alternative are also considered in this Draft Environmental Assessment (DEA). They are a No Action Alternative and a More Restrictive Alternative (see Section 2.2, below). The consequences of these alternatives on various resources are discussed in this DEA.

1.2 PROPOSED FEDERAL ACTION

The Proposed Action is issuance of an ITP by the Service pursuant to the provisions of section 10(a)(1)(B) of the ESA, which will authorize the incidental take of the covered species resulting from the operations and implementation of mitigation measures for the Project. Under section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of listed species, as long as the take is incidental to, and not the purpose of, otherwise lawful activities. The purpose of the section 10(a)(1)(B) permit is to ensure that any incidental taking that might occur will be minimized and mitigated to the maximum extent practicable and will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. The Applicant is seeking a 20-year permit term to implement their HCP. At the end of the 20-year term, the Applicant may apply for a new ITP or for an ITP renewal (see Chapter 8.0 of the HCP).

The submission of the ESA section 10(a)(1)(B) permit application requires the development of a HCP designed to ensure that the taking will not appreciably reduce the likelihood of survival and recovery of the species in the wild, while allowing for any limited, incidental take of the species that might occur during the operation of the Project. The implementing regulations for section 10(a)(1)(B) of the ESA, as provided at 50 CFR 17.22, specify the requirements and issuance criteria for obtaining an ITP. The Applicant has prepared an HCP to support their permit application.

The Service will analyze the impacts of the proposed covered activities and the HCP on all elements of the natural and human environment that could be affected, including other wildlife species that occur within the Plan Area (the area in which the activities associated with the HCP will occur). Consistent with Service guidance, it will also consider, among other things, the effectiveness of the action alternatives in reducing impacts to migratory birds and other bat species.

1.3 CALIFORNIA RIDGE WIND ENERGY FACILITY

The Project is an existing wind energy facility located in eastern Illinois approximately two miles northeast of Royal, Illinois (Figure 1). CRWE was constructed early in 2012 and began commercial operation in December 2012. It consists of 134 wind turbines each capable of generating 1.6 megawatts (MW) with a total generating capacity of approximately 214.4 MW. The Project is located on approximately 35,270.2 acres of privately-owned land, of which only a small portion supports the Project facilities. In addition to the turbines (see Section 2.4.1.1 of the HCP), the Project consists of the following:

- Access roads (see Section 2.4.1.2 of the HCP)
- Communications and Collection system (see Section 2.4.1.3 of the HCP)
- Substation and Operations and Maintenance Building (see Section 2.4.1.4 of the HCP)
- Transmission line (see Section 2.4.1.5 of the HCP)
- Meteorological (MET) towers (see Section 2.4.1.6 of the HCP)

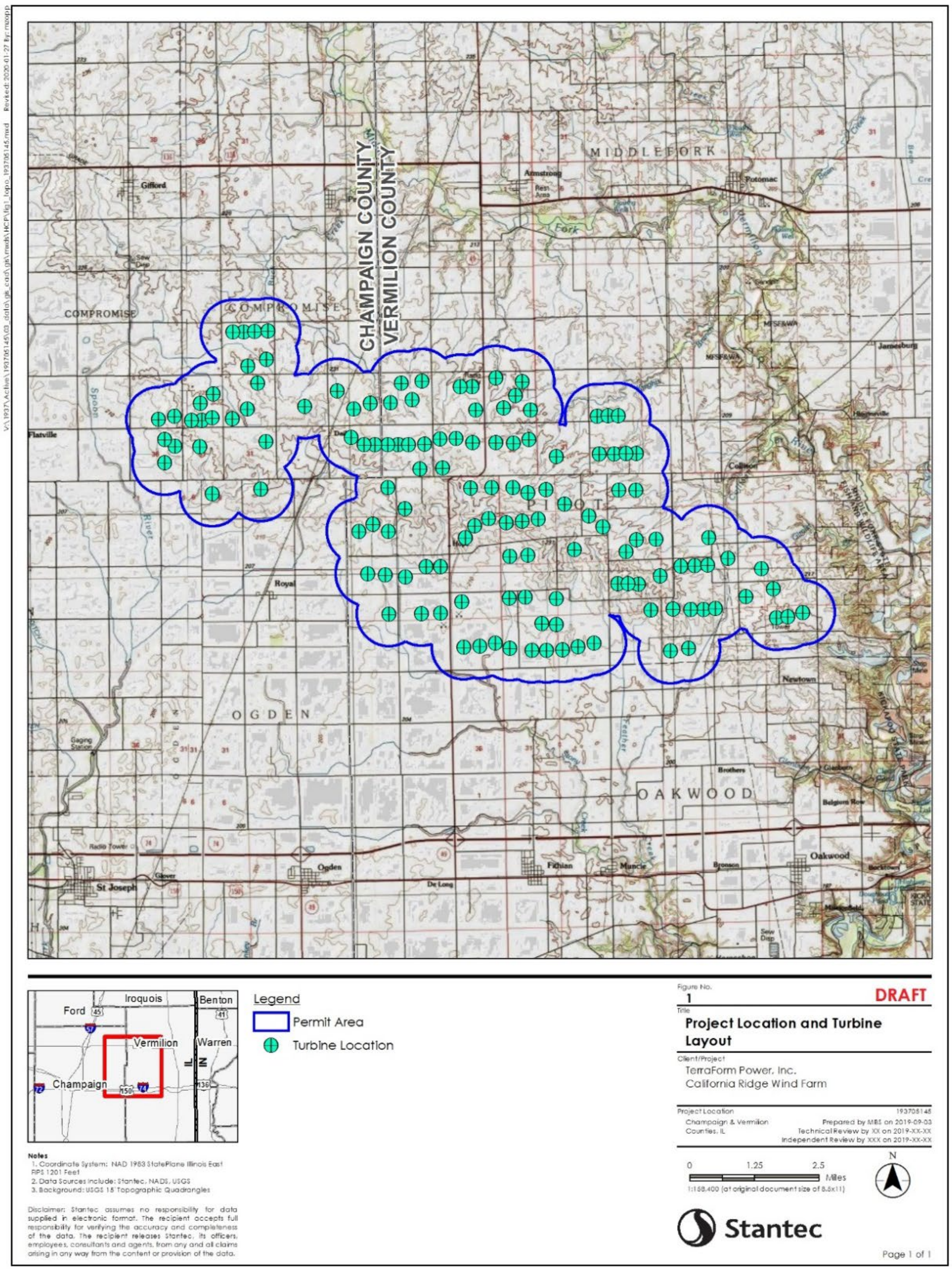

Figure 1-1. Project Location.

The Project has been operating under a take-avoidance strategy except for research activities covered under a) an ESA section 10(a)(1)(A) permit and b) the Department of Energy's bat research grant program and associated incidental take authorization. Post-construction monitoring conducted in conjunction with this research discovered one Indiana bat fatality (on September 23, 2016) and two northern long-eared bat fatalities (on September 25, 2013 and September 2, 2014). These fatalities occurred at control turbines that were feathered below manufacturer's cut-in speed. Additionally, the research documented fatalities of other non-listed bats, including little brown bat and tricolored bat. Results of this monitoring are further discussed in Section 3.6.

1.3.1 Covered Activities and Scope

The proposed action is issuance of an ITP by the Service pursuant to the provisions of section 10(a)(1)(B) of the ESA, which would authorize the incidental take of the federally endangered Indiana bat, federally threatened northern long-eared bat, the non-listed little brown bat, and the non-listed tricolored bat resulting from the operation of the Project. The covered activities associated with the proposed action are the operation of the Project, monitoring, and the mitigation associated with the implementation of the HCP.

The Service does not authorize the siting, construction, repowering, or operations of wind energy facilities. Rather, an ITP from the Service provides an applicant with incidental take coverage for listed species under the ESA for lawful activities. The only activity for which the applicant has requested take coverage is project operations, which may cause take of listed bat species. As required by the NEPA, this EA will evaluate the effects on the human environment resulting from the issuance of the permit and the implementation of the associated HCP. Specifically, this EA evaluates the effects of the change in operations of the Project as a result of the issuance of the ITP and implementation of the HCP, as well as alternatives to the issuance of the ITP, as currently proposed.

1.3.2 Covered Species

The Applicant has requested take coverage for the federally endangered Indiana bat and federally threatened northern long-eared bat as well as the non-listed little brown bat and non-listed tricolored bat (Covered Species).

The Indiana bat was listed as endangered throughout its geographic range by the Service in 1967 (32 Federal Register [FR] 4001). An Indiana Bat Recovery Plan was first developed and signed on October 14, 1983 (USFWS 1983). An agency draft of the Revised Recovery Plan was released in March 1999 (USFWS 1999). The Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision was made available for public comment on April 16, 2007 (72 FR 19015-19016) (USFWS 2007). Critical habitat, consisting of 11 caves and 2 mines, has been designated for the Indiana bat (41 FR 41914). No critical habitat occurs within the Project area. The nearest known winter hibernaculum and designated critical habitat is Blackball Mine in LaSalle County, Illinois, located approximately 99 miles (158 kilometers) northwest of the Project area. The Indiana bat is state-listed as endangered in Illinois.

The northern long-eared bat was listed as threatened throughout its geographic range by the Service in 2015 (80 FR 17974-18033). The listing and an interim 4(d) rule became effective on May 4, 2015. On January 14, 2016, the Service published a final "4(d) rule" that removes or exempts prohibitions for most incidental take of northern long-eared bats, including take associated with the operation of a wind farm (81 FR 1900-1922). A "4(d) rule" is a regulation pertaining to a species listed as threatened under the ESA and gets its name from the authorizing statute, at 16 U.S.C. 1533(d). This statutory provision authorizes the promulgation of regulations that govern the level of protection accorded to threatened species. Protection can, but is not required to, be as stringent as the statutory protections accorded to endangered species. No critical habitat is designated at this time. The northern long-eared bat is state-listed as threatened in Illinois.

The little brown bat is not a federally listed, proposed, or candidate species, but is currently under a Discretionary Status Review on the National Listing Workplan. The Service anticipates determining if a protective status should be designated in 2023 (USFWS 2019a). Currently, no Federal critical habitat, conservation plans, or recovery plans exist for this species. In addition, the little brown bat is not state-listed in Illinois.

The tricolored bat is not a federally listed, proposed, or candidate species, but it is currently under a status review after having been petitioned for listing as a threatened or endangered species under the ESA (Center for Biological Diversity [CBD] and Defenders of Wildlife [DW] 2016). The petition also requests a concurrent designation of critical habitat (CBD and DW 2016). Currently, no Federal critical habitat, conservation plans, or recovery plans exist for this species. In addition, the tricolored bat is not state-listed in Illinois.

1.4 PURPOSE AND NEED FOR THE PROPOSED ACTION

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed under the ESA as endangered (16 U.S.C. 1538). Under Federal regulation, take of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation (50 CFR 17.31). The 1982 amendments to the ESA established a provision in section 10 that allows for "incidental take" of endangered and threatened species or wildlife by non-Federal entities (16 U.S.C. 1539).

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

The need for the Proposed Action (i.e., issuance of an ITP) is also based on the finding of one dead Indiana bat at the facility in 2016 and two dead northern long-eared bats in 2013 and 2014. These findings occurred during research activities at the Project, and the taking of the Indiana bat was authorized by the Service under section 7 of the ESA (USFWS 2013). The northern long-eared bat was not a federally listed species at the time. Other bat fatalities, including little brown bat and tricolored bat, have also occurred at the Project. Wind turbines present a potential source of bat mortality, and risk of take to the covered species is expected to continue throughout future operation of the Project.

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

Per 40 CFR 1502.13, the Service must also incorporate the goals of the applicant in determining the purpose and need for the action. Therefore, as identified in Sections 1.2 and 7.1 of the HCP, the permit decision needs to also provide for a) maximizing renewable energy in an environmentally responsible manner, b) increase the understanding of the risk to covered species populations resulting from operation of wind energy facilities, c) minimizing mortality of the covered species as a result of wind farm operations in the Permit Area, d) supporting the survival and recovery of the covered species by maintaining or increasing the reproductive capacity of the populations of the covered species.

1.5 DECISION TO BE MADE BY RESPONSIBLE OFFICIAL

The Service must decide whether to issue or deny the proposed ITP. The Service shall issue the ITP to the applicant if the issuance criteria and implementing regulations for the ESA and general permitting are met. The issuance criteria for an ITP are contained in section 10(a)(2)(B) of the ESA and the implementing regulations for the ESA (50 CFR 17.22(b)(2) and 17.32(b)(2) and 50 CFR 222.307(c)(2)). The Service may decide to issue a permit conditioned upon implementation of the HCP as submitted by the Applicant, or to issue a permit conditioned upon implementation of the HCP as submitted, together with other measures specified by the Service. We are required to deny the permit if these criteria are not satisfied. California Ridge would serve as the permittee under the ITP (if issued) and is liable for all obligations assigned to them under the ITP and HCP.

1.6 REGULATORY AND POLICY BACKGROUND

This EA was developed in compliance with and consideration of the following guidance resources, laws, and regulations. The Council on Environmental Quality (CEQ) issued a final rule to update its NEPA implementing regulations, which went into effect on September 14, 2020. This EA is written to comply with these implementing regulations.

- Land-based Wind Energy Guidelines (LWEG)
    - The Service published the voluntary LWEG in 2012 to be used in conjunction with the appropriate regulatory tools in order to form the best practical approach for conservation of species of concern.
    - https://www.fws.gov/ecological-services/es-library/pdfs/WEG_final.pdf
- National Environmental Policy Act of 1970 (NEPA)
    - NEPA requires federal agencies to assess the environmental effects of their proposed actions prior to making decisions.
    - https://www.epa.gov/nepa/what-national-environmental-policy-act
- Endangered Species Act of 1973 (ESA)
    - Federally-listed threatened and endangered species and designated critical habitat are governed by the ESA and its implementing regulations (50 CFR parts 13 and 17).
    - The 1982 amendments to the ESA established a provision in section 10 that allows for "incidental take" of endangered and threatened species of wildlife by non-Federal entities (16 U.S.C. §1539).
    - https://www.fws.gov/international/laws-treaties-agreements/us-conservation-laws/endangered-species-act.html
    - The 2016 HCP Handbook provides comprehensive guidance to applicants on the ITP process (https://www.fws.gov/midwest/endangered/permits/hcp/hcphandbook.html).

- Migratory Bird Treaty Act of 1918 (MBTA)
    - The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations.
    - https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php
- Bald and Golden Eagle Protection Act of 1940 (BGEPA)
    - The BGEPA prohibits the take of a bald eagle (*Haliaeetus leucocephalus*) or golden eagle (*Aquila chrysaetos*).
    - On September 11, 2009, the Service published a final rule (Eagle Permit Rule) under the BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles (74 FR 46836-46879). This rule was revised and finalized on December 16, 2016 (2016 Eagle Rule; 81 FR 91494-91554).
    - https://www.fws.gov/midwest/midwestbird/eaglepermits/bagepa.html
    - On May 2, 2013, the Service announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2 (http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf).
- Illinois Endangered Species Protection Act (520 Illinois Compiled Statutes, Chapter 10)
    - It is unlawful to possess, take, transport, sell, offer for sale, give, or otherwise dispose of any animal or the product thereof of any animal species under the Illinois List of endangered and threatened species. It is also prohibited to deliver, receive, carry, transport, ship, take, sell, or offer for sale plants or plant products of endangered species on the Illinois List.
    - https://www.ilga.gov/legislation/ilcs/ilcs3.asp?ActID=1730&ChapterID=43
- National Historic Preservation Act
    - The NHPA mandates that all federal agencies must consider the effects of their projects and programs on cultural resources listed or eligible for inclusion in the National Register of Historic Places (NRHP). Later amendments include P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458, P.L. 96-199, P.L. 76-244, and P.L. 96-515. Section 106 of the NHPA requires federal agencies to consult with the State Historic Preservation Office (SHPO), Native American Tribes, and other interested parties on the effects of their undertakings on historic properties. No impacts to cultural resources are expected as a result of this Federal Action.
    - https://www.fws.gov/policy/614fw3.html

2.0 ALTERNATIVES

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

Each alternative was evaluated for its ability to meet the purpose and need (see section 1.4), feasibility to implement, and environmental impacts. Only those alternatives that passed the screening process were selected for detailed analysis.

2.1 DEVELOPMENT OF ALTERNATIVES

The scope of reasonable alternatives is defined by the purpose and need for the action and guided by the goals and objectives of the acting agency. Reasonable alternatives include those that meet the purpose and need of the proposed action and are practical or feasible from both a technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the Applicant. Alternatives were developed to address the potential for take of the covered species during Project operations, and as such, are primarily operational alternatives relating to the dates and times of operation and changes in cut-in speed (i.e., the wind speed at which turbines begin generating power and sending it to the grid). All curtailment studies to date show a generally consistent inverse relationship between cut-in speed and bat mortality (Table 2-1). Curtailment actions effective at reducing risk of collision for all bat species (including tree bats) are assumed to be equally effective for Indiana bats and northern long-eared bats.

Table 2-1. Summary of publicly available curtailment studies on bats conducted to-date in eastern North America[1].

Project	Year	State/Province[2]	Cut-in Speed (m/s)	Reduction in Bat Mortality	Average Reduction	Citation
Fowler Ridge	2011	Indiana	3.5	36%	36%	Good et al. 2012
Laurel Mountain	2011	West Virginia		35%		Stantec 2015
Summerview	2007	Alberta	4	57%	39%	Baerwald et al. 2009
Mount Storm	2010	West Virginia		22-47%		Young et al. 2011[3]
Mount Storm	2011	West Virginia		12%		Young et al, 2012
Fowler Ridge	2011	Indiana	4.5	57%	62%	Good et al. 2012
Wolfe Island	2011	Ontario		48%		Stantec 2012
Anonymous 1	2010	USFWS Region 3		47%		Arnett et al. 2013[4]
Laurel Mountain	2011	West Virginia		73%		Stantec 2015
Laurel Mountain	2012	West Virginia		71%		Stantec 2015
Raleigh Wind	Unk.	Ontario		77%		AWWI 2018
Casselman	2008	Pennsylvania	5	87%	62%	Arnett et al. 2011
Casselman	2009	Pennsylvania		68%		Arnett et al. 2011
Fowler Ridge	2010	Indiana		50%		Good et al. 2011[5]
Pinnacle	2012	West Virginia		47%		Hein et al. 2013[4]
Pinnacle	2013	West Virginia		58%		Hein et al. 2014
Criterion	2012	Maryland		62%		Young et al. 2013
Summerview	2007	Alberta	5.5	60%	66%	Baerwald et al. 2009
Fowler Ridge	2011	Indiana		73%		Good et al. 2012
Wolfe Island	2011	Ontario		60%		Stantec 2012

Project	Year	State/Province[2]	Cut-in Speed (m/s)	Reduction in Bat Mortality	Average Reduction	Citation
Anonymous 1	2010	USFWS Region 3		72%		Arnett et al. 2013[4]
Sheffield	2012	Vermont	6	63%	63%	Martin et al. 2013
Casselman	2008	Pennsylvania	6.5	74%	76%	Arnett et al. 2011
Casselman	2009	Pennsylvania		76%		Arnett et al. 2011
Fowler Ridge	2010	Indiana		78%		Good et al. 2011[5]
Pinnacle	2013	West Virginia		75%		Hein et al. 2014
Beech Ridge	2012	West Virginia	6.9	73-89%	81%	Tidhar et al. 2013[6]

[1]Studies conducted in USFWS Region 8 (California and Nevada) were excluded due to the high proportion of Brazilian free-tailed bats (*Tadarida brasiliensis*), a species known to be active in higher wind speeds compared to the typical suite of species in Illinois. Due to this, the reductions in bat fatalities in Region 8 studies are likely lower than what would be seen in Illinois.
[2]USFWS Region 3 includes Minnesota, Iowa, Missouri, Illinois, Wisconsin, Indiana, Michigan, and Ohio.
[3]This study looked at curtailment for the first half of the night (47% reduction) versus the second half of the night (22% reduction). It was assumed for this analysis that curtailing for the full night would result in at least a 47% reduction.
[4]These studies used modeled differences, not calculated reductions based on fatality estimates.
[5]These studies did not feather below cut-in speed.
[6]This study did not have control turbines, so this is the reduction from the West Virginia average (73%) and from the average in the Northeastern United States (89%).

The alternatives do not address aspects of the Project beyond operations, such as turbine siting or construction, because the Project is an existing completed facility and because no additional siting or construction activities are proposed in the Applicant's HCP.

2.2 ALTERNATIVES RETAINED FOR DETAILED ANALYSIS

The alternatives retained for detailed analysis are described in detail in Sections 2.2.1 through 2.2.3 and summarized in Table 2-2 below. All action alternatives under consideration implement feathering of turbines below certain cut-in speeds between sunset and sunrise during the entire bat active season from April 1 through October 15. Additionally, all action alternatives under consideration implement the Applicant's Bird and Bat Conservation Strategy (BBCS).

Table 2-2. Summary of alternatives.

Alternative	Cut-in Speed[1]		Temperature Threshold[3]	HCP Implemented	BBCS Implemented
	April 1 to July 31[2]	August 1 to October 15			
Alternative 1 (No Action)[4]	3.0 m/s	6.9 m/s	N/A	No	Yes
Alternative 2 (Proposed Action)	3.0 m/s	5.0 m/s	50ºF	Yes	Yes
Alternative 3 (More Restrictive)	5.5 m/s	5.5 m/s	50ºF	Yes	Yes

[1]Turbine blades feathered below the cut-in speed from one-half hour before sunset to one-half hour after sunrise.
[2]Curtailment begins at the start of the bat active season.
[3]Temperature thresholds apply during fall migration season (August 1 – October 15). Cut-in speed would be raised from 3.0 m/s when temperatures are above 50ºF.
[4]The 6.9 m/s cut-in speed would begin August 1 and would continue until October 15 based on the fall migratory period.

2.2.1 Alternative 1: No-Action Alternative

California Ridge has been operating the Project under a take-avoidance strategy, except for research activities covered under a) an ESA section 10(a)(1)(A) permit and b) the Department of Energy's bat research grant program and associated ESA section 7 incidental take authorization. During initial siting and construction of the Project, collision mortality risk to Indiana bats was minimized by siting turbines away from the Middle Fork and its riparian zone and following a 1,000-foot setback from foraging habitat. The project also committed to feathering turbines below wind speeds of 6.9 m/s during the fall bat migration period. The Service documented in a technical assistance letter (TAL) on December 8, 2011 that these measures were unlikely to result in incidental take of Indiana bats and no incidental take permit was recommended. As a result of additional monitoring, this TAL was amended on August 28, 2013 to revise the curtailment strategy to include feathering of the wind turbines between sunset to sunrise during the fall migratory period[1] until a wind speed of 6.9 m/s is reached. The Service also issued a TAL on June 5, 2013, which covered Phase II of the Project. This TAL includes the same conservation measures as the August 28, 2013 TAL covering Phase I of the Project. (Note, the HCP and ITP application, as well as the alternatives in this EA, include both phases of the facility and are considered as a single Project.)

Under the No-Action Alternative, an ITP would not be issued, and the Project would continue to operate under the TALs for the life of the Project. Because the Service considers the measures in the TALs unlikely to result in take of Indiana bats at the Project, California Ridge would not obtain an ITP or implement an HCP. The BBCS would be revised to reflect the avoidance and minimization measures necessary for a TAL over the long-term and avoidance of take of listed species, and California Ridge would continue to conduct post-construction monitoring in accordance with the BBCS and TAL.

2.2.2 Alternative 2: The Proposed Action

Under this alternative, the Service would issue an ITP to the Applicant for incidental take of Indiana, northern long-eared bats, little brown bats, and tricolored bats at the Project based upon the Applicant's commitment to fully implement their proposed HCP and BBCS (Appendix A).

The proposed HCP includes specific measures to minimize, mitigate, and monitor take of the covered species as a part of Project operations:

<u>Minimization through Operations</u> – The curtailment plan is explained in detail in the Project HCP in Section 7.2.1. The Applicant would minimize the potential take of Indiana bats and northern long-eared bats resulting from Project operations by adjusting turbine operational parameters. Individual turbines would be feathered below a wind speed of 3.0 m/s from March 15 to July 31 from sunset to sunrise. Between August 1 and October 15 all turbines would be feathered below a wind speed of 5.0 m/s from sunset to sunrise when ambient temperatures are above 50ºF based on a 10-minute rolling average. If temperatures are below 50ºF, the cut-in speed will be the manufacturer's cut-in speed (3.0 m/s).

<u>Measures to Mitigate the Impact of Taking</u> – The mitigation plan is described in detail in the Project HCP in Section 7.2.2. Although raising the cut-in speed and feathering blades below the seasonal cut-in speed is expected to minimize take of the covered species, some level of incidental take may still occur. Therefore, the Applicant would mitigate for the impacts of the taking of the covered species by implementing mitigation that is designed to produce a credit of at least 44 female Indiana bats, 58 female northern long-eared bats, and 195 female little brown bats as determined using the USFWS Resource

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[1] The fall migratory period was initially identified as August 1 through September 30 in the TAL; however, acoustic bat activity data collected at Phase II of the project (after the 2011 TAL was issued) suggested that the dates should be extended from August 1 to October 7.

Equivalency Analysis (REA)[2] models specific to each Covered Species (USFWS 2016a, 2016b). No REA model currently exists for the tricolored bat; however, given the overlap in habitat use by tricolored bats and the other Covered Species, a stacking ratio applied to the mitigation for the other covered species will suffice for mitigation of take of tricolored bats as well. Thus, all mitigation requirements will be increased by 10% to account for take of tricolored bats.

The Applicant has, in consultation with the Service, developed mitigation criteria that serve as standards for acceptable mitigation projects to be undertaken to offset take of covered species from operation of the Project. The Applicant will secure mitigation sites in Illinois that meet the habitat requirements of all four species and have documented presence within the HUC-12 watershed (in which the mitigation site is located) or within 2.5 miles of the potential mitigation site (if the mitigation is in a watershed adjacent to the occupied HUC-12). Mitigation credits may be stacked, where sites that cover all 4 species will have credits increased by 30%, 20% for 3 species, or 10% for 2 species. Mitigation could include projects that address protection of hibernaculum, protection of summer maternity colony habitat, restoration of occupied summer maternity habitat, and/or protection of occupied swarming habitat. Additionally, a mitigation bank or in-lieu fee program could be used for mitigation if one becomes available in the future. Approval from the Service is required of mitigation projects prior to project implementation.

Monitoring and Adaptive Management – A monitoring program would be implemented as part of the HCP to verify ITP compliance through evaluation of the level of take of the Covered Species, to provide progress reports on the fulfillment of mitigation requirements, and to enable evaluation of the effectiveness of the minimization and mitigation actions in meeting the biological goals and objectives (see Section 7.1 of the HCP). The monitoring program consists of compliance monitoring to evaluate the level of take of the Covered Species at the Project and mitigation effectiveness monitoring to ensure that the mitigation projects are implemented and functioning as suitable habitat for the Covered Species. Monitoring results would be reported to the Service after each year of monitoring.

Adaptive management, based on the amount of estimated take occurring at the Project through mortality monitoring, provides a mechanism to respond to changes in fatality rates of the covered species to ensure that the Project effectively minimizes and/or mitigates take to not exceed the permitted levels. In the first five years, adaptive management would be triggered based on bat carcasses found during post-construction monitoring. If the observed take of any of the covered species observed during monitoring is higher than initial estimates considered in the HCP, then adaptive management would be triggered and California Ridge would recalculate mitigation requirements for the remainder of the permit term, increase the amount of Surety, and implement additional mitigation or increased minimization measures to ensure take is fully offset and does not exceed the permitted amount.

Beginning in the sixth year of the permit, the adaptive management trigger would be based on the cumulative annual take rate and the projected take estimate. Adaptive management would be used to prevent the cumulative take estimate from reaching the take limits of any of the covered species. This could include further offsetting the impact of the increased rate of take through additional mitigation or by reducing the cumulative annual take rate by further minimizing the effects of the CRWE operation (see Section 7.4 of the HCP). This could include raising cut-in wind speeds in 0.5 m/s increments, implementing deterrent technology or a smart curtailment strategy, or increasing search effort during

[2] The Resource Equivalency Analysis (REA) models for Indiana bats and northern long-eared bats were used to determine mitigation needs. REAs are typically denominated in units of resource services, which account for direct take of female bats and their lost reproductive potential. When an adult female bat is prematurely killed at a wind energy facility, her and her offspring's reproductive potential is lost. The mitigation debits and credits are thus measured in the number of female bats killed from the Proposed Action and gained from the proposed mitigation. The Proposed Action would also kill male bats, but the proposed mitigation would also gain male bats.

subsequent years of post-construction monitoring. In the event that the permitted take level for one or more of the covered species is reached, California Ridge would feather turbine blades below 6.9 m/s during times and periods of risk to the covered species to avoid further take for the remainder of the permit term.

The HCP also provides for conditions under which turbine cut-in speeds can be lowered (a "reversion trigger"). Specifically, if two years of monitoring show that the estimated annual take rate for all covered species is below the anticipated take estimate for all species, cut-in speeds of project turbines may be reduced in increments of 0.5 m/s. A reduction in cut-in speeds would be followed by two years of intensive monitoring at the new cut-in speed to ensure that take levels are remaining below the anticipated take estimate. Under these provisions, cut-in speeds could be lowered incrementally down to 3.0 m/s. See section 7.4 of the HCP for further information.

The Applicant covers changed circumstances in Section 8.1 of the HCP to address the following events: listing of a new bat species that occurs in the Permit Area; new technology or information that improve bat mortality monitoring/estimating mortality/minimizing mortality; change in covered species migration dates; change in summer risk to covered species as indicated by forested habitat occupancy; change in summer risk to Indiana or northern long-eared bats as indicated by fatality data; repowering of project turbines; delisting of a species/listing not warranted or warranted but precluded decision; and, changes in a mitigation project's ability to meet success criteria. The HCP outlines triggers for each of these changed circumstances and describes the Applicant's responses.

The Applicant covers funding assurances in Section 8.2.3 of the HCP. Funding assurance would be provided through a Letter of Credit from a financial institution acceptable to the Service for portions of the conservation program that are not yet implemented. An initial amount of $1,329,761 would be secured within 30 days of the issuance of the ITP to cover mitigation for the anticipated take level, 10% of the potential mitigation that may be required under adaptive management, and the changed circumstances fund. The timing of funding and funding assurance mechanism for implementing the HCP is further described under Section 8.2.3 of the HCP.

2.2.3 Alternative 3: More Restrictive Alternative

Under Alternative 3, the Service would issue an ITP based on an HCP addressing the incidental take of the covered species expected from a modified cut-in speed operational protocol. The Applicant would be expected to implement a revised BBCS that will reflect measures in the HCP for the modified cut-in speed. Under this alternative, individual turbines would be feathered below a wind speed of 5.5 m/s during the entire bat active season from April 1 to October 31.

The HCP would outline a conservation program including mitigation, monitoring, and adaptive management requirements that meets ITP issuance criteria. It is assumed that monitoring and adaptive management program described in Section 2.2.2 would remain in place and that mitigation would be similar to that described in Section 2.2.2 but scaled to account for changes in the amount of take and resulting impacts to Covered Species and their habitats.

2.3 ALTERNATIVES ELIMINATED FROM DETAILED ANALYSIS

2.3.1 Additional Elevated Operational Adjustment Alternatives

The Service considered alternatives that included feathering turbines below wind speeds of 5.0 m/s, 6.0 m/s and 6.5 m/s during any and all periods of covered species risk. These alternatives were eliminated from detailed consideration because the best available science does not support a substantial difference in covered species fatality reductions when compared to a 5.0 m/s, 5.5 m/s or 6.9 m/s cut-in speed, which are already elements of other alternatives carried forward for detailed analysis. By this we mean that the range of potential impacts to each species that would result from applying these cut-in speeds is captured among the alternatives analyzed in detail. See Table 2-1 for the list of curtailment studies, and also Appendix D, Table 5 for a breakdown, by season, of the expected take to covered species across representative cut-in speeds between no operational adjustment and 6.9 m/s.

2.3.2 Less Restrictive Alternative

Past EAs for wind projects in the Midwest have included an alternative that would result in a higher take of covered species than the HCP alternative. In the context of the proposed California Ridge HCP, less restrictive alternatives include any operational strategy involving feathering of turbines at any wind speed below 5.0 m/s during the fall migration period for the covered species. In this EA, we have chosen not to carry a high-take alternative forward for detailed analysis because it is unlikely and unreasonable that the Service would decide to issue a permit with fewer conservation measures and a higher take limit than the Applicant proposed.

2.4 NO OPERATIONAL ADJUSTMENT SCENARIO

Under the No Operational Adjustment Scenario, all Project turbines would operate year-round without restrictions (i.e., no curtailment or time-of-year restrictions, no feathering of turbines) This scenario was not considered as an alternative for consideration because it does not protect, conserve, or enhance the covered bat species and there is a risk of violating section 9 of the ESA. However, it is included in our analyses of environmental consequences to bats (Section 3.6.2) as a baseline comparison for the other alternatives.

3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 AFFECTED ENVIRONMENT

The affected environment is the area and its resources (i.e., biological, physical, socioeconomic) potentially impacted by the Proposed Action and Alternatives. The purpose of describing the affected environment in the sections below is to define the context in which the impacts would occur. To make an informed decision about which alternative to select, it is necessary to first understand which resources would be affected and to what extent. The affected environment sections of this document provide the basis for this understanding.

Relative to the Applicant’s proposal, the affected environment includes those settings where any activities associated with the HCP (operations, maintenance, monitoring, and mitigation) would occur. This includes 1) the CRWE wind farm (the Permit Area) and 2) the HUC-8 in which the mitigation for impacts would occur. The ITP would cover the Permit Area and all covered activities.

In defining potentially affected resources, we considered the potential impacts associated with the covered activities under the Proposed Action and the implementation of the HCP. Specifically, we analyzed the impacts of the operation of the turbines and mitigation actions as described in the HCP. Consistent with

NEPA, we also considered alternatives to the Proposed Action involving the operation of the Project, which is directly associated with the take of Indiana, northern long-eared, little brown, and tricolored bats.

Project operations and mitigation vary among the considered alternatives. With regard to implementation of any of the alternatives considered, bat resources are likely to experience the most pronounced impact and vary measurably among alternatives. Hence, our analysis is commensurate with the estimated impacts and focuses predominately on this resource. We recognize four other resource categories that may experience variable effects under the alternatives: avian resources, non-volant wildlife resources, air quality and vegetation. Thus, we also provide an analysis for these resources.

Project operations and implementation of mitigation under the alternatives are unlikely to have significant effects to geology and soils, surface and ground water, environmental justice, land use, visual resources, cultural resources, transportation, and communications. The project is already built and operational, and mitigation actions will only involve vegetation and habitat management on undeveloped land. Therefore, the Applicant's proposed action and the alternatives in this EA are not anticipated to result in changes to these resources from their current condition. Hence, our review does not extend to include detailed analyses of these resources.

In summary, the following descriptions of resources are limited to those affected by the alternatives under consideration, described in Section 2.0. The alternatives under consideration include three scenarios in which a 134-turbine wind farm could operate, i.e., three different operational adjustments associated with turbine cut-in speeds, along with the corresponding mitigation measures. Our detailed analysis is confined to the biological environment (vegetation; wildlife; avian; bats) and the physical environment (air quality).

3.1.1 Overview of the NEPA Project Area

The Project is located in Champaign and Vermilion counties in eastern Illinois two miles northeast of Royal, Illinois. The NEPA Project area includes the land on which the turbines are built and covers approximately 35,207 acres (Figure 1). The setting includes primarily agricultural lands (i.e., row crops and agriculture) interspersed with small patches of forest, rural residences, and farmsteads.

Land cover of the Project area is dominated by cultivated agriculture (primarily corn and soybeans) (95.2%), with small amounts of forested areas (0.2%) found in patches near farmsteads or streams. Streams that flow within the area include Knights Branch and Buck Creek (tributaries of the Middle Fork of the Vermilion River) and Stony Creek, Feather Creek, and Spoon River (tributaries of the Salt Fork of the Vermilion River). Other unnamed tributaries also occur within the Project area. Less than 10 acres of wetlands and approximately 10 acres of open water fall within the Project area. In the larger context area of the Vermilion River basin (Vermilion, Champaign, Ford, Iroquois, Livingston, and Edgar counties), cropland is the principal land cover (76.7%) with woodlands and wetlands only accounting for 4.3% (41,273 acres) and 1.0% (9,438 acres) of the area respectively (ILDNR 2000).

The 214.4-MW wind farm includes 134 wind turbine generators and other associated project components (Section 1.3), located on land leased from private landowners who continue their current uses of the agricultural lands. As a leaseholder, California Ridge's rights are limited to those incorporated in the lease agreement to allow for safe and effective operation, maintenance, and decommissioning of the Project. California Ridge has no control over landowner activities on the properties in which the Project is sited beyond what is specified in their lease provisions. California Ridge used standard construction procedures, including best management practices, to minimize impacts to the existing environment and habitat, including siting wind turbines 1,000 feet or more from suitable bat foraging habitat.

The Applicant is working to identify and implement appropriate mitigation projects within the same HUC-8 watershed as the Project (Figure 3-2). They plan to secure mitigation sites that meet the requirements of all four species and have documented presence within the HUC-12 watershed in which any proposed mitigation is located. Mitigation under all alternatives is assumed to be placed in the same HUC-8 watershed as Project, with the same requirements for covered bat species presence.

3.1.2 PLANNED ACTIONS AND ENVIRONMENTAL TRENDS

In accordance with 40 CFR § 1502.15, we evaluated the effect of other reasonably foreseeable planned actions on affected resources within specific analysis areas. Analysis areas were selected based on the NEPA Project Area (see Section 3.1.1), the duration of the agency action, the type of planned actions that may impact the affected resources, and the scale at which effects on the resource can be meaningfully discussed. Two primary types of planned actions that may impact the affected resources include other wind energy development and changes to forested habitat within the mitigation area. Planned actions and general environmental trends are discussed in this section, whereas impacts in the context of environmental trends for each affected resource are discussed below.

Priority actions for conservation and restoration have been identified in the Vermilion River watershed. Objectives include invasive species control, protection of wetlands, enhancement of oaks in wooded tracts, and maintenance of 3 to 5 forested tracts >200 acres (ILDNR 2005). The Middle Fork of the Vermilion River, the only designated National Wild and Scenic River in Illinois, is afforded protection through the Wild and Scenic Rivers Act to preserve its free-flowing state and the immediate environments for the benefit and enjoyment of present and future generations. The Vermilion River Wildlife Conservation Partnership developed the Vermilion River and Little Vermilion River Conservation Opportunity Area Wildlife Action Plan (2011) to identify priority conservation actions across the 791,665-acre Opportunity Area in Champaign, Vermilion, Ford, Edgar, and Iroquois counties. One identified goal was to increase the amount and quality of terrestrial wildlife habitat by improving existing sites, acquiring new sites, and restoring native plant communities. Priority actions included restoration of degraded habitats; establishing amphibian breeding habitat adjacent to woodlands, forests, and restorations; controlling exotic and invasive species; reducing hard habitat edges; and increasing prescribed burning.

According to the U.S. Census Bureau, the populations of Champaign and Vermilion counties were estimated at 179,936 and 783,800 respectively in 2000 and 201,541 and 81,639 in 2010. Projections for 2025 by the Illinois Department of Health estimate that Champaign County will grow to 225,626 and Vermilion County will decrease to 76,441. Population changes can be one indicator for land use changes that may affect wildlife habitat availability and/or suitability.

The Champaign County Land Resource Management Plan (2010) documents moderate but stabilized growth, primarily in urban areas but also along rural fringes. Rural residential development converted approximately 118 acres of farmland per year from 1988 to 2005, which made up approximately 21% of the average annual farmland conversion (563 acres). Farmland conversion in expected to increase over time as population growth continues. From 1988 to 2005, farmland was converted at a rate of 0.73 acres per person added. No data was provided for conversion of other land uses (e.g., open space) to residential, commercial, or industrial development in Champaign County. No trends or future land use plans were available for Vermilion County.

Illinois' renewable portfolio standard set forth by the Illinois Power Agency Act (20 ILCS 3855/1-75c) establishes a goal of 25% renewable energy procurement by 2025, of which 75% be derived from wind and photovoltaic projects. Additionally, 4 million renewable energy credits must be procured from wind projects each year by 2030. Illinois ranked sixth in the U.S. for installed wind energy capacity in 2019 at 5,858 MW generating 7.6% of the state's energy (AWEA 2020). An additional 743 MW of wind energy are under construction and 993 MW under development as of April 2020. For Illinois to reach its 25% renewable goal by 2025, we expect an additional 11,000 MW of wind energy would be needed. Wind energy development within USFWS (Legacy) Region 3 has been steadily increasing to the current installed capacity of approximately 27,856 MW (AWEA 2020), with an expected nationwide growth rate of 2.4-percent annually for installed wind energy capacity (USEIA 2015).

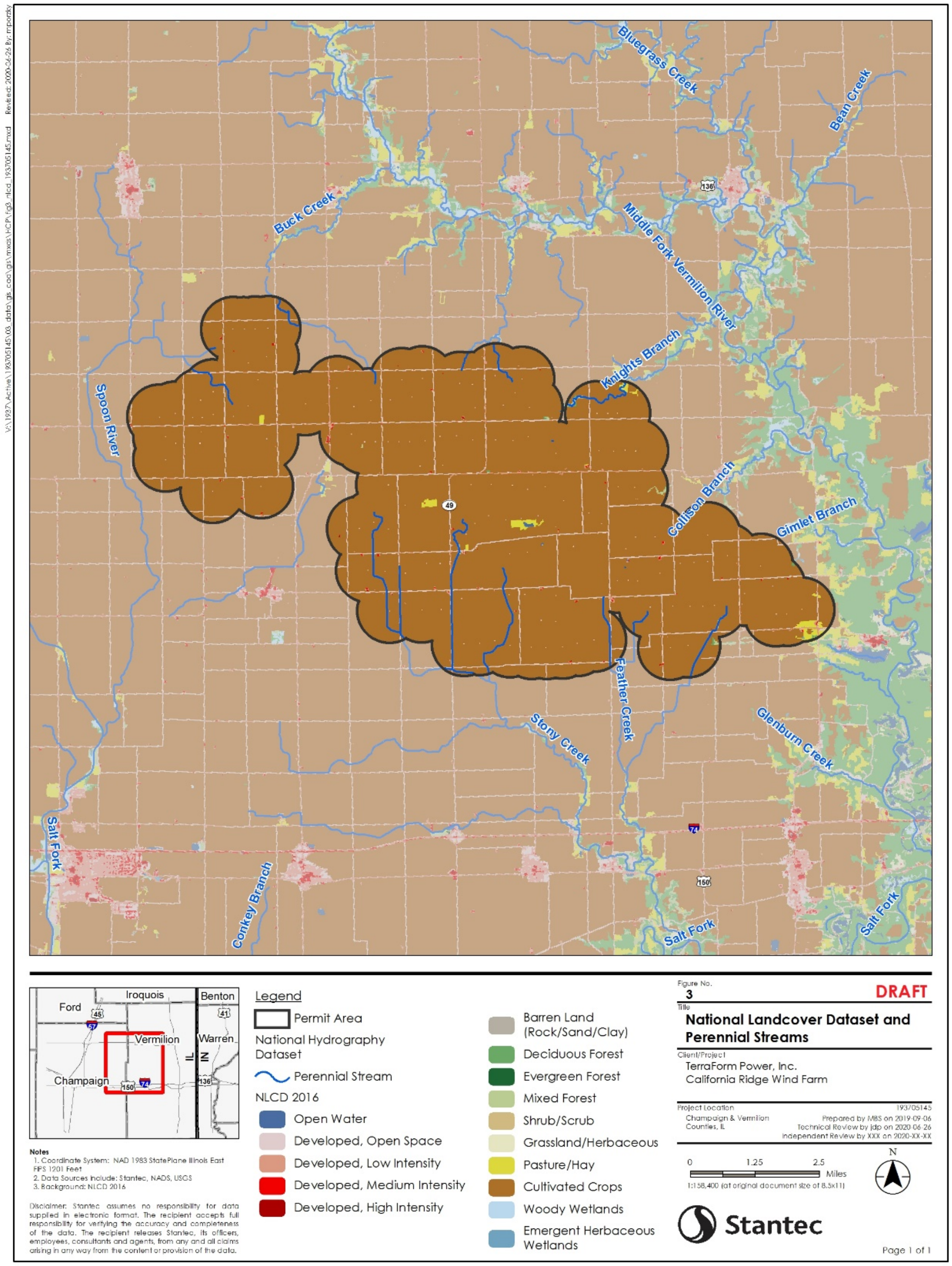

Figure 3-1. National Land Cover Data.

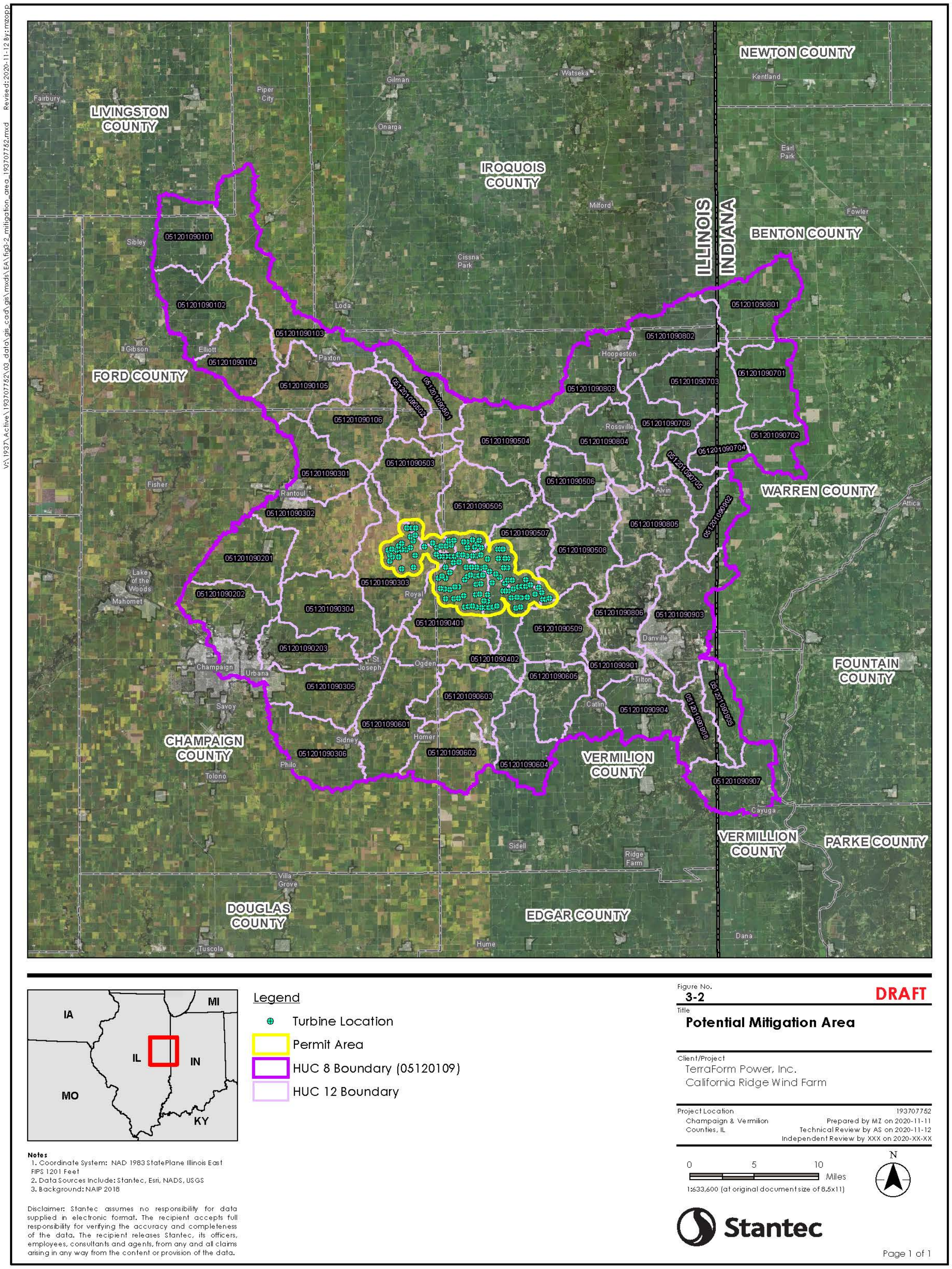

Figure 3-2. Potential Mitigation Area with the HUC-8 Watershed Boundary.

3.2 ENVIRONMENTAL CONSEQUENCES

The environmental consequences sections analyze the environmental impacts of each of the three alternatives in Chapter 2 that were retained for detailed analysis (summarized in Table 2-2). The alternatives differ from each other with respect to operational adjustments and the amount of mitigation that would be implemented.

The effects of each alternative (if applicable, some impacts are the same under all alternatives) are described in each resource section. Effects include those that are caused by the action (issuance of an ITP) and occur at the same time and place as the action. They also include those that are caused by the action (issuance of an ITP) but occur later in time or are further removed in place but still reasonably foreseeable. Long-term effects persist through the life of the project; short-term effects would be limited in time and duration.

3.3 VEGETATION

3.3.1 Affected Environment

Vegetation resources include all plants, including rare, threatened, and endangered plants. As stated previously, vegetation in the Project area is dominated by agricultural crops with occasional farmsteads. Waterways associated with the Middle and Salt Forks of the Vermillion River are within or near the Project and may function as bat foraging corridors, although turbines are located at least 1,000 ft away from these areas. General landcover is described in Section 3.1.1. Vegetation in potential mitigation areas consists of existing forested habitat or agricultural cropland.

3.3.1.1 Threatened and Endangered Plant Species

Based on current information from ILDNR's Natural Heritage Database, one state-listed plant has been recorded in Champaign County and ten state-listed plants in Vermilion County (ILDNR 2020). Champaign County has occurrences of Sangamon phlox (*Phlox pilosa sangamonensis*) while Vermilion County has occurrences of Mead's milkweed (*Asclepias meadii*), sedge (*Carex bromoides*), drooping sedge (*Carex prasina*), Willdenow's sedge (*Carex willdenowii*), small yellow lady's slipper (*Cypripedium parviflorum*), queen-of-the-prairie (*Filipendula rubra*), weak bluegrass (*Poa languida*), Wolf's bluegrass (*Poa wolfii*), bulrush (*Scirpus hattorianus*), and royal catchfly (*Silene regia*). Based on the Service's threatened and endangered species database, the eastern prairie fringed orchid (*Platanthera leucophaea*), prairie bush-clover (*Lespedeza leptostachya*) and Mead's milkweed (*Asclepias meadii*) may occur in Champaign and/or Vermilion County.

3.3.2 Environmental Consequences

3.3.2.1 Impact Criteria

Federally listed plants are afforded protection under the ESA. State-listed plants are afforded protection under the Illinois Endangered Species Protection Act (520 Illinois Compiled Statutes [ILCS] 10). Executive Order 13112 addresses federal coordination and response to the problems associated with invasive species. There are no specific federal or state regulations pertaining to unlisted plants that are relevant to the analysis for the Applicant's proposal. As per NEPA and CEQ guidelines, the human environment includes vegetation resources, and impacts to these resources can result in secondary effects to other resources.

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

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

3.3.2.2 Effects to Vegetation Resources

Mitigation activities under each action alternative would involve the protection and restoration of summer roosting or foraging habitat for the covered species (i.e., woodlands). These areas would also be protected from development or changes in land use for at least 10 years beyond the end of the permit term. Under the Alternative 2 (Proposed Action), 101.3 acres of forested habitat mitigation will occur, and up to 563.2 total acres of mitigation could occur if adaptive management is triggered. Under Alternative 3 up to 524.7 acres of forested habitat mitigation would occur. Mitigation actions under either action alternative would have beneficial effects to woodland vegetation and flora present in the mitigation area.

3.3.2.3 Impacts in the Context of Environmental Trends

Today approximately 12% of Illinois is covered by forest, or 4.9 million acres. Historically, approximately 40% of Illinois was forested. Forest area declined from 13.8 million acres to approximately 3 million acres in 1924, its lowest point. Over the last 80+ years, forested area in Illinois has been increasing. From 1998 to 2005, the annual increase rate was the highest observed at 0.6% and accounted for 40% of growth since 1948 (U.S. Forest Service [USFS] 2009). From 2011 to 2016, forest land expanded by another 3% (USFS 2017). Although forest cover may be increasing, quality of wooded habitat in Illinois is thought to be declining due to lack of management, erosion, invasive species, and fragmentation (ILDNR 2005).

According to the Champaign County Land Resource Management Plan (2010), only 7% of the county was forested (primarily around river corridors) when Euro-American settlers first settled the area in the early 19th century. Today, forested areas have been heavily converted to other land uses (primarily agriculture) and are now largely confined to the 100-year floodplain comprising only 1% of land cover in the county in 1999. Prairie comprised roughly 92.5% of land cover in the early 1800’s and is almost entirely converted to agriculture (91.5% in 1999) or urban (6%). Acreage of parks has increased in Champaign County by 115% (2,644 acres to 5,756 acres from 1970 to 2005); however, not all of these parks contain habitat for wildlife. No comparable information was available for Vermilion County.

The HUC-8 watershed (#05120109) in which the Project is located is 916,371.5 acres (Figure 3-2), of which 48,103.87 acres is currently deciduous forest land cover according to NLCD (2016). Compared to NLCD (2001), deciduous forest cover has decreased by approximately 549.7 acres (or 1.13%) due to conversion primarily to agriculture and urban development. It is reasonable to expect that this trend and planned actions (considered in Section 3.1.2) would continue to affect forested habitat similarly over the duration of the permit term. Approximately 12,871.1 acres of protected land[3] occur within the HUC-8 watershed (USFWS unpublished data) of which 6,658 acres (51.7%) is deciduous forest (NLCD 2016)

[3] Protected lands include lands owned by the state of Illinois, counties, local municipalities, non-government organizations, or private individuals.

(Figure 3-3). Thus, 13.84% of deciduous forest in the HUC-8 watershed is currently protected. The protection and/or restoration of between 101.3 and 563.2 acres of forested habitat would increase the percentage of forested, protected land in the watershed by 1.52 to 8.46%. While beneficial, significant, population level effects on vegetation resources in the plan area are not expected due to the mitigation. These areas would also be managed to promote the sustainability and integrity of the ecosystem using typical land stewardship practices, and therefore are not expected to negatively impact any federal or state listed species. It is not anticipated that forest habitat restoration or stewardship activities would have a significant effect on vegetation or local flora under any of the action alternatives considered, and mitigation would not occur under the No Action Alternative.

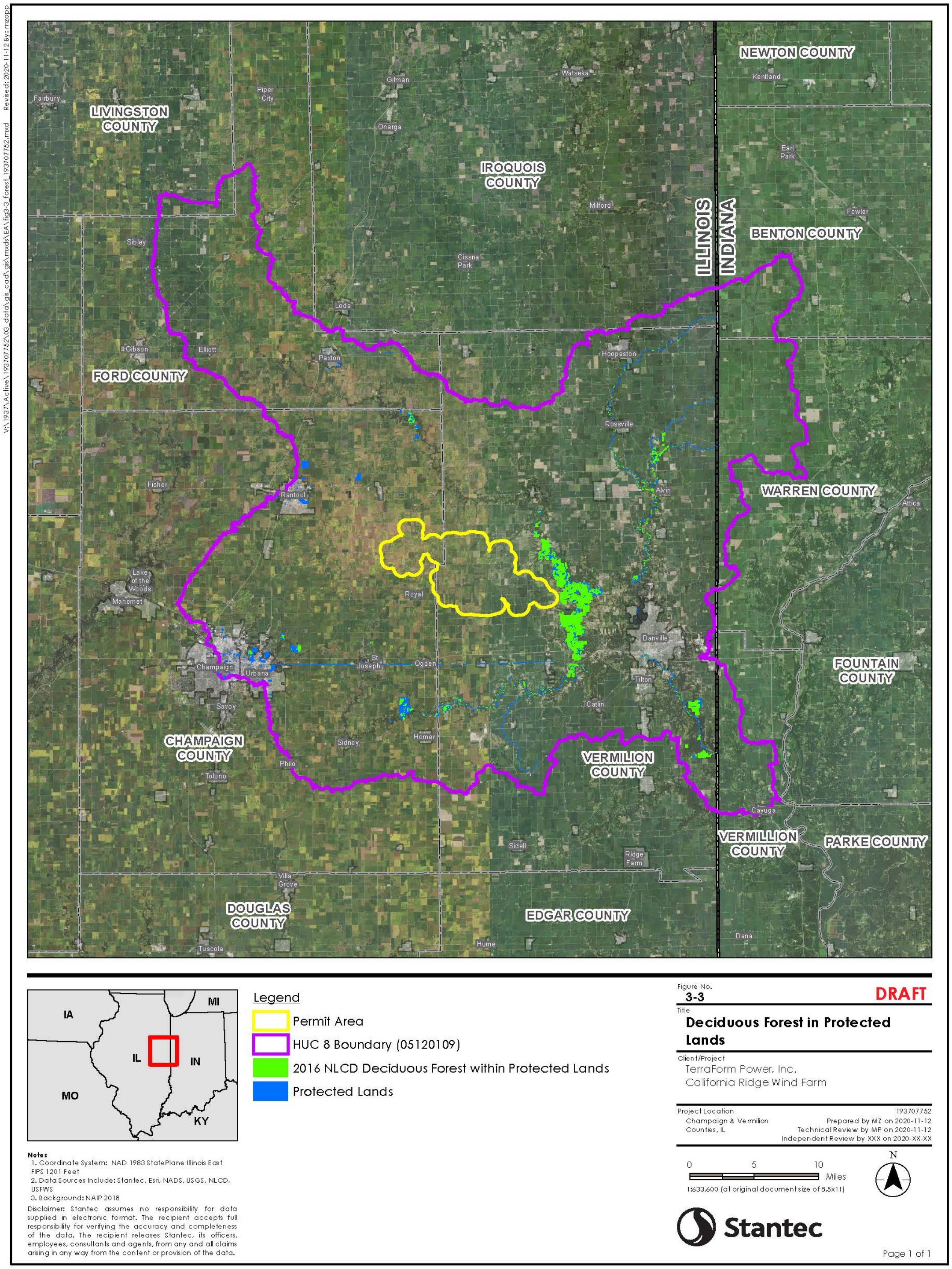

Figure 3-3. Deciduous Forest Located on Protected Lands within the HUC-8 Watershed Boundary.

3.4 WILDLIFE RESOURCES

This section addresses non-volant (i.e., non-flying) wildlife; birds and bats are addressed in Sections 3.5 and 3.6, respectively. General wildlife includes common terrestrial and aquatic animals and rare, threatened, and endangered animals. Project operations and mitigation projects may affect wildlife resources.

3.4.1 Affected Environment

Based on the habitat available (Section 3.1.1), the majority of the terrestrial wildlife in the Project area are generalist species adapted to an agricultural environment. Limited habitat for aquatic species exists in the Project area. Several nature preserves or other public lands are located in Vermilion County east of the Project but are not within the Project area. Wildlife present may include coyote (*Canis latrans*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), Virginia opossum (*Didelphis virginiana*), squirrels (*Sciurus* spp.), wild turkey (*Meleagris gallopavo*), and other commons mammals and birds. Creeks and drainages, although limited in the Project area, may be used by amphibians, fish, reptiles, and waterfowl.

3.4.1.1 Threatened and Endangered Species

Federally listed species are afforded protection under the ESA. Based on the USFWS's threatened and endangered species database, Champaign and Vermilion County are within the range of five threatened or endangered wildlife species: Indiana bat, northern long-eared bat, clubshell (*Pleurobema clava*), rabbitsfoot (*Quadrula cylindrica cylindrica*), and rusty-patched bumble bee (*Bombus affinis*). The little brown bat and tricolored bat, although not federally listed, are under review for listing by the Service.

In Illinois, state-listed species are afforded protection under the Illinois Endangered Species Protection Act (520 Illinois Compiled Statutes [ILCS] 10). Based on the Illinois DNR website, Champaign County has 22 species of state-endangered or threatened wildlife recorded in the county and Vermilion County has 35 species (ILDNR 2020).

3.4.2 Environmental Consequences

3.4.2.1 Impact Criteria

Major impacts to wildlife and aquatic resources are those that substantially affect a species' population (locally, regionally, or range-wide) or reduce its habitat quality or quantity. Examples of effects include disturbance, injury, mortality, and habitat alteration. Other effects include habitat loss or degradation over time or effects to resources used by wildlife in different life stages (i.e., alterations to surface water or alterations to plant composition). Another potential effect may be the creation of habitat such as edges and openings that favor a different mix of species and in some cases, increase predation pressure, thereby causing displacement or avoidance.

3.4.2.2 Effects to Wildlife Resources

Turbine operations under any alternative are not expected to affect aquatic or non-volant, terrestrial wildlife (i.e., non-flying), including threatened and endangered species. It is possible that some terrestrial animals already avoid the Project area because of the presence of the Project on the landscape and human activity associated with operation of the Project. However, common species, such as white-tailed deer, raccoon, and coyote, tend to become habituated to human activity and habitat modification. Conversely, wind facilities may attract terrestrial scavengers, such as raccoons and coyotes, to the area due to avian and bat fatalities providing a food source.

All alternatives would continue to pose the same effects on non-volant wildlife from the ongoing operation and maintenance of the Project. Impacts from turbine operations will be limited to species occurring within the rotor-swept zone of each turbine. Therefore, turbine operation is not expected to affect terrestrial or aquatic wildlife.

Clearing of full plots for post-construction mortality surveys would occur in actively cropped areas; therefore, no impacts to wildlife are expected as a result of clearing search plots for post-construction mortality surveys under any of the action alternatives. Post-construction mortality surveys would not result in any effects to aquatic wildlife resources because no aquatic resources are present under the turbines.

Mitigation activities would involve protection of summer foraging or roosting habitat for the four bat species (i.e., woodlands), and therefore would benefit terrestrial and aquatic wildlife inhabiting these woodlands. The amount of forested habitat available to terrestrial wildlife in the HUC-8 watershed would be expected to increase by 1.52 to 8.46% under the action alternatives (see section 3.3.2.3). Additionally, if mitigation activities involve the gating of hibernacula, it would benefit terrestrial and aquatic wildlife that are still able to access those caves through the gate by limiting the access of potential predators and humans. Alternatively, gating could have a negative impact on larger species no longer able to access the cave. However, it is not anticipated that these activities would have a significant effect on aquatic and terrestrial wildlife under any of the action alternatives considered, and mitigation would not occur under the No Action Alternative.

None of the alternatives under consideration would result in population level effects to terrestrial or aquatic wildlife resources because the acres of mitigation represent only 0.2% to 1.17% of available forested habitat within the HUC-8 watershed analysis area (NLCD 2016). Therefore, no significant adverse or beneficial impacts to terrestrial and aquatic wildlife is expected.

3.4.2.3 Impacts in the Context of Environmental Trends

Wildlife is affected by land use patterns, habitat fragmentation, habitat degradation, invasive species, and lack of management. As population growth and development continues in Champaign and Vermilion counties (see section 3.3.2.3, above), wildlife habitat may become more fragmented or unsuitable in portions of the county. Around the Middle Fork and Salt Fork of the Vermilion River, habitat improvements are likely to continue to preserve important values and associated elements of the wild and scenic river corridor. Impacts like those discussed in Section 3.3.2.3 would be similarly expected for wildlife.

3.5 AVIAN RESOURCES

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

Birds are highly mobile, and dispersal and migration are important aspects of their life strategies and survival. Birds will occur within and travel through the Project area and mitigation sites while flying to and from natural resources within the surrounding landscape and during migration. This analysis focuses on species of birds protected under the ESA, MBTA, BGEPA, Illinois Compiled Statutes and USFWS Birds of Conservation Concern (BCC), but it also considers species that are common to the Project area and region. Abundant species are expected to occur more frequently and are more likely to experience impacts from the Project. This analysis considers site-specific habitat and land cover assessment information, site-specific pre-construction avian survey data, and post-construction mortality surveys.

3.5.1 Affected Environment

Prior to Project construction, California Ridge consulted with the Service and Illinois Department of Natural Resources (ILDNR) to identify potential concerns related to birds and the need for studies to assess the potential for avian risk associated with development and operation of the Project. Avian species that occur in the Project area are diverse and may include:

- Passerines (songbirds and corvids [crows and jays]);
- Nocturnal non-passerines (nightjars);
- Shorebirds;
- Waterbirds (waterfowl, loons, grebes);
- Game birds; and
- Raptors (falcons, eagles, hawks), vultures, and owls.

Habitat for birds is limited within the Project area, as land cover is dominated by cultivated agriculture (primarily corn and soybeans) (95.2%), with small areas of hay/pasture (0.5%), deciduous forest (0.1%), mixed forest (0.1%), and open water, woody wetlands, barren land, and emergent herbaceous wetlands (0.6% combined) (NLCD 2016). Due to high levels of disturbance and lack of native vegetation, agricultural habitats are of restricted quality for birds. Cultivated agriculture is rarely used as nesting habitat by birds, although certain, disturbance-tolerant species may forage in crops. Agricultural fields may attract large flocks of birds, such as blackbirds and Canada geese (*Branta canadensis*), during the fall migration and winter seasons (Erickson et al. 2002). Unmowed grassland, mowed grassland, pasture, hayfields, savannah, and railroad verge may provide nesting habitat for grassland and passerine birds. However, these habitats exist only as small, isolated patches within the Project area. Similarly, the Project area contains only limited amounts of forested habitat (woodlot, shelterbelts). Forest fragments such as those found within the Project area are typically not considered high-quality nesting habitat for birds due to their limited size and abundance of edge habitat, which is associated with higher incidence of nest predation and parasitism (Cavitt and Martin 2011). These small patches of forest habitat may receive higher levels of bird use during migration, as forest fragments often provide stopover habitat for migrating passerines and other birds (Packett and Dunning 2009).

3.5.1.1 Pre-construction and Post-construction Surveys

Baseline surveys, conducted between April 15 – May 20, 2013, July 15 – September 30, 2013, and April 1 – May 20, 2015 at CRWE, included fixed-point bird use surveys, American golden-plover migration surveys, raptor nest surveys, and post-construction mortality surveys. Pre-construction reports are provided in Appendix C of this EA, and summaries of these surveys are shown below in Table 3-1.

Table 3-1. Summary of pre-construction and post-construction site surveys at CRWE.

Survey	Summary	Report Citation
Fixed-point bird use	● Total of 360 twenty-minute surveys from March 2009 through February 2010. ● Forty-eight bird species identified (5,325 individual bird observations). ● Total of 65 individual raptors recorded, representing 6 species. ● Average species richness of 0.67 large bird species/2,625-ft [800-m] plot/20-min survey and 1.66 small bird species/328-ft [100-m] plot/20-min survey. ● European starling (*Sturnus vulagris*), brown-headed cowbird (*Molothrus ater*), and red-winged blackbird (*Agelaius phoeniceus*) composed 44% of all bird observations. ● Bird use was greater in the spring and fall than during winter, apart from raptors where use was fairly even across seasons. ● No threatened or endangered species were detected and no obvious fly-ways or concentration sites were observed.	Good et al. 2010
American golden-plover migration	● Surveys conducted in April and May of 2013 and 2015 ● 32 groups observed with an estimated 3,053 individual plovers observed.	Ritzert et al. 2014, Shoener 2015
Raptor nest	● Search for nesting raptors in May 2011, including a two-mile buffer ● No bald eagle or raptor nests were found	Ritzert et al. 2011
Post-construction Mortality Surveys	● Conducted in spring 2013 – 2015 and fall 2013 - 2015 ● 119 bird carcasses found during searches ● 32 different species, primarily small songbirds ● 1 state threatened species found ● Seasonal fatality rates ranged from 0.05 - 0.13 birds/turbine in the spring and 2.5 - 2.64 birds/turbine in the fall.	Ritzert et al. 2014a, b, Gruver et al. 2014, Shoener 2015a, b

3.5.1.2 Threatened and Endangered Avian Resources

Federally listed bird species are not known to occur in or migrate through Champaign or Vermilion counties. Several state-endangered or threatened bird species are known to occur in these counties, including short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), northern harrier (*Circus cyaneus*), least bittern (*Ixobrychus exilis*), loggerhead shrike (*Lanius ludovicianus*), and yellow-crowned night heron (*Nyctanassa violacea*) (ILDNR 2020). The state-endangered northern harrier and upland sandpiper were observed during pre-construction surveys (Good et. al 2010). Two black-billed cuckoos (*Coccyzus erythropthalmus;* state-threatened) were found during post-construction mortality surveys in 2013 and 2015 and incidentally in 2014 (Gruver et. al 2014, Shoener 2015a, Shoener 2015b) and the project currently has a take permit from the State of Illinois for this species (ILDNR Permit #140). No federally listed species have been observed during pre- or post-construction surveys.

3.5.1.3 USFWS Birds of Conservation Concern

The Fish and Wildlife Conservation Act of 1980, as amended, (16 U.S.C. 2901, et seq.), mandates the Service to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act" (16 U.S.C. 2912). The Service has identified those migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the highest conservation priorities (USFWS 2008).

The Project is located in the Eastern Tallgrass Prairie Bird Conservation Region (BCR 22). For this BCR, the Service has identified 39 species for which proactive management and conservation actions should be considered (i.e., "Birds of Conservation Concern" or BCC species). During pre-construction surveys, three BCC species were observed, including the upland sandpiper, northern flicker (*Colaptes auratus*), and dickcissel (*Spiza americana*). Of the 39 BCC species, only the black-billed cuckoo has been found during post-construction mortality surveys.

3.5.2 Environmental Consequences

3.5.2.1 Impact Criteria

Birds can be affected at the individual and population-level. Impacts to avian resources would be considered major should implementation of an alternative result in any of the following a) naturally occurring population reduced in numbers below levels for maintaining viability at local or regional level; b) substantial loss or degradation of habitat for a rare, threatened, or endangered bird species; or c) substantial change in habitat conditions producing effects that cause naturally occurring populations to be reduced in numbers below levels for maintaining viability at local or regional levels.

3.5.2.2 Effects to Avian Resources

Operational impacts to avian resources are currently occurring and are expected to continue under all of the alternatives being analyzed. Impacts on avian resources are not expected to differ among the alternatives because the only technique proven to minimize impacts to birds is turbine shutdown during high-risk periods triggered by real-time field observations and/or automated detectors (Marques et al. 2014). Therefore, for our analysis, we assume that feathering turbines during bat active periods would not affect avian resources, and as such, the operational impacts under each of the alternatives under consideration are identical. Typically, when impacts to a resource are the same under all alternatives, including the no-action alternative, an in-depth analysis of these impacts is not considered under NEPA. However, in order to be consistent with other wind energy NEPA documents in the Midwest, we are choosing to discuss impacts to avian resources.

Operational impacts of wind facilities on birds include varying degrees of displacement from the wind turbines and surrounding habitat and fatalities resulting from collisions with turbines, transmission lines, and other project-related structures (Winegrad 2004). Impacts to avian resources from mitigation lands include positive impacts from preservation, stewardship, and restoration of forested habitat, as discussed below.

Two categories of impacts (disturbance/displacement and fatalities) are each discussed in detail below. The alternatives vary only in nighttime operational adjustments (cut-in speed and associated timing; Table 2-2). The protocol (cut-in-speed/temperature) in which turbines are operated at night is not known to affect avian use in the vicinity of turbines (Marques et al. 2014). All alternatives include the implementation of the Project's BBCS (Appendix A), which outlines steps taken to minimize impacts to all bird species. Therefore, potential impacts from turbine operation are not expected to differ among the alternatives.

Disturbance/Displacement

Wind turbines may displace birds from an area due to the creation of edge habitat, introduction of vertical structures, and/or disturbances directly associated with turbine operation (e.g., noise, shadow flicker) (Leddy et al. 1999, Shaffer and Buhl 2015, Fernández-Bellon et al. 2019). Disturbance impacts are often complex, involving shifts in abundance, species composition, and behavioral patterns. The magnitude of these impacts varies across species, habitats, and regions. Limited data available indicate that avoidance impacts to birds generally extend 246 ft to 2,624 ft from a turbine, depending on the environment and the bird species affected (Strickland 2004). Studies by Shaffer and Johnson (2008) and Kerlinger (2002) have concluded that, in general, bird species that are more adapted to human disturbances or agricultural or edge habitat are less likely to exhibit avoidance behavior near turbines than other species.

None of the alternatives under consideration involve construction of additional turbines or other infrastructure; therefore, additional disturbance and displacement impacts to birds are not expected. It is not anticipated that the operational protocols (i.e., cut-in speed adjustments) under any of the alternatives under consideration would either increase or decrease the level of disturbance or displacement for avian species in the vicinity of the Project (Marques et al. 2014).

Turbine Related Fatality

Wind turbines pose risks to birds under all three alternatives. Post-construction surveys at the Project included standardized mortality monitoring (see Table 3-1) from 2013 to 2015. A total of 26 bird carcasses were found (see Table 3-1) during surveys. Nineteen of the 26 fatalities occurred in the fall of 2013, with unidentified passerines and mourning doves being the most common. Bird fatalities at other wind facilities have been documented during both the breeding and migration seasons; however, data suggest that the majority of fatalities at other wind energy facilities occur during the spring and fall migration periods (NRC 2007; Johnson et al. 2002).

Resident and migrating songbirds (passerines) represent the majority of fatalities at wind turbines nationwide (75%, excluding California; Erickson et al. 2001) and represented the majority of fatalities at CRWE during standardized post-construction monitoring between 2013 and 2015. Passerines have accounted for over 50% of avian fatalities at most wind facilities (Erickson et al. 2002). It is likely that birds taking off at dusk, landing at dawn, or traveling in low cloud or fog conditions (which lower the flight altitude of most migrants) are at the greatest risk of collision (Kerlinger 1995).

Based on data from post-construction fatality surveys, the avian fatality rate at the Project is estimated to be between 0.05 to 0.13 birds/turbine in the spring and 2.5 to 2.64 birds/turbine in the fall. Comparatively, the nationwide estimate of average avian fatalities rates ranges from 2.10 to 3.35 small birds/MW (Erickson et al. 2014). Smallwood (2013) estimated an all-bird fatality rate, including raptors, at 11.10 birds/MW (573,000 avian fatalities at installed wind energy capacity of 51,630 MW in 2012).

Based on how many turbines will be operating in a given year, the facility-wide estimates for seasonal fatalities are expected to be:

- 6.7 to 17.42 bird fatalities in the spring annually (134 to 349 over the 20-year permit, rounded); and,
- 335 to 353.76 bird fatalities in the fall annually (6,700 to 7,076 over the 20-year permit, rounded).

Using the site-specific data, over the course of the 20-year permit, the Project will take approximately 6,834 to 7,425 birds; however, limited data is available for CRWE which may underestimate the actual number of fatalities that occur at the Project per year. If bird fatalities per MW follow the nationwide average, the CRWE may take 9,005 to 14,365 birds over the 20-year permit.

Of the 119 avian carcasses found during post-construction monitoring at CRWE, 2 raptor fatalities (red-tailed hawk) and 2 fatalities of a state-threatened species (black-billed cuckoo) were documented; the remaining fatalities included 30 different small bird species and 16 carcasses were unidentified.

Killdeer and red-eyed vireo were the two most common species fatalities observed at CRWE (each had 12 fatalities documented over three years of post-construction monitoring. These species have estimated global populations of 2.3 million and 130 million respectively (Partners in Flight 2020). The black-billed cuckoo, the rarest species observed, was estimated at 870,000 individuals, with 410,000 occurring in the United States as of 2013 and an estimated decline of 2% per year from 1966 to 2012 (Partners in Flight 2020). To assess the impact of fatalities on populations, the species with the highest estimated annual take and the species with the smallest population sizes were analyzed (Appendix B).

Using the CRWE data, the species with the highest annual fatality estimate(s), killdeer and red-eyed vireo, have an estimated take of up to 38 individuals per species annually (assumed 2.77 bird/turbine fatality rate based on 0.13 birds/turbine in spring and 2.64 birds/turbine in fall and a species composition of 10.08% of all fatalities individually). This represents 0.0016% of the global killdeer population and 0.000029% of the global red-eyed vireo population. The species with the smallest global population size, the black-billed cuckoo, has an estimated take of up to 1.53 individuals per year (WEST 2016), which represents 0.00018% of the global black-billed cuckoo population. Based on the low impacts to populations, the take associated with CRWE would not be significant.

No eagle nests are known to occur in the Permit Area, and no eagles were observed during pre-construction use surveys. Also, no eagle carcasses have been found during the three years of post-construction and research fatality monitoring at the project. Therefore, we do not expect the project to impact bald or golden eagles. Should new information arise during the permit term that indicates the project is at risk of taking bald or golden eagles, the Applicant would need to comply with the BGEPA. Effects to bald or golden eagles would be analyzed under the BGEPA permitting process, if applicable.

Effects of Maintenance and Mitigation

Maintenance activities would be required to ensure the safety and operability of CRWE under all three alternatives being considered. Thus, maintenance impacts to birds would be the same for all alternatives.

The impacts on avian resources from noise, vibration, and/or increased human activity and traffic associated with maintenance activities would occur intermittently and over short periods of time in already disturbed areas. Impacts could include short-term avoidance of areas where maintenance activities are occurring and could occur during any time of year, since maintenance may occur year-round. While the potential exists for BCC species present in the area to be impacted, it is most likely to affect species known to breed in the area, less likely to affect migrating individuals, and even less likely to affect rare/vagrant species. The only BCC species observed during pre-construction avian use surveys were the upland sandpiper, northern flicker, and dickcissel. Because maintenance activities are temporary, would occur intermittently over short periods of time, and are not expected to result in bird mortality, population-level impacts from maintenance activities are not expected to occur. Additionally, post-construction mortality surveys to be conducted under any of the action alternatives would result in additional human activity and traffic at CRWE, though the impacts of these activities on avian resources are not expected to differ greatly from the current conditions associated with the operation and maintenance of the operating facilities. Limited vegetation clearing would occur as part of routine maintenance activities under any of the alternatives under consideration, with some additional vegetation clearing necessary for post-construction mortality surveys under any of the action alternatives. However, the impacts of vegetation clearing on avian resources would be minor, as the activities would occur only in areas already cleared or disturbed.

No mitigation would occur under the No Action Alternative, as no take of the Covered Species is expected. Therefore, no ITP would be needed, and no HCP would be prepared. Avian species would therefore not receive the habitat conservation benefits expected under the other considered alternatives.

Under the other two alternatives, mitigation would be implemented (see Section 2.2) for the Covered Species, but no specific mitigation is proposed for avian resources. Forest birds would receive the habitat enhancement and protection benefits inherently associated with the bat summer/swarming habitat or maternity colony habitat protection mitigation proposed under the HCP. The protection and/or restoration of 101.3 to 563.2 acres of forested habitat would increase the percentage of forested, protected land in the watershed by 1.52 to 8.46%. It is assumed that every acre of forested habitat protected would also provide an acre of habitat for forest bird species whose range overlaps with the mitigation site, though the exact species would depend on the location and specific habitat selected. It is not anticipated that the gating of hibernacula, if chosen as the mitigation, would result in a significant negative or beneficial impact on avian resources under either of the action alternatives.

3.5.2.3 Impacts in the Context of Environmental Trends

For the purposes of this EA, the analysis area for avian resources is the Service's Region 3. The effects analysis uses a 20-year timeframe based on the requested duration of the ITP. The selected spatial and temporal scales provide a reasonable assessment of past, present, and reasonably foreseeable future effects, which include wind energy development, habitat loss, and climate change.

Wind Energy Development

Wind energy is one of many potential sources of mortality of birds (Table 3-2). Wind turbines account for less than 1% of the overall estimated annual avian fatality documented in the United States (Table 3-2) (Loss et al. 2015, USFWS 2018). None of the alternatives considered are expected to individually adversely impact the population viability of avian resources at a local or regional level (see Section 3.5.2.1). Impacts to birds from the Project will be related only to fatality or injury from Project operations, as CRWE is already constructed and operating, and additional displacement effects are not anticipated. Avian fatality is assumed to be the same under all three alternatives as cut-in speed adjustments have not been shown to have an effect on avian mortality (Smallwood and Bell 2020). Some forest bird fatalities resulting from operations of CRWE may be offset by the mitigation implemented for the Covered Species, as they may receive the habitat enhancement and protection benefits inherently associated with the bat habitat protection mitigation proposed under the action alternatives.

Table 3-2. Estimated annual avian fatality from anthropogenic sources in the United States.

Mortality Source	Fatality Estimate			Percentage	Source
	Central	Lower	Upper		
Cats	2,407,000,000	1,306,000,000	3,992,000,000	72.48	Loss et al. 2013a
Buildings	599,000,000	365,000,000	988,000,000	18.04	Loss et al. 2014a
Automobiles	199,600,000	88,700,000	339,800,000	6.01	Loss et al. 2014b
Agricultural pesticides	79,000,000	67,000,000	91,000,000	2.38	Pimentel et al. 1992 Mineau 2005
Power line collisions	22,800,000	7,700,000	57,300,000	0.69	Loss et al. 2014c
Communication towers	6,581,945	NA[1]	NA[1]	0.20	Longcore et al. 2012
Power line electrocutions	5,630,000	920,000	11,550,000	0.17	Loss et al. 2014c

Mortality Source	Fatality Estimate			Percentage	Source
	Central	Lower	Upper		
Oil Pits	840,000	500,000	1,000,000	0.03	Trail 2006
Wind turbines (all)[2]	573,093	467,097	679,089	0.02	Smallwood 2013
Wind turbines (monopole)	234,000	140,000	328,000	0.01	Loss et al. 2013b
Total[3]	**3,321,025,038**	**1,836,287,097**	**5,481,329,089**	**-**	-

[1] No range of uncertainty produced in original study.
[2] Includes both old-generation lattice turbines and new-generation monopole turbines.
[3] Total does not include "wind turbines (monopole)" as it is assumed to be inclusive under "wind turbines (all)".

By 2050, wind energy development is projected to grow to 404.25 gigawatts (GW) across the continental United States, with Illinois producing 43.82 GW (U.S. Department of Energy 2015). Currently, wind facilities have an operating capacity of 111.8 GW in the U.S. (5.8 GW in Illinois), which has tripled over the last decade (AWEA 2020b). Wind energy is currently a low source of bird mortality compared to other anthropogenic sources; but, as wind development continues to rapidly increase, avian mortality could substantially increase (Loss et al. 2015). None of the alternatives would alter the expected avian mortality from the project and the Project is not expected to be a substantial contributor of avian mortality to the annual wind energy fatality estimate (0.05 - 0.4%, using an estimate of 371.25 - 718.25 birds/year based on project-specific data and nationwide average of 11.10 birds/MW/year [Smallwood 2013], respectively).

The state of Illinois currently has a Renewable Portfolio Standard that mandates 25% renewable energy procurement by 2025 for investor-owned utilities and retail suppliers, of which 75% be derived from wind and photovoltaic projects. In 2019, renewable energy generated 7.6% of the electricity generated in Illinois, of which 97% was derived from wind power (USEIA 2020d). Based on this, we expect approximately 11,000 additional megawatts of wind energy to come online for the state to reach their 25% goal. At 16,000 MW, the estimated avian mortality for the state's wind energy could be anywhere from 33,600 to 177,572 birds/year (using a nationwide fatality rate range of 2.10 to 11.10 birds/MW by Erickson et al. 2014 and Smallwood 2013, respectively). Thus, avian fatality is expected to increase in the state as wind energy continues to grow, following the nationwide trend. Overtime wind-related fatalities could represent a higher source of mortality for birds than presented in Table 3-2; however, a determination of the significance of all bird fatality rates from wind energy in Illinois is beyond the scope of this EA because the Service does not have jurisdiction or control over the development of wind energy or the implementation of voluntary conservation measures.

Climate Change

Over half of the 588 North American bird species studied in a recent report by the Audubon Society (Audubon) are likely to be negatively impacted by climate change, losing more than half of their current geographic range (Audubon 2015). These species can be affected not only by a changing climate, but also by secondary factors, such as changing habitat, sea level rise, changes in predation, competition and dispersal, and migratory changes (Audubon 2015). While some species (188 out of the 588; 32%) may experience habitat loss coupled with the potential to colonize new areas, other species (126 out of 588; 21%) may experience only habitat loss, with no potential for range expansion (Audubon 2015).

Migratory birds are of special concern, as phenological (i.e., timing of a periodic biological phenomenon in relation to climatic conditions) mismatches between food and habitat availability may result when birds are arriving earlier to their breeding grounds (PGC-PGBC 2015). In addition, extreme weather events, which are predicted to increase with climate change, as well as late spring storms, have been shown to kill migrating birds (Dionne et al. 2008; Zumeta and Holmes 1978).

None of the considered alternatives would increase the effects of climate change on avian resources; instead, all three alternatives are expected have a beneficial impact by reducing greenhouse gas emissions through the production of electricity via wind energy (i.e., a reduction in the amount of fossil fuels used to produce electricity). The difference in effects between the alternatives, or from current operations, is small relative to the overall beneficial effect for each alternative.

3.6 BAT RESOURCES

This section describes bat resources in general and the existing conditions for bats within the Project area. For the purposes of this EA, federally listed, state-listed, and non-listed bats (those species not listed as threatened or endangered under the ESA or the state of Illinois) are addressed together in this section. The Indiana bat, northern long-eared bat, little brown bat, and tricolored bat make up the covered bat species, and the remaining eight bat species with potential to occur within the Project area make up the non-covered bat species.

3.6.1 Affected Environment

Twelve bat species occur in Illinois, ten of which could occur in Champaign and Vermilion counties (Table 3-3) based on their known ranges (Bat Conservation International, Inc. 2020). Of these species, the Indiana bat is federally- and state-listed as endangered and the northern long-eared bat is federally- and state-listed as threatened. The Service is also currently collecting information to review the status of the little brown bat and tricolored bat to determine if threats to these species may be increasing their likelihood of extinction.

3.6.1.1 Status and Environmental Trends of Non-Covered Bat Species

Nine of the twelve bat species known to occur in Illinois have been documented at the Project. The non-listed and non-covered species, including the big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), evening bat (*Nycticeius humeralis*), and silver-haired bat (*Lasionycteris noctivagans*), are discussed in this section. The other four species, the Indiana bat, northern long-eared bat, little brown bat, and tricolored bat, are discussed in Section 3.6.1.2. A summary of non-covered bat species that may occur in the project area is found in Table 3-3, below.

Table 3-3. Status and typical habitat of non-covered bat species potentially occurring in Champaign and Vermilion Counties, Illinois (ILDNR 2020).

Common Name	Scientific Name	Status	Summer Habitat	Winter Habitat[1]
Southeastern myotis[3]	*Myotis austroriparius*	State endangered	Caves, trees, structures	Hibernates in caves
Silver-haired bat	*Lasionycteris noctivagans*	None	Trees	Tree-roosting, long-distance migrant
Big brown bat	*Eptesicus fuscus*	None	Trees, structures, caves, mines	Hibernates in caves, mines, structures
Eastern red bat	*Lasiurus borealis*	None	Trees	Tree-roosting, long-distance migrant

Common Name	Scientific Name	Status	Summer Habitat	Winter Habitat[1]
Hoary bat	*Lasiurus cinereus*	None	Trees	Tree-roosting, long-distance migrant
Evening bat	*Nycticeius humeralis*	None	Trees, structures	Probable long-distance migrant

[1]As per England et al. (2001) and BCI (2018).
[2]Under status review for listing under the federal ESA.
[3]Not confirmed in Project area but was documented to occur in Vermilion County in 1996 (ILDNR 2020). Because no detections of this species have occurred at CRWE, this species is not carried forward for further analysis.

Bats listed in Table 3-3 include both short-distance migrants that hibernate colonially within the region in winter (typically in caves or mines) and long-distance migrants that migrate out of the region in winter and are thought to hibernate primarily in trees. Bats of all species are typically absent from the landscape in the region of the Project area between mid-November and mid-March and either emerge from hibernacula or migrate to the region in spring (April-May). Bat species likely to occur in the Project area forage in a variety of habitats and include species adapted to foraging in cluttered, riverine, as well as open habitats. Foraging habitat preference varies among species, likely driven by distribution and abundance of suitable insect prey and morphology of each bat species. Agricultural land does not provide roosting habitat for bats, but certain bat species may forage over agricultural fields although they are more likely to use forested and open water habitats (Bat Conservation International, Inc. 2020).

Little is known about the migratory behavior of bats. Cave-hibernating bats disperse up to several hundred miles from hibernacula during summer, with females often dispersing further from hibernacula than males (Fleming and Eby 2003; Roby and Gumbert 2016). Migratory tree bats migrate from hundreds to thousands of miles from their breeding grounds to mild climates where they openly hibernate in trees or may remain active throughout the winter and forage for food (Popa-Lisseanu and Voigt 2009). Seasonal timing and species composition of bat mortality at wind farms indicate bats are at increased risk of collision during migration, particularly during fall migration. This increased risk of mortality may be related to an attraction to tall structures, mating or courtship behavior, increased flight height, or failure to detect turbines during migratory flight (Kunz et al. 2007a, 2007b; Cryan 2008).

Local and global populations of the non-covered species are unknown; however, these wide-ranging species are believed to be in decline as a result of wind turbine collisions, habitat loss, WNS, and other causes (Winhold et al. 2008, Turner et al 2011, Frick et al. 2017, Rodhouse et al. 2019). The bats most affected by wind facilities are believed to be migratory tree bat species (i.e., hoary bats, eastern red bats, and silver-haired bats) that mostly emit low-frequency calls (Johnson et al. 2004; reviewed by Kunz et al. 2007). Bats that use low-frequency calls may be more inclined to forage above the tree line where there are few obstructions. Thus, tree bats may be more likely to fly in the rotor-swept zone of turbines when compared to smaller bat species that have different foraging and migration strategies.

3.6.1.2 Status and Environmental Trends of Covered Bat Species, Including Threatened and Endangered Bats

This section focuses on the bats proposed to be covered in the HCP, which include the federally endangered Indiana bat, federally threatened northern long-eared bat, little brown bat, and tricolored bat. The Indiana bat is also state-endangered in Illinois, and the northern long-eared bat is state-threatened (see Table 3-3). Sections 4.1 and 4.2 of the Project HCP provide an in-depth account of Covered Species. Table 3-4 provides a brief description of status, biology, behavior, and habitat requirements relevant to this EA and its analysis. For a more detailed description of these species, please refer to the Indiana Bat

(*Myotis sodalis*) Draft Recovery Plan: First Revision (USFWS 2007) and the Service's final rule for listing the northern long-eared bat (USFWS 2015), final 4(d) rule (USFWS 2016c), and programmatic BO (USFWS 2016d). Additionally, these covered species were found during fatality monitoring at the site associated with post-construction monitoring and research. See Section 3.4.3 of the HCP.

Table 3-4. Description of covered bat status, trends, biology, behavior, and habitat requirements.

Topic	Summary	Sources
Indiana bat		
Status	● Originally listed as in danger of extinction on March 11, 1967 (32 FR 4001). ● Estimated range-wide population in 2019 was 537,297, down 4.0% from 2017 (559,412) and roughly 19% lower than the 2007 estimate. ● Indiana bat population in Illinois was approximately 78,403 in 2019, representing 14.6% of the range-wide population. ● Blackball Mine, a Priority 2 hibernaculum approximately 99 miles northwest of the Project area in LaSalle County, Illinois, is the closest known Indiana bat hibernaculum. ● WNS is a primary threat to the species continued existence (see Section 4.1.6 of the HCP for a description of WNS). ● Twenty-two documented Indiana bat fatalities have occurred at wind energy facilities in the United States.	USFWS 1967, USFWS 2019b, USFWS 2021
Trends	● Experienced rapid declines between 1960s and early 1990s due to habitat loss and degradation but increased in the mid-1990s in several states. ● The arrival of WNS in New York in 2006 caused dramatic population declines of cave hibernating bats, including Indiana bats. The range-wide population has declined by 19.2% since 2007. ● Illinois, one of the largest state populations of Indiana bats, has declined by 3.4% since 2017. The Ozark-Central Recovery Unit declined by 8.1%.	USFWS 2007, 2019b
Seasonal Migration	● Maternity colonies tend to disband beginning in the first two weeks of August, with most bats leaving their summer ranges by mid-September. ● Highly mobile during fall, eventually congregating near hibernacula between August and October and swarming on a nightly basis for several weeks. ● Migrating bats generally follow a straight-line migration path, but do not typically fly in rain or when temps are below 9-10 degrees Celsius in spring and fall. ● A spring migration study at Blackball mine suggests that Indiana bats may follow watershed drainage corridors while migrating to their summer habitats in Illinois.	USFWS 2007, Cope and Humphrey 1977, Roby and Gumbert 2016, USFWS 2015

Topic	Summary	Sources
Summer Roosting	● Roost primarily in trees during summer, usually under exfoliating bark and occasionally using narrow crevices or cracks in trees located in semi-open areas of forest with greater solar exposure	USFWS 2007
Foraging	● Nocturnal insectivores, feeding exclusively on flying insects. ● Typically forage from 6 feet to 100 feet above the ground and hunt primarily around, not within, the canopy of trees.	USFWS 2007
Occurrence in the Project Area	● No known caves or mines or critical habitat within the Project area to support hibernating Indiana bats. ● No Indiana bats are expected to be in the Project area November – March. ● Indiana bats could be present during spring (April – May) or fall (August – October) migrations. ● Indiana bat summer maternity colonies have been documented in forested riparian tracts of the Middle Fork of the Vermilion River in Vermilion and Ford Counties, but the Project area itself is unlikely to support summer foraging or roosting habitat.	Gardner et al. 1996., ILDNR 2017
	Northern long-eared bat	
Status	● Proposed for listing as endangered on October 2, 2013, and subsequently listed as threatened on April 2, 2015. ● WNS is the primary threat to the species continued existence (see Section 4.2.6 of the HCP for a description of WNS). ● Typically, small numbers in numerous hibernacula across its range. ● Estimated range-wide population of 6,546,718 adults in 2016, with a corresponding pre-WNS population size in Illinois of approximately 213,720 adults. ● Current Illinois population of between 21,327 and 106,635 bats, with potential declines of 50-90% (see Trends, below.) ● No designated critical habitat at this time.	USFWS 2013, USFWS 2015, USFWS 2016c, Griffin 1940, Barbour and Davis 1969, Caire et al. 1979, Amelon and Burhans 2006, ASRD and ACA 2009
Trends	● States with available data show rapid declines in northern long-eared bat numbers since the onset of WNS. ● In 2014, Illinois had documented observations of northern long-eared bats in 21 hibernacula. WNS was first discovered in the state in the winter of 2012-2013. Two hibernacula in Illinois documented individual count declines of 97 and 99% from pre- to post-WNS. ● Unpublished data from USFWS estimates that northern long-eared bats may have declined by 50-90% in Midwestern states over the last decade.	USFWS 2015, USFWS pers. comm.

Topic	Summary	Sources
Seasonal Migration	● Occupy summer habitats from approximately April through September and begin to swarm near their hibernacula in August or September. ● Considered a short-distance migrant, with distances documented between 35 and 55 miles. ● Share hibernacula with other bat species. ● Individuals may rouse and switch hibernacula throughout the winter.	Caire et al. 1979, USFWS 2015, Fitch and Shump 1979, Griffin 1940, Whitaker and Rissler 1992, Caceres and Barclay 2000
Summer Roosting	● Inhabit forests and roost singly or in colonies in the cracks, crevices, and bark of both live and dead trees. ● May roost in structures, such as buildings, barns, sheds, and cabins.	Lacki and Schwierjohann 2001, Foster and Kurta 1999, Perry and Thill 2007
Foraging	● Forages on a variety of insects, such as moths, beetles, and spiders. ● Show preference for forested hillsides and ridges, as opposed to riparian areas.	Brack and Whitaker 2001, Feldhamer et al. 2009, Jung 2009, Owen et al. 2003, Foster and Kurta 1999
Occurrence in the Project Area	● No known hibernacula are known within or near the Project area. ● The Middle Fork of the Vermilion River may provide suitable summer habitat, but no suitable habitat is located within the Project area. ● Northern long-eared bats have been recorded 8 – 10 miles away from the Project on the Middle Fork of the Vermilion River. ● Northern long-eared bats may be present during their spring (mid-March to mid-May) and fall (mid-August to mid-October) migrations.	
	Little brown bat	
Status	● Not a federally listed, proposed or candidate species, but is currently under a Discretionary Status Review on the National Listing Workplan. The listing decision is anticipated to occur in 2023. ● No federal critical habitat, conservation plans, or recovery plans exist for this species. ● Prior to the onset of WNS, little brown bats were abundant and widely distributed across much of North America. The range-wide population estimate of little brown bats was 6.5 million bats east of the 100th meridian. ● Limited information is available for little brown bats in Illinois. For this EA, we estimate that 172,824 little brown bats may be a reasonable estimate of the Illinois population to consider in this analysis.* ● Threats include WNS and removal of roosts in buildings	USFWS 2019, Turner et al. 2011, Frick et al. 2010 *See Appendix C.

Topic	Summary	Sources
Trends	● In the northeast, population trends of little brown bat showed that most hibernacula demonstrated stable or growing populations before the emergence of WNS. Post-WNS, hibernacula had precipitous mean declines of 85% in the first year, 62% in the second year, and 45% per year thereafter. ● Numbers of hibernating little brown bats have documented declines of 91% in 42 sites across five states (NY, PA, VE, VA, and WV). ● Some colonies in the northeast have shown amelioration in declines, population stabilization, and persistence following infection of WNS. ● In Indiana hibernacula, little brown bats have declined by 79.6 – 90% compared to pre-WNS numbers. ● Unpublished data from USFWS estimates that little brown bats have declined by 57% across several Midwestern states over the last decade.	Frick et al. 2010, Turner et al. 2011, Langwig et al. 2012, Dobony et al. 2011, Indiana DNR 2015, Maslo et al. 2015, Langwig et al. 2017, Pettit and O'Keefe 2017, USFWS pers. comm.
Seasonal Migration	● Hibernate in caves and mines with other bat species from November until March or April. ● Females move to maternity sites in April, ● Little brown bats may migrate up to 200 miles to a suitable cave or mine for hibernation.	INHS 1999, ILDNR 2016
Summer Roosting	● Most females form maternity colonies in anthropogenic structures, but also large dead trees in cracks, crevices, or under exfoliating bark.	Humphrey and Cope 1976, Kunz et al. 1998
Foraging	● Forages for insects over wetlands, waterways, and edges of agricultural fields.	Fenton and Barclay 1980
	Tricolored bat	
Status	● Not a federally listed, proposed or candidate species, but is currently under review. The Service was petitioned to list the species in 2016 and a 90-day finding published in 2017 indicated that the petitioned action may be warranted. The listing decision is anticipated to occur in 2021. ● There are no range-wide estimates of tricolored bats, but in the eastern U.S. it is believed that the population is an order or two less than the little brown bat population. ● For this EA, we estimate that 113,310 tricolored bats may be a reasonable estimate of the Illinois population to consider in this analysis*. ● No federal critical habitat, conservation plans, or recovery plans exist for this species.	USFWS 2019, Ingersoll et al. 2013, Turner et al. 2011 *See Appendix C.

Topic	Summary	Sources
Trends	● Tricolored bats are a common species found throughout eastern North America but have experienced population declines since the onset of WNS in 2006. Cumulative declines in regional bat abundance across the eastern U.S. show declines of 34% (±38%) in tricolored bats from 1999-2011. ● Numbers of hibernating tricolored bats have documented declines of 75% in 42 sites across five states (NY, PA, VE, VA, and WV). ● In Indiana, declines in tricolored bats range from 12.5 – 71% when analyzing pre- and post-WNS data. ● Unpublished data from USFWS estimates that tricolored bats have declined by 50% across several Midwestern states over the last decade.	Turner et al. 2011, Ingersoll et al. 2013, Indiana DNR 2015, Pettit and O'Keefe 2017, USFWS pers. comm.
Seasonal Migration	● Hibernate singly in small caves during the winter. ● Females arrive and start forming colonies in the second half of April. ● Females disperse from colonies after young are weened (4 or 5 weeks after giving birth between early June and mid-July).	Feldhamer et al. 2015
Summer Roosting	● Most females form small maternity colonies in older forests and occasionally anthropogenic structures. ● Males roost singly.	Fujita and Kunz 1984; Perry and Thill 2007
Foraging	● Forages over wetlands, waterways, and edges of agricultural fields.	Hofmann 2008

3.6.1.3 Occurrence of Bat Resources in the Project Area

This section describes the presence of covered and non-covered bats within the Project Area according to pre-construction and post-construction surveys. Data presented in this EA are summarized from the Project's HCP and other site-specific surveys. A summary of the surveys is described in Tables 3-5a and 3.5b. Based on the results of the post-construction monitoring, nine species of bats have been found as fatalities in the Project area, including Indiana and northern long-eared bats during fall migration. Pre- and post-construction studies focused on potential impacts of turbines to bats. As such, these studies may not accurately reflect species composition within the Project area. However, they likely reflect the species composition of bats whose activities regularly put them in the rotor swept zone of those turbines. Both mortality and acoustic surveys consistently demonstrated that less than 5% of bats that occur in the rotor swept zone are *Myotis* species, regardless of season.

Table 3-5. Summary of pre-construction and post-construction bat surveys at CRWE.

Survey	Summary	HCP Section and Citations
Pre-construction Acoustic	● Conducted August 5 through November 4, 2009, with three detectors at two MET tower sites. ● Total of 776 bat passes were recorded. ● Approximately 27.3% of calls were high frequency (i.e., eastern red bat [*Lasiurus borealis*], evening bat (*Nycticeius humeralis*), tricolored bat [*Perimyotis subflavus*], and *Myotis* species). ● Approximately 7% of calls were unidentifiable to species.	HCP Section 3.4.2 (BHE 2010)
Post-construction Mortality	● Studies conducted in spring 2013 – 2015 and fall 2013 – 2016. Post-construction monitoring in Fall 2013 and 2014 occurred at turbines operating at 3.0 m/s. Post-construction monitoring during other years occurred at turbines operating at different cut-in speeds or where deterrents were in place as part of the DOE bat deterrent study. ● Total of 2,267 bat carcasses found: 1 Indiana bat (0.04%), 2 northern long-eared bats (0.09%), 5 little brown bats (0.22%), and 7 tricolored bats (0.31%). ● Approximately 98.4% of all bat carcasses recovered were found in the fall, and 100% of bat carcasses for the covered species were found in the fall (see Table 3-6).	HCP Section 3.4.3 (Ritzert et al. 2014a, 2014b, Shoener 2015a, Gruver et al. 2014b, Skalski and Shoener 2015, Shoener 2015b, Kinzie et al. 2018)

Table 3-6. Results of post-construction monitoring at the Project by species and season.

Species	Bat Carcasses per Season		Total Found	Percent Composition
	Spring (2013-2015)	Fall (2013-2016)		
Eastern red bat	5	1,216	1,221	53.76%
Silver-haired bat	23	460	483	21.27%
Hoary bat	5	459	464	20.43%
Big brown bat	4	76	80	3.52%
Tricolored bat	0	7	7	0.31%
Little brown bat	0	5	5	0.22%
Evening bat	0	4	4	0.18%
Northern long-eared bat	0	2	2	0.09%
Indiana bat	0	1	1	0.04%
Total (9 species)	**37**	**2,230**	**2,267**	**100%**

3.6.2 Environmental Consequences

3.6.2.1 Impact Criteria

The following sections analyze potential impacts of each alternative on listed and unlisted bats. Major impacts may occur to other bats should implementation of an alternative result in a) observed Project mortality rates greatly exceeding the estimated rate for a wind project in the region; b) substantial loss or degradation of habitat; or c) substantial change in habitat conditions producing effects that result in additive reductions in naturally occurring populations.

Major impacts to covered bats could occur should implementation of an alternative result in a) naturally occurring populations reduced in numbers below levels for maintaining viability at local or regional level; or b) substantial loss or degradation of habitat that causes naturally occurring populations to be reduced in numbers below levels for maintaining viability at local or regional levels.

3.6.2.2 Effects to Bat Resources

Disturbance/Displacement

Limited information is available regarding the disturbance/displacement of bats at wind facilities (Kunz et al. 2007a). Based on the number and frequency of documented deaths of bat species observed at wind energy facilities throughout North America, there appears to be little to no avoidance of wind facilities by bats (USFWS 2011). Indeed, some researchers have suggested that migratory tree bats (i.e., hoary bats [*Lasiurus cinereus*], eastern red bats [*Lasiurus borealis*], and silver-haired bats [*Lasionycteris noctivagans*]) may be attracted to wind turbines because of their migratory and mating behavior patterns (Kunz et al. 2007b; Cryan 2008). At dawn, these tree bats may mistake wind turbines for roost trees, thereby increasing the risk of fatality (Kunz et al. 2007b). Cryan (2008) suggested that male tree bats may be attracted to wind turbines by mistaking them as tall trees used as lekking sites (i.e., communal breeding site). Due to the lack of avoidance, bats are not expected to be disturbed or displaced from the Project as a result of project operations.

Turbine Related Fatality

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

Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the United States and Canada and found that bat fatalities have been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, hoary bat, eastern red bat, and silver-haired bat have contributed to nearly 75% of the total documented fatality at wind facilities (Kunz 2007a). Studies at several wind energy facilities have demonstrated that turbine operational protocols (i.e., adjusting the wind speed at which turbines are allowed to begin generating power and/or feathering turbine blades to prevent freewheeling below that speed) significantly influence bat fatality (e.g., Fiedler 2004; Kerns et al. 2005; Arnett et al.

2008; Baerwald et al. 2008; Good et al. 2011, 2012; see Table 2-1). Therefore, it is expected that impacts to bat species at the Project would vary depending on the alternative under which the turbines are operated.

During post-construction fatality monitoring conducted at the Project (see Table 3-6), a total of 2,267 bats were found. The breakdown of fatalities of non-covered bat species for all Alternatives, based upon the species composition found to date (and assuming that curtailment affects all species equally), is expected to be:

- Eastern red bat – 54% of all bat fatalities
- Silver-haired bat – 21% of all bat fatalities
- Hoary bat – 20% of all bat fatalities
- Big brown bat – 4% of all bat fatalities
- Evening bat – <1% of all bat fatalities

Note the above percentages do not equal exactly 100% because the list does not include covered bat species. The estimated impacts to non-covered bats are summarized in Table 3-7.

The estimated impacts to the Covered Species are summarized in Table 3-8. Details on impact analysis by alternative are provided in the following sections. Take of the covered species was calculated using site-specific data from post-construction monitoring when turbines were operating at 3.0 m/s (Gruver et al. 2014, Skalski and Shoener 2015). Because this data was collected when WNS was initially being detected in Illinois (ILDNR 2013), we adjusted the carcass number inputs to our modeling to reflect a more reasonable estimate of take at the Project under current-day conditions. Specifically, data was adjusted to reflect an approximately 8% decline in Indiana bats, 50-90% decline in northern long-eared bats, 57% decline in little brown bats, and 50% decline in tricolored bats based on recent unpublished data from the Service (USFWS pers. comm.) These declines are estimated from available winter population census data from Illinois and the surrounding states. We note here that winter population data is difficult to accurately and consistently collect, and therefore maybe subject to inherent error. However, this is the best available information we have to inform the status of the Covered Species populations. See Appendix D for a more detailed discussion of the take analysis and breakdown of potential impacts to Covered Species by season.

Table 3-7. Summary of estimated non-covered bat fatalities by alternative annually and for the 20-year permit duration.

Species	No Operational Adjustment Scenario [1]		Alternative 1: No Action Alternative		Alternative 2: Proposed Action Alternative		Alternative 3: More Restrictive Alternative	
	Annual	20 Years	Annual	20 Years	Annual	20 Years	Annual	20 Years
Big Brown Bat Fatality Estimate	157	3,140	53	1,060	73	1,460	54	1,080
Silver-haired Bat Fatality Estimate	947	18,940	320	6,400	440	8,800	322	6,440

Species	No Operational Adjustment Scenario [1]		Alternative 1: No Action Alternative		Alternative 2: Proposed Action Alternative		Alternative 3: More Restrictive Alternative	
	Annual	20 Years	Annual	20 Years	Annual	20 Years	Annual	20 Years
Eastern Red Bat Fatality Estimate	2,395	47,900	808	16,160	1,111	22,220	814	16,280
Hoary Bat Fatality Estimate	910	18,200	307	6,140	423	8,460	310	6,200
Evening Bat Fatality Estimate	8	160	3	60	4	80	3	60
Total Bats for Non-covered Species	**4,417**	**88,340**	**1,491**	**29,820**	**2,051**	**41,020**	**1,503**	**30,060**
Percent Reduction from No Operational Adjustment Scenario			66.2		53.6		66	

[1] This is not an alternative under consideration but is included in the analysis for comparison.
Methodology for calculations presented in Appendix D.

Table 3-8. Summary of estimated fatalities for Covered Species by alternative annually and for the 20-year permit duration.

Species	No Operational Adjustment Scenario[1]		Alternative 1: No Action Alternative		Alternative 2: Proposed Action Alternative		Alternative 3: More Restrictive Alternative	
	Annual	20 Years	Annual	20 Years	Annual	20 Years	Annual	20 Years
Indiana Bat Fatality Estimate[2]	12	240	0	0	5	100	4	80
Northern Long-eared Bat Fatality Estimate[2]	36	720	0	0	14	280	13	260
Little Brown Bat Fatality Estimate[3]	50	1,000	17	332	23	460	17	340
Tricolored Bat Fatality Estimate[3]	26	520	9	180	12	240	9	180

Species	No Operational Adjustment Scenario[1]		Alternative 1: No Action Alternative		Alternative 2: Proposed Action Alternative		Alternative 3: More Restrictive Alternative	
	Annual	20 Years	Annual	20 Years	Annual	20 Years	Annual	20 Years
Total Bats for Covered Species	124	2,480	26	512	54	1,080	43	860
Percent Reduction from No Operational Adjustment Scenario			79.03%		56.45%		65.32%	

[1] This is not an alternative under consideration but is included in the analysis for comparison.
[2] Summer take at the Project is not expected for Indiana bats and northern long-eared bats as there are no turbines sited within 1,000 feet of suitable summer habitat, therefore take for these two species is based solely off of the spring and fall mortality estimates.
[3] Take for little brown bat and tricolored bat is based on the entire bat active season, including summer.
Methodology for calculations presented in Appendix D.

Bat fatalities are estimated at 0.16 to 0.19 bats/MW in spring (April 1 – May 15) and 9.99 bats/MW in fall (August 1 – October 15), which result in an average of 2,180 bat fatalities in the spring and fall (when operating at 3.0 m/s cut-in speed). According to the Midwest Wind Energy Multi-Species HCP (MSHCP), 6.5% of bat fatalities occur during the spring, 25.5% occur during the summer, and 68.0% occur during the fall (USFWS 2016d). Assuming that 2,180 bat fatalities comprise 74.5% of all annual fatalities, the total bat fatalities at CRWE is estimated at 2,927 bats when operating at 3.0 m/s during the entire bat active season. Without any feathering, the expected bat fatalities for all species would be 4,574 bats for the 214.4-MW facility. These all-bat fatality rates provide the baseline fatality rates to which we applied the percent reductions in bat fatalities under the alternatives, as described below. See also Appendix D.

According to data collected from 2015 through 2017 across Iowa by MidAmerican Energy Company (MEC), 3.57% of bat fatalities occur in the spring, 31.37% in the summer, 64.44% in the fall, and 0.66% in the late fall (October 15 – November 15) (MEC 2019). This dataset provides more recent information about bat fatality rates in the Midwest than the MSHCP but covers a smaller geographic area. We have chosen to use the MSHCP distribution data in the main text of this EA to be consistent with the methodology presented in the HCP. However, because the MEC data is also valid, we evaluated the potential impacts to bat resources using the MEC distribution information, and this analysis is provided in Appendix D. The conclusions presented in this section did not substantially differ when the MEC dataset distribution was used for the analysis.

<u>No Action Alternative</u>

Under the No Action Alternative, the applicant would continue to operate under the Bird and Bat Conservation Strategy (CRWE 2011, 2013). Cut-in speeds would be raised from sunset to sunrise to 6.9 m/s during the fall migratory season (August 1 – October 15) each year. During the remainder of the active bat season (March 15 – July 31) turbines would be feathered below the manufacturer's cut-in speed at 3.0 m/s. Since no turbines are located within 1,000 feet of summer foraging habitat for Indiana and northern long-eared bats, no take is anticipated during this season for these species. Spring fatalities are possible, but are not expected to occur, at CRWE for Indiana and northern long-eared bats. If an Indiana bat take were detected (in any season), the Project would implement adaptive management measures to avoid future take and/or pursue appropriate permitting (CRWE 2011, 2013).

No take of little brown bats at 6.9 m/s has been reported to the Service, with one exception. The Pioneer Trail Wind Farm reported five little brown bat carcass discoveries during the fall of 2012 when the facility was feathering cut-in speeds at 6.9 m/s. One of those carcasses was later identified by Stantec as a big brown bat, not a little brown bat. The remaining carcasses had been disposed of and could not be verified (Terry VanDeWalle [Stantec], pers. comm.). No other project operating at 6.9 m/s has reported the fatality of little brown bats at this wind speed to the Service. If feathering turbines below 6.9 m/s in the fall avoids take of little brown bats, the no action alternative may result in up to 11 fatalities per year (in spring and summer). If feathering below 6.9 m/s does not avoid take of little brown bats, the no action alternative may result in up to 17 little brown bats per year (340 over 20 years).

Tricolored bats could occur at any point during the bat active season. Applying the 35% reduction in the spring and summer and the 81% reduction in the fall, the fatality rate of tricolored bats may be up to 9 bats per year (180 over 20 years) under the No Action Alternative.

A summary of expected non-covered bat species fatalities is provided in Table 3-7. Under the No-Action Alternative, approximately 1,491 fatalities of non-covered bat species are expected annually. Over the 20-year permit term, up to approximately 29,820 fatalities of non-covered bat could occur.

HCP Alternative

Under the HCP Alternative, turbines would be feathered below the manufacturer's cut-in speed from sunset to sunrise during the fall migration season for the covered species (August 1 – October 15). When air temperatures are above 50° Fahrenheit (F), the cut-in speed would be raised from 3.0 m/s to 5.0 m/s at all turbines. When air temperatures are below 50°F, the cut-in speed will be the manufacturer's cut-in speed (3.0 m/s). During the remainder of the bat active season (March 15 – July 31), all turbines will be feathered below the manufacturer's cut-in speed (3.0 m/s) from sunset to sunrise. Since no turbines are located within 1,000 feet of summer foraging habitat for Indiana and northern long-eared bats, no take is anticipated during this season for these species. Take of little brown bats and tricolored bats could occur at any point during the bat active season.

Feathering at cut-in speeds of 3.0 m/s is expected to reduce all bat fatalities by 35% while feathering at cut-in speeds of 5.0 m/s is expected to reduce fatalities by 62%. We assume for this analysis that very little covered bat species activity will occur below 50°F and that the reduction in fatality rates under the aforementioned cut-in speeds apply. Under this alternative the authorized take of the covered species would be:

- 5 Indiana bats per year (100 bats over 20-year permit duration)
- 14 northern long-eared bats per year (280 bats over 20-year permit duration)
- 23 little brown bats per year (460 bats over 20-year permit duration)
- 12 tricolored bats per year (240 bats over 20-year permit duration)

A summary of expected non-covered bat species fatalities is provided in Table 3-7. Under the HCP Alternative, approximately 2,051 fatalities of non-covered bat species are expected annually. Over the 20-year permit term, up to approximately 41,020 fatalities of non-covered bat are expected occur. However, the HCP Alternative includes a reversion trigger under which cut-in speeds can be lowered if take rates of covered species are below the anticipated take rates (see Section 2.2.2, above). If the reversion trigger is activated at the shortest interval allowed under the plan (every two years), the non-covered bat fatality rate may increase to between 2,139 and 2,926 bats per year, depending on the change in cut-in speed. This means that over the 20-year permit term, the non-covered bat fatality rate could be up to 54,517. Covered bat species take, however, would still be less than 1 Indiana bat, less than 2 northern long-eared bats, less than 5 little brown bats, and less than 7 tricolored bats any time the reversion trigger is activated.

More Restrictive Alternative

The More Restrictive Alternative would have all turbines feathered below cut-in speeds of 5.5 m/s from sunset to sunrise during the entire bat active season (March 15 – October 31) regardless of temperature and would not be reduced during the permit term. This operational protocol would be expected to result in an average bat mortality reduction of 66%. Take would be expected to occur during spring and fall for Indiana and northern long-eared bats and throughout the bat active season for little brown and tricolored bats. Under this alternative expected take of the covered species would be:

- 4 Indiana bats per year (80 bats over 20-year permit duration)
- 13 northern long-eared bats per year (260 bats over 20-year permit duration)
- 17 little brown bats per year (340 bats over 20-year permit duration)
- 9 tricolored bats per year (180 bats over 20-year permit duration)

Regional Impact of Turbine Fatality

Based on take estimates provided in Table 3-8, the annual percent impact for each species relative to the species' recovery unit or state population estimates are presented in Table 3-9. Based on these small percentages, we do not expect naturally occurring populations of the covered bat species to be reduced in numbers below levels for maintaining viability at local or regional level.

Table 3-9. Impact of annual take at the Project under each alternative relative to the state or regional population of each covered species.

Species Population	Annual Take Percentage of Species' Population			
	No Operational Adjustment Scenario[1]	Alternative 1: No Action Alternative	Alternative 2: Proposed Action Alternative	Alternative 3: More Restrictive Alternative
Percent of Ozark-Central Recovery Unit Population of Indiana Bat (276,317)[2]	0.004	0	0.002	0.001
Percent of Illinois Northern Long-eared Bat Population (21,327)[3]	0.169	0	0.065	0.061
Percent of Illinois Little Brown Bat Population (172,824)[4]	0.029	0.010	0.013	0.010

Species Population	Annual Take Percentage of Species' Population			
	No Operational Adjustment Scenario[1]	Alternative 1: No Action Alternative	Alternative 2: Proposed Action Alternative	Alternative 3: More Restrictive Alternative
Percent of Illinois Tricolored Bat Population (113,310)[4]	0.023	0.008	0.011	0.008

[1] This is not an alternative under consideration but is included in the analysis for comparison.
[2] Source: 2019 Indiana Bat (*Myotis sodalist*) Population Status Update. June 27, 2019. U.S. Fish and Wildlife Service.
[3] Source: Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-eared Bat and Activities Excepted from Take Prohibitions. January 5, 2016. U.S. Fish and Wildlife Service, conservatively reduced by 90% (see section 3.6.1.2) .
[4] See Appendix C on calculation for state-wide population estimate of little brown bats and tricolored bats.

Effects of Maintenance and Monitoring

Maintenance activities will be required to ensure the safety and operability of CRWE under all three alternatives being considered. Maintenance activities would occur primarily during daylight hours and may include increased noise, vibration, traffic, and human activity in the vicinity of the turbines while maintenance is being performed. We have no information to indicate that maintenance activities would differ between the no action and the action alternatives. Therefore, we conduct no further analysis on this activity.

Post-construction mortality surveys to be conducted under any of the action alternatives would result in additional human activity and traffic at CRWE, though the impacts of these activities on bat resources are not expected to differ greatly from the current conditions associated with the operation and maintenance (including post-construction monitoring) of the operating facilities. Limited vegetation clearing would occur as part of routine maintenance activities under any of the alternatives under consideration, with some additional vegetation clearing necessary for post-construction mortality surveys under any of the action alternatives. However, the impacts of vegetation clearing on bat resources would be minor, as the activities will occur only in areas already cleared or disturbed for agricultural purposes.

Effects of Mitigation

No mitigation would occur under the No Action Alternative because no HCP would be prepared, and no ITP would be issued. Indiana bats, northern long-eared bats, and other bat species would not therefore receive the habitat conservation benefits expected under the action alternatives.

Under both action alternatives, forested habitat mitigation would be implemented and occur in the same HUC-8 watershed as the project (#05120109). There are currently 48,103.87 acres of deciduous forest habitat in HUC-8 name and 6,658 acres are protected (NLCD 2016, USFWS unpublished data). Under the Alternative 2 (Proposed Action), 101.3 acres of forested habitat mitigation will occur, and up to 563.2 total acres of mitigation could occur if adaptive management is triggered. Also, up to 8 artificial roost structures would be constructed as part of the mitigation for little brown bats. Under Alternative 3 up to 524.7 acres of forested habitat mitigation and up to 6 artificial roost structures would be implemented. The protection and/or restoration of between 101.3 and 563.2 acres of forested habitat would increase the percentage of forested, protected land in the watershed by 1.52 to 8.46%.

Other bat species making use of similar habitat will also receive the habitat enhancement and protection benefits inherently associated with the covered species' summer/swarming habitat or maternity colony habitat protection mitigation proposed under the HCP. It is assumed that every acre of forested habitat protected for the covered species will also provide an acre of habitat for other bat species whose range overlaps with the mitigation site, though the exact species will depend on the location, specific habitat selected, and occupancy of the specific site. Gating of hibernacula under any of the action alternatives, if chosen as the mitigation, would result in beneficial impacts to the covered species and any other cave bat species that utilize the cave, though again, this may vary depending on the site selected. Gating of hibernacula is unlikely to benefit migratory tree bat species, as these species are not known to use this type of resource.

3.6.2.3 Impacts to Bats Resources in the Context of Environmental Trends and Planned Actions

To assess the effect of planned wind energy development on covered bat species, we define the following analysis areas. For the Indiana bat, the analysis area is the Ozark-Central Recovery Unit, which includes Illinois and Missouri as well as portions of Iowa, Oklahoma, and Arkansas. For the northern long-eared bat, recovery units have not been established; thus, the population estimate for the state of Illinois is utilized in this analysis. A smaller geographic range is biologically reasonable for the northern long-eared bat, as the species is a shorter distance migrant than the Indiana bat (USFWS 2014). The state of Illinois is also the analysis area for the little brown bat and tricolored bat. State population estimates of little brown bat and tricolored bat are provided in Appendix C.

We are choosing to discuss two effects analysis areas for non-covered bat species: the state of Illinois and the Service's Legacy Region 3, which includes Unified Interior Region 3 and the states of Iowa and Missouri from Unified Interior Region 4. The state of Illinois currently has a Renewable Portfolio Standard that mandates 25% renewable energy procurement by 2025 for investor-owned utilities and retail suppliers, of which 75% be derived from wind and photovoltaic projects. In 2019, renewable energy generated 8% of the electricity generated in Illinois, of which 97% was derived from wind power (USEIA 2020d). Based on this, we expect approximately 11,000 more megawatts of wind energy to come online for the state to reach their 25% goal. Because this timeframe does not cover the duration of the permit, we also consider the effects of projected build-out of wind energy in the Service's Legacy Region 3 according to the USEIA (see section 3.7.2.3), even though this rate of wind development is less certain.

These spatial scales provide the best available and most reasonable scales to use for population estimates of covered and non-covered bat species. The effects analysis uses a 20-year timeframe based on the requested duration of the ITP. The selected spatial and temporal scales provide a reasonable assessment of reasonably foreseeable planned actions and environmental trends related to wind energy development, forested habitat change, climate change, destruction/disturbance of hibernacula, and the spread of WNS.

Wind Energy Development

Wind energy development within Region 3 has been steadily increasing to the current installed capacity of approximately 27,856 MW (AWEA 2020), with an expected nationwide growth rate of 2.4-percent annually for installed wind energy capacity (USEIA 2015). Based upon this, over the 20-year permit term, it is anticipated that wind energy build-out could reach 41,226 MW within Legacy Region 3. Bat fatality within Region 3 is estimated to average 17.59 bats/MW/year if turbines are free-wheeling (i.e. blades are not feathered below any particular wind speed) (USFWS 2016d). However, many projects have incorporated blade feathering at night into their operational protocols for various reasons (voluntary implementation of the AWEA best practice of feathering below manufacturer's cut-in speed, implementing an HCP, or operating under a TAL to avoid take of Indiana bats). This means that project cut-in speeds may range from none (free-wheeling) to 6.9 m/s, and the associated reduction in bat fatalities may range from none to 81%. Applying the bat fatality rate of free-wheeling turbines (17.59 bats/MW) to the currently installed wind capacity in Region 3 (27,856 MW) would result in 489,988 bat fatalities per year in Legacy Region 3. If all projects were implementing avoidance cut-in speeds of 6.9 m/s, this would result in approximately 93,098 bat fatalities per year. We do not have access to the actual operational protocols of every project in Legacy Region 3, but we do know that most projects are at 3.0 m/s, some projects are at 5.0 m/s, some projects are at 6.9 m/s and a few projects may still be free-wheeling. Therefore, for this analysis, we believe it is reasonable to assume that all projects are feathering turbines at least below manufacturer's cut-in speeds, and actual bat fatality rates reflect an approximately 35% reduction from bat fatality rates at free-wheeling turbines. This yields an estimated current bat fatality rate of 318,492 bats per year in Legacy Region 3.

Because CRWE is already built and operating, it has been contributing to the past and present impacts of bat fatalities from wind energy in the Region. Under the No Action Alternative, the project would continue to operate under its current operational protocols and therefore would not increase or decrease the current and expected bat fatality rate in the Region. The other two alternatives would increase the future impact of bat fatalities from wind energy in Region 3, as discussed below.

Under the Proposed Action and the More Restrictive Alternatives, an additional 591 and 27 non-covered bats, respectively may be killed annually at the project when compared to the No-Action Alternative. This represents an additional 0.008%-0.18% of the annual bat fatality from wind energy within Region 3 in 2020 and 0.005%-0.13% of the annual bat fatality rate in 2040. The increase in bat fatalities under either action alternative does not result in a substantial addition to overall bat fatality in the Region.

The significance of current and potential future bat fatality rates across all wind projects in Legacy Region 3 is unknown, especially for migratory tree bats. It is difficult to accurately estimate population sizes, and we do not have a good understanding of population demographic estimates (e.g., population trend or growth rate, mortality rates, fecundity) for many bat species, including migratory tree bats. However, a determination of the significance of all bat fatality rates from wind energy in Legacy Region 3 is beyond the scope of this EA because the Service does not have jurisdiction or control over the development of wind energy or the implementation of voluntary conservation measures. Rather, we must evaluate if the consequences of any of the alternatives in this EA would have a significant impact on bat resources in the context of the currently affected environment, reasonably foreseeable planned actions, and environmental trends.

Climate Change

Climate change is anticipated to affect bat species in several ways (PGC-PFBC 2015). Affects may include higher mortality due to drought (O'Shea et al. 2011, Frick et al. 2010); increases in prey availability (Moosman et al. 2012) and riparian habitat (Menzel et al. 2005 as cited in PGC-PFBC 2015) due to increased precipitation; and range expansions or restrictions due to temperature changes (Arndt et al. 2012 as cited in PGC-PFBC 2015). Droughts may result in higher mortality for some species; this has been demonstrated for the big brown bat and little brown bat (O'Shea et al. 2011; Frick et al. 2010). Conversely, depending on the timing, increases in precipitation can be beneficial for insectivorous bat species by increasing prey availability (Moosman et al. 2012). The connection between WNS and climate change is unknown but warming climates may reduce the vulnerability of the little brown bat and other species to this pathogen (Ehlman et al. 2013).

None of the alternatives would increase the effects of climate change; instead, all alternatives would have varying levels of beneficial impact to the overall effects of climate change by reducing greenhouse gas emissions through the production of electricity via wind energy (i.e., a reduction in the amount of fossil fuels used to produce electricity). The difference in effects between the alternatives is small relative to the overall beneficial effect for each alternative.

Destruction/Disturbance of Hibernacula

Of the bat species potentially affected by the Project, the Indiana bat, northern-long eared bat, big brown bat, little brown bat, and tricolored bat utilize underground hibernacula during the winter months (Table 3-3).

Cave gating is a potential source of mitigation under the action alternatives. Gating of caves, if not designed properly, can impede the flight of bats and result in mortality through bats striking the gate or due to predators congregating at the gate entrance (USFWS 2007). Gates provide the protection of reducing human-caused disturbance from recreational activities or vandalism, and they could potentially decrease the spread of WNS by humans.

The action alternatives have the potential to affect hibernacula, and if cave gating occurs as mitigation, care would be taken to avoid the potential negative impacts of gating. Mitigation proposed by the Applicant would have positive effects to cave-hibernating bats in the form of a gating project at a hibernaculum. This mitigation would add cumulatively to any future positive impacts to overall winter habitat in the Ozark-Central Recovery Unit, Region 3 and the state of Illinois resulting from ongoing hibernacula protection and restoration projects conducted by entities such as state resource agencies, Bat Conservation International, private mining companies, and other wind developers. The No Action Alternative would not affect hibernacula since no mitigation would occur under this alternative.

White-nose Syndrome

WNS has emerged as the largest single source of mortality for cave-hibernating bats in recent years. As of September 2020, WNS has been confirmed in 35 states (including Illinois) and 7 Canadian provinces, as far west as Washington State (USFWS 2020a). As of 2012, estimates of total bat mortality had reached 6.7 million bats since discovery of the disease in 2006 (USFWS 2012). WNS was first confirmed in Illinois in 2013 in four counties (LaSalle, Monroe, Hardin, and Pope counties) (ILDNR 2013). Twelve hibernating bat species are affected by WNS in North America: Indiana bat, northern long-eared bat, little brown bat, tricolored bat, big brown bat, cave bat (*Myotis velifer*), fringed bat (*Myotis thysanodes*), eastern small-footed bat (*Myotis leibii*), long-legged bat (*Myotis volans*), western long-eared bat (*Myotis evotis*), gray bat (*Myotis grisescens*), and Yuma bat (*Myotis yumanensis*) (USFWS 2020b). To date, WNS has not been documented in migratory tree-roosting bat species (e.g., hoary bat, silver-haired bat, eastern red bat), which account for the majority of wind turbine related mortality; although the causative fungus, *Pseudogymnoascus destructans*, has been detected in eastern red bat, but no diagnostic signs of white nose syndrome were present (USFWS 2020b).

Turner et al. (2011) documented an 88% decline in overall numbers of hibernating bats comparing pre- and post-WNS counts at 42 sites in five northeastern states with declines varying by species. At these sites, northern long-eared bats decreased by 98%, little brown bats by 91%, tricolored bats by 75%, and big brown bats by 41% (Turner et al. 2011). The rate at which WNS may impact the Ozark-Central Recovery Unit, Region 3 or the state of Illinois bat populations cannot be predicted, as the progression from detection of a single bat with visible fungus to large-scale mortality has been observed to occur within a matter of weeks at some sites in the Northeast, while at others it has not occurred until the next hibernation season, or even later (Turner et al. 2011). However, it is expected that WNS will ultimately have similarly devastating impacts on hibernacula in the Ozark-Central Recovery Unit, Region 3 and the state of Illinois, causing mortality similar to that observed in the northeastern United States and possibly the abandonment or extinction of certain hibernacula. Recent unpublished data from the Service estimates that WNS has likely had the following impacts on the covered bat species included in this EA since its arrival in Midwestern states: 8% decline of Indiana bats, 50-90% decline of northern long-eared bats, 57% decline of little brown bats, and 50% decline of tricolored bats (USFWS pers. comm.).

Research on the effects of WNS continues, and at this time it is unknown whether the current fatality rate from WNS will continue over the next 20 years. However, the additive fatality from the Project under any of the action alternatives is not anticipated to substantially increase overall covered and non-covered bat fatality in the Region, and bat fatality under the No Action Alternative is expected to be less than the other alternatives under consideration.

3.7 AIR QUALITY AND CLIMATE

The Clean Air Act (CAA) of 1970 (42 U.S.C. §7401 et seq.) is a comprehensive federal law that regulates air emissions from stationary and mobile sources. The CAA authorizes the U.S. Environmental Protection Agency (USEPA) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and welfare and regulate emissions of hazardous air pollutants. However, it is the responsibility of each state to develop and implement a plan for maintaining and enforcing the USEPA's established NAAQS.

We used data from the Illinois Environmental Protection Agency, Illinois Air Quality Report (Illinois Environmental Protection Agency [IEPA] 2018), USEPA, and the U.S. Energy Information Administration (USEIA) to assess air quality conditions relative to the Project.

3.7.1 Affected Environment

We reviewed data from the monitoring stations closest to the Project (Champaign and Bondville, Illinois in Champaign County) (IEPA 2018). Both stations monitor fine particulates (particulate matter 2.5 or $PM_{2.5}$). Fine particulates are most often emitted from activities involving combustion (e.g., industrial, residential, and vehicular). Fine particles can also form when certain gases emitted during combustion are transformed to a solid or liquid in the atmosphere. Large-scale agricultural burning or dust storms can also produce large volumes of fine particulates. Design values of $PM_{2.5}$, or the three-year average of annual arithmetic mean concentration values, are monitored. Between 2016 and 2018, these two monitoring stations had $PM_{2.5}$ Design Values of 7.5 and 7.6 ug/m^3, which fall below the NAAQS criteria of 12.0 ug/m^3. Comparatively, these sites had $PM_{2.5}$ Design Values of 9.0 and 8.6 ug/m^3 between 2014-2016, thus concentrations appear to be trending downward near the Project. All NAAQS criteria have been met at these sites.

Greenhouse gases (GHGs) are gases that warm the Earth's atmosphere by absorbing solar radiation reflected from the Earth's surface. The most common GHGs are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Scientists find that increasing GHG concentrations are warming the planet, and rising temperatures may, in turn, produce changes in precipitation patterns, storm severity, and sea level — a phenomenon commonly referred to as "climate change."

Of the 4.12 trillion kilowatt-hours (kWh) of electricity generated in 2019 at utility-scale (≥ 1 MW generating capacity) facilities in the United States, about 61% was from fossil fuels (coal, natural gas, petroleum, and other gases), about 20% was from nuclear energy, and about 17% was from renewable energy sources, including 7.3% from wind energy (USEIA 2020).

Power in Illinois is electrically generated by nuclear (54%), coal (30%), renewables (10%), and natural gas (7%) (IEC 2019). Illinois ranks 6th in the United States for installed wind power capacity at 5,858 MW (AWEA 2020).

3.7.2 Environmental Consequences

3.7.2.1 Impact Criteria

The following sections analyze potential impacts of each alternative on air quality and climate. The Clean Air Act of 1970 (CAA), and the CAA Amendments of 1990 established National Ambient Air Quality Standards (NAAQS) for selected pollutants. The NAAQS established maximum levels of acceptable background pollution with a margin of safety to protect public health and welfare. NAAQS compliance in Illinois is monitored by the IEPA. CEQ guidance requires federal agencies to consider GHG emissions and climate change when evaluating proposed actions.

3.7.2.2 Effects

Turbine operations do not generate air emissions and will not generate emissions under any of the alternatives considered. Carrying out maintenance activities under any of the alternatives is expected to require the same level of vehicle traffic resulting in carbon dioxide and particulates, but no change from the current conditions. However, these emissions are not anticipated to have a significant effect on local or regional air quality or contribute greatly to the amount of greenhouse gases. Turbine operations and maintenance activities will not generate any new sources of air pollutants. Mitigation activities will not have an effect on air quality or climate, as protection of land will not result in the emission of any pollutants.

Higher cut-in speeds and longer operational curtailment periods result in less operational time and lost energy production potential. The No Action Alternative and More Restricted Alternative would result in smaller net reductions in emissions on a regional scale than the Proposed Action. The Proposed Action is expected to produce more electricity per year due to less restrictive curtailment protocols. Compared to the Project's current operations, any of the action alternatives would allow for greater energy production and larger emission reductions.

Because the project is already built and operating, the degree of difference of emissions between the alternatives is small compared to one another and compared to the current operations. Thus, the air quality and climate effects are already occurring and will be expected to continue throughout the operational life of the Project, regardless of alternative. None of the alternatives under consideration would have any significant adverse or beneficial effects to air quality or climate conditions in Champaign or Vermilion County, Illinois.

3.7.2.3 Impacts in the Context of Environmental Trends

Long-term trends show that air quality in the United States has improved over time with declines in air pollutant concentrations. Between 1970 and 2019, the combined emissions from six common pollutants ($PM_{2.5}$ and PM_{10}, sulfur dioxide [SO_2], oxides of nitrogen [NO_x], volatile organic compounds, carbon monoxide [CO], and lead [Pb]) dropped by 77% nationally; however, CO_2 emissions have increased by 25% over the same time period (USEPA 2020).

Energy production and consumption trends show increasing use of clean energy sources from renewables and less-polluting sources like natural gas over coal (Table 3-10). The majority (90%) of coal consumption in the United States (in 2019) is from the electric power sector (USEIA 2020a). As coal plants are retired and/or replaced with cleaner sources of energy, air quality trends are expected to experience continued improvements. In 2019, coal generation dropped by 18% which reduced emissions by 190 million metric tons and electric power sector emissions overall were down by nearly 10% (Houser and Pitt 2020).

Table 3-10. Energy production and consumption in the United States in 1950, 2000, and 2019 in quadrillion British thermal units (Btu) (USEIA 2020a).

Energy Source	1950		2000		2019	
	Produced (quadrillion Btus)	Percent Comp.	Produced (quadrillion Btus)	Percent Comp.	Produced (quadrillion Btus)	Percent Comp.
Coal	14.06	40%	22.74	32%	14.27	14%
Natural Gas	6.23	18%	19.66	28%	34.89	35%
Crude Oil	11.45	32%	12.36	17%	25.44	25%
Natural Gas Plant Liquids	0.82	2%	2.55	4%	6.34	6%
Nuclear	0.00	0%	7.86	11%	8.46	8%
Renewables	2.98	8%	6.10	9%	11.64	12%
Total	*35.54*	*100%*	*71.27*	*100%*	*101.04*	*100%*
Energy Source	**Consumed (quadrillion Btus)**	**Percent Comp.**	**Consumed (quadrillion Btus)**	**Percent Comp.**	**Consumed (quadrillion Btus)**	**Percent Comp.**
Coal	12.35	36%	22.58	23%	11.31	11%
Natural Gas	5.97	17%	23.82	24%	32.10	32%
Petroleum	13.30	38%	38.15	39%	36.72	37%
Nuclear	0.00	0%	7.86	8%	8.46	8%
Renewables	2.98	9%	6.10	6%	11.46	11%
Total	*34.60*	*100%*	*98.51*	*100%*	*100.05*	*100%*

Illinois is the nation's second-largest bituminous coal producer after West Virginia (USEIA 2020c). Only about one-fifth of the coal mined in Illinois is consumed in the state (USEIA 2020d). The majority of electricity generated in the state comes from nuclear power (54%) and coal contribution dropped by 27% in 2019 due to closures of coal-fired generating plants (USEIA 2020d). The retirement of several coal-fired plants and increasing reliance on natural gas and renewable energy has contributed toward nearly a 30% decline in GHGs from the energy sector in Illinois from 2005 to 2016 (IEPA 2019). Transportation is now the leading source of carbon emissions in Illinois, but coal remains the greatest source of GHGs in the Midwest.

The differences in alternatives considered in the EA do not significantly affect the Project's contribution of renewable energy to the state or nation towards reducing GHG emissions. The Project has been operating since 2012 and is already contributing towards the reductions and trends discussed above.

4.0 IDENTIFICATION OF THE PREFERRED ALTERNATIVE

The Department of the Interior defines the preferred alternative as "the alternative which the [agency] believes would best accomplish the purpose and need of the proposed action while fulfilling its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors" (43 CFR 46.420(d)). The preferred alternative may or may not be the same as the project proponent's proposed action or the environmentally preferable alternative under an Environmental Impact Statement and associated Record of Decision (43 CFR 46.450).

The preferred alternative is a preliminary indication of the federal responsible official's preference of action, which is chosen from among the analyzed alternatives in the NEPA document. The preferred alternative may be selected for a variety of reasons (such as the priorities of a particular lead agency) in addition to the environmental considerations discussed in the NEPA document. The preferred alternative is not a final agency decision; rather, it is an indication of the agency's preference. The final agency decision is presented in the Findings Document associated with the permit.

In accordance with NEPA and the CEQ regulations and based on consideration of agency and public comments on the Draft EA (see Appendix E), the Service has selected Alternative 2: The Proposed Action as the preferred alternative. Of the alternatives evaluated in this Final EA, this alternative best fulfills the agency's statutory mission and responsibilities while meeting the purpose and need for the following reasons:

1. Issuance of an ITP in accordance with the Proposed Action would allow the Project to generate more clean energy while providing greater mitigation benefit to offset the loss of covered species as a result of Project operation.

2. Issuance of an ITP meets the need of California Ridge to implement their HCP and operate the Project legally under the ESA.

5.0 LIST OF PREPARERS

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	25 years' experience with environmental studies, including NEPA documentation and bat and bird studies
Erica Christiansen	EA Preparation B.S. Wildlife Ecology and Conservation 5 years' experience with environmental studies, including wildlife, section 7 consultation and NEPA documentation

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APPENDIX A – Bird and Bat Conservation Strategy

AVIAN AND BAT PROTECTION PLAN FOR CALIFORNIA RIDGE WIND ENERGY'S CALIFORNIA RIDGE WIND ENERGY PROJECT

in Vermilion and Champaign Counties, Illinois

Prepared for

U.S. Fish and Wildlife Service
Rock Island Field Office
Moline, Illinois

By

California Ridge Wind Energy LLC
Chicago, Illinois

November 2011

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1.0 INTRODUCTION

California Ridge Wind Energy LLC (CRWE) is developing the California Ridge Wind Energy Project (Project) in Vermilion and Champaign Counties, Illinois, approximately 5 miles (8 km) northwest of Danville, Illinois (Figure 1.1). Land use within the Project area is 92 percent tilled agriculture and developed areas. Native habitats (woodlots and pastures) exist near some floodplains but occupy a small proportion of the Project area. The Project is located within the Vermilion River watershed and the Middle Fork of the Vermilion River (Middle Fork) is located 1.5 mi (2.4 km) east of the Project and turbines are 0.25 mi (0.40 km) east of the Project boundary.

The Project will consist of several primary components, including up to 134 wind turbines, access roads, transmission and communication equipment, storage areas, and control facilities.

The Project is located on approximately 33,500 acres (13,557 ha) of privately-owned land. Only a small portion of the 33,500-acre (13,557-ha) Project area will host wind farm facilities. It is anticipated that the area of direct land use for the 134 turbines, access roads, substation and O&M facility will be approximately 774 temporary acres (312 ha) and 117 permanent acres (47 ha). CRWE has acquired or is in the process of acquiring the necessary land rights to construct and operate the Project and its associated facilities.

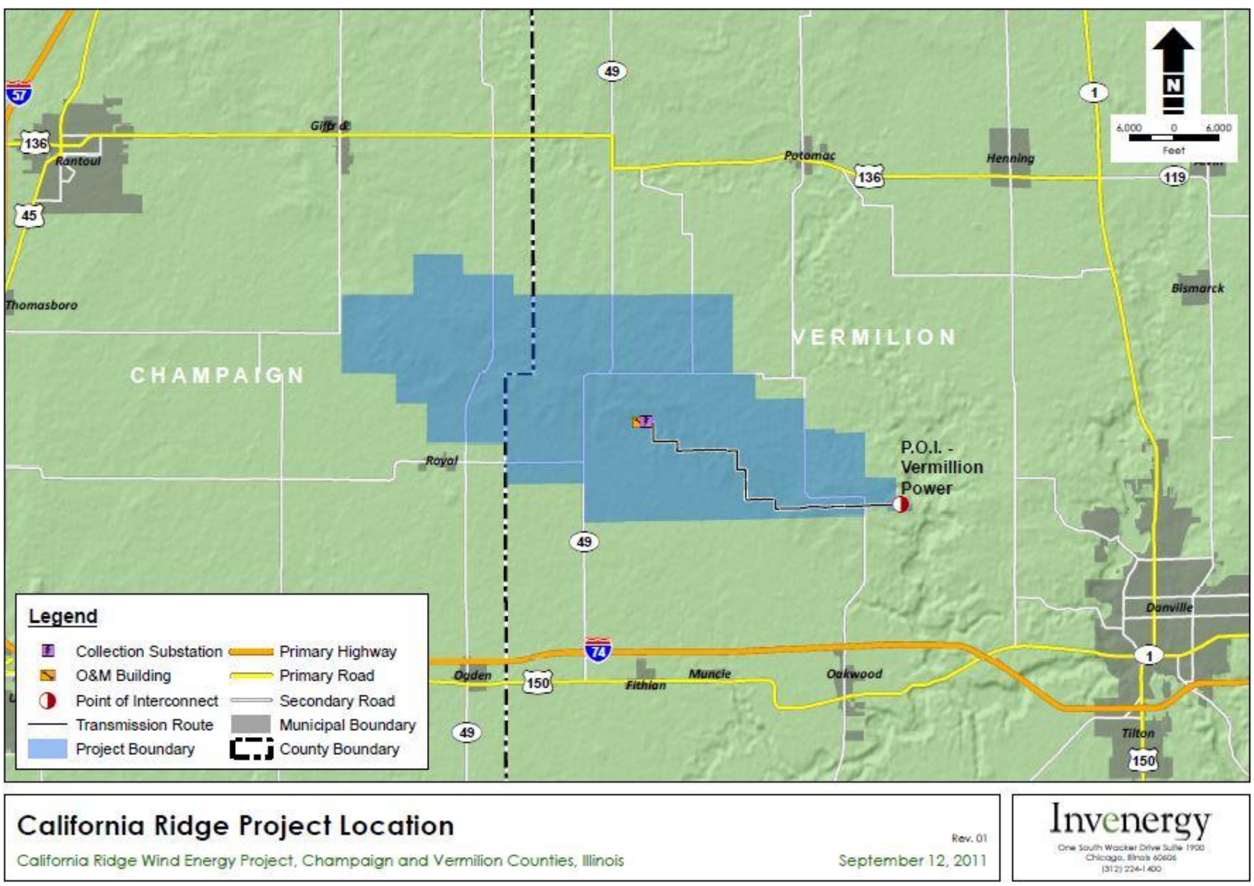

Figure 1.1 California Ridge Wind Energy Project Location

1.1 PURPOSE OF THE AVIAN AND BAT PROTECTION PLAN

Wind energy is one of the fastest growing sources of renewable energy in the United States, is the most economically competitive form of renewable energy, and is generally viewed as an environmentally friendly alternative to nuclear and fossil fuel power plants (AWEA 2008; National Research Council 2007). However, construction and operation of wind energy projects has the potential to impact bird and bat populations through habitat fragmentation, displacement, and mortality due to collision with or proximity to rotor blades (NWCC 2010).

After completing a detailed analysis of the proposed Project, CRWE concludes that construction and operation of the Project is unlikely to result in the "take[1]" of any Endangered Species Act (ESA)-listed species. This Avian and Bat Protection Plan (ABPP) was developed to document (1) the results of CRWE's monitoring and evaluation effort for the Project, and (2) CRWE's avoidance and conservation measures that will make take of ESA-listed species unlikely to occur, while reducing potential impacts to other bird and bat species.

Specific goals of the California Ridge ABPP are to:

1) Identify measures that will avoid and reduce potential impacts to birds and bats during construction, operation, maintenance, and decommissioning of the Project;
2) Ensure the potential impacts to ESA-listed bat species are reduced to the point where take is unlikely; and
3) Outline effective post-construction monitoring and adaptive management procedures to guide management actions for the life of the Project.

1.2 CONSULTATION HISTORY

CRWE commenced consultation with USFWS regarding the Project in May 2009, when an initial consultation letter was provided by USFWS (letter from Richard Nelson, USFWS, to Jacqueline Hamilton, HDR Engineering, May 14, 2009). USFWS stated in that letter that if the Project area contained suitable summer habitat for Indiana bats (*Myotis sodalis*) then additional surveys would be required to determine if the bat was present. The Project area does not contain maternity habitat, and, as discussed in Section 2.1 below, CRWE has avoided suitable foraging habitat by 1000 ft (305 m) or more. The USFWS made site development recommendations for placement of turbines related to natural habitat and recommended monitoring for effects on wildlife. This letter also included a list of recommended mitigation measures, consistent with the Service Interim Guidance on Avoiding and Minimizing Wildlife Impacts from Wind Turbines (USFWS 2003), which have been incorporated into the Project (see Section 2.3 below).

Subsequently, CRWE consulted with the USFWS during the fall of 2010 after conducting a habitat analysis and completing bird and bat surveys in the Project area. CRWE sought feedback for moving forward with the development. During a meeting on October 14th, 2010, USFWS and CWRE discussed the large amount of agricultural land in the Project area and lack of areas to perform mist-netting for Indiana bats; it was determined, based on lack of summer habitat and suitable mist-netting sites, that mist-netting was not warranted, and that the Project's only foreseen risk to Indiana bats was collision mortality risk during migration. The setbacks from foraging areas were also discussed.

[1] The term "take" is defined by the Endangered Species Act to mean "*to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect*" See 16 U.S.C. § 1532 (19).

During a second meeting with the USFWS on November 18th, 2010, the USFWS and CWRE discussed CWRE's initial implementation of two turbine siting measures to avoid or minimize potential for impacts to summering Indiana bats: (1) siting turbines away from the Middle Fork and its riparian zone and (2) utilizing a 1,000 ft (305 m) setback from foraging habitat connected to the River, the combination of which the USFWS agreed would adequately avoid impacts to foraging summering bats. This work has since been completed as discussed and the final product is included herein.

Based upon information and comments provided by USFWS, CRWE completed a detailed Project site characterization, including extensive biological surveys to obtain data on bird and bat use of the California Ridge Wind Energy Project area. The following studies were prepared by CRWE and are hereby incorporated by reference:

- Habitat mapping, land cover analysis
- Bird use counts
- Raptor nest surveys
- Bat use and activity studies (acoustic monitoring)
- Incidental wildlife observations
- Consultation with experts and USFWS

1.3 REGULATORY FRAMEWORK

1.3.1 Endangered Species Act

The federal Endangered Species Act (ESA) of 1973 [16 U.S.C. §§ 1531 *et seq*.] provides for the listing, conservation, and recovery of endangered and threatened species. The USFWS possesses responsibility for implementing the ESA to protect terrestrial species and resident fish species.

Section 9 of ESA prohibits the unauthorized "take" of listed species. Take is defined broadly by ESA to mean "*to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect*" a listed species. The term "harm" has been further defined in agency regulations to mean habitat modification that actually kills or injures a listed species.

On April 5, 2011, USFWS entered into a Memorandum of Understanding ("MOU") with a number of wind energy companies to develop a programmatic, multispecies habitat conservation plan (MSHCP) for several listed species that could potentially be affected by wind energy projects. Completion of the MSHCP is several years away. As a part of the process of developing the MOU, Region 3 of the USFWS developed a process whereby interested wind energy companies may pursue technical assistance letters with USFWS to address ESA issues during the development of the MSHCP. Through the consultation process associated with developing technical assistance letters, wind energy projects may be designed and operated to avoid potential take of listed species.

As described above, CRWE intends this ABPP to serve as the basis for the development of a technical assistance letter with USFWS to document that take of listed species is unlikely to occur if the Project is designed and operated pursuant to the measures contained in the ABPP.

1.3.2 Migratory Bird Treaty Act

Among other things, the Migratory Bird Treaty Act (MBTA, 16 U.S.C. §§ 703-712) prohibits the taking, killing, injuring or capture of listed migratory birds. The unauthorized taking of even one bird is legally considered a "take" under the MBTA and is a violation of the law. Bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles are afforded additional legal protection under the Bald and Golden Eagle Protection Act (BGEPA, 16 §§ U.S.C. 668-668d; see below).

To avoid and minimize impacts to MBTA-listed species, CRWE will implement this ABPP in consultation with the USFWS that incorporates applicable measures based on USFWS Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines (USFWS 2003) and the USFWS Wind Turbine Guidelines Advisory Committee Recommendations (USFWS 2010b). These guidelines contain materials to assist in evaluating possible wind power sites, wind turbine design and location, and pre- and post-construction research to identify and/or assess potential impacts to wildlife. Measures to be taken to avoid and minimize impacts to migratory birds are described below.

1.3.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA, 16 U.S.C. §§ 668-668d) prohibits the take of bald and golden eagles unless pursuant to regulations. BGEPA defines the take of an eagle to include a broad range of actions, including "*…to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb.*" The term "disturb" is defined in regulations found at 50 CFR 22.3 to include to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Measures to be taken to avoid and minimize impacts to eagles are described below.

The USFWS published a final rule (Eagle Permit Rule) on September 11, 2009 under the Bald and Golden Eagle Protection Act (BGEPA) (50 C.F.R. 22.26) authorizing limited issuance of permits to take bald eagles and golden eagles. A permit would authorize the take of bald eagles and golden eagles where the take is compatible with the preservation of the bald eagle and the golden eagle; necessary to protect an interest in a particular locality; associated with but not the purpose of the activity; and

1) for individual incidences of take: the take cannot be practicably avoided and
2) for programmatic take: the take is unavoidable even though advanced conservation practices are being implemented.

The USFWS recently published and is seeking public comment on the Draft Eagle Conservation Plan Guidance, which explains the USFWS's approach to issuing permits to individual companies or broad, industry-wide permits for ongoing take of eagles under this authority, and provides guidance to permit applicants (project proponents). The final rule notes that wind power is an industry sector for which programmatic permits are appropriate.

1.4 ABPP TERM

This ABPP will be in effect through development, construction, operation, maintenance, and decommissioning of the Project (Term). This term will cover the 20-year minimum functional life of turbines following completion of construction, and potential extended operations and/or decommissioning of the Project. CRWE will update this ABPP, as needed, through adaptive management (see Chapter 5.0) throughout the Term. Should the Project be re-powered at the end of the Project's expected life, the ABPP will automatically renew and remain in effect until the Project is decommissioned.

1.5 ABPP PROJECT AREA

This ABPP applies to all those lands leased by CRWE for construction and operation of the Project (Figure 1.2). These lands include the locations for all 134 turbines and associated facilities.

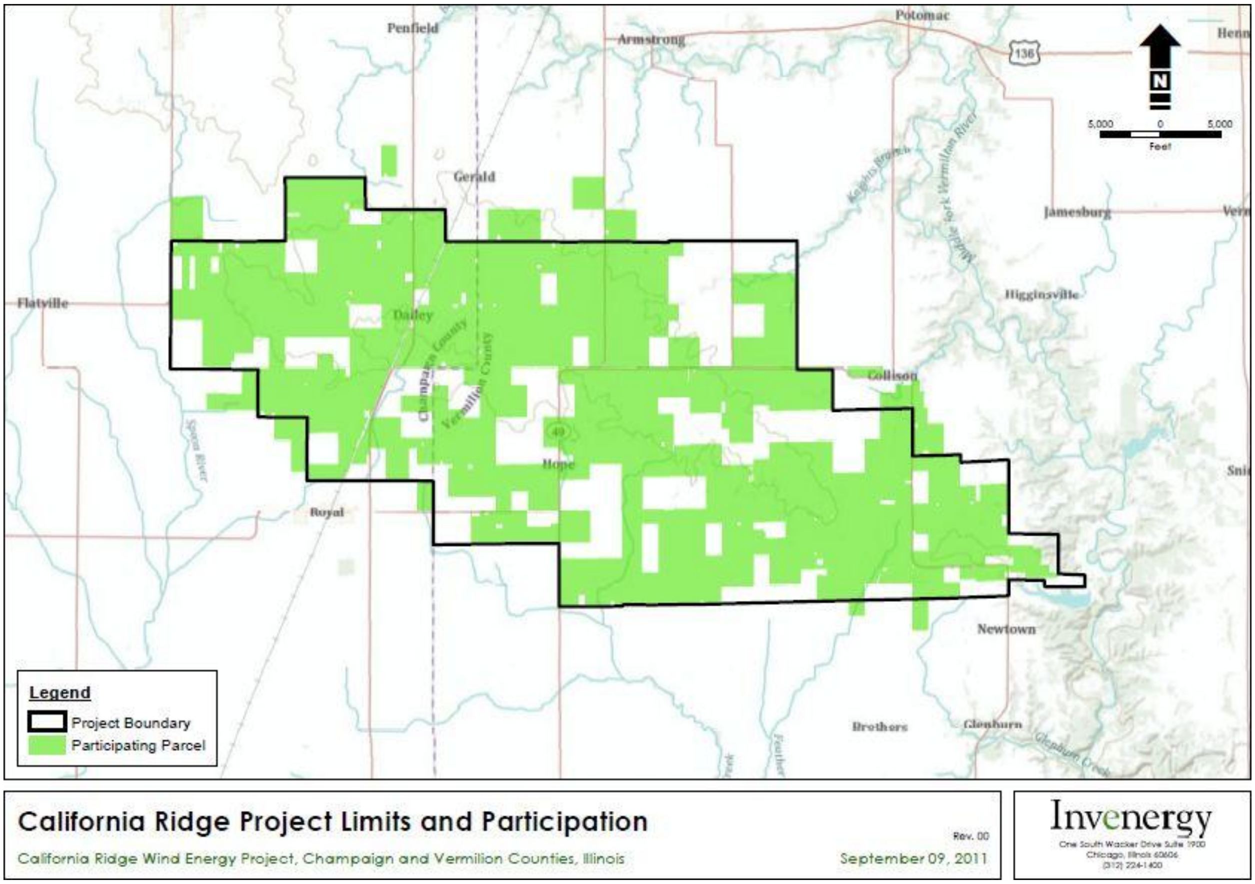

Figure 1.2 Project Area for the California Ridge ABPP

2.0 PROJECT DESCRIPTION

2.1 PROJECT AREA, SITING, AND FACILITIES SITING

The Project is located in Champaign and Vermilion Counties, Illinois (Figure 1.2), approximately 5 miles (8 km) northwest of Danville, IL. Land use within the Project area is 93 percent tilled agriculture and developed areas. Native habitats (woodlots and pastures) exist near some floodplains but occupy a small proportion of the Project area. The Project is located within the Vermilion River watershed and the Middle Fork is located 1.5 miles (2.4 km) east of the Project and turbines are 0.25 mi (0.40 km) east of the Project boundary. It is bounded on the west by rural farm land.

The Project is located on approximately 33,500 acres (13,557 ha) of privately-owned land. Only a small portion of the 33,500-acre (13,557-ha) Project area will host wind farm facilities. It is anticipated that the area of direct land use for the 134 turbines, access roads, substation and O&M facility will be approximately 774 acres (312 ha). CRWE has acquired or is in the process of acquiring the necessary land rights to construct and operate the Project and its associated facilities.

The area of permanent (life of project) impacts for the 134 turbines, access roads, transmission line, substation and O&M facility is approximately 117 acres (47 ha) (Table 2.1). About 774 acres (312 ha) will be temporarily disturbed (Table 2.1). Once construction is completed, disturbed areas that are not required for operations will be reclaimed, and only about 117 acres (47 ha) will remain permanently disturbed.

Table 2.1 Estimated Surface Disturbance Acreage for the California Ridge Wind Energy Project

Disturbance Type	Temporary Disturbance (acres [hectares])	Permanent Disturbance, 134 Turbine Project (acres [hectares])
Turbine assembly areas/pads[1]	389 [157]	24 [10]
Existing roads to be upgraded[2]	32 [13]	0 [0]
New access roads to be constructed[3]	184 [74]	73 [29]
Staging area and batch plant[4]	15 [6]	0 [0]
Collection line trenches[5]	40 [16]	0 [0]
Overhead transmission line[7]	109 [44]	17 [7]
Substation and O&M building	5 [2]	3 [1]
Total	**774 [313]**	**117 [47]**

[1] Assumes a 40 x 120 ft (12 x 37 m) access pad plus a 197 ft (60 m) radius laydown area centered on each turbine location during construction and a permanently maintained 100 ft (30 m) diameter area.

[2] Assumes 65 mi (105 km) of existing roads to be upgraded, 20 ft (6 m) wide during construction, reclaimed to 16 ft (5 m) wide for the life-of-project. It is assumed existing roads are 16 ft (5 m) wide originally and the only impacts are the additional 4 ft (1m) of width added temporarily.

[3] Assumes 38 mi (61 km) of new access roads to be constructed, 40 ft (12 m) wide during construction, reclaimed to 16 ft (5 m) wide for the life-of-project.

[4] Assumes that the staging area and batch plant location is reclaimed.

[5] Assumes 82 mi (132 km) of collection line trenches, up to 4 ft (1 m) wide during construction, completely reclaimed for the life-of-project.

[6] Assumes 9.0 mi (14.5 km) of overhead transmission line, with construction disturbance in 100 ft (15 x 30 m) ROW with 16 ft (5m) wide permanent access assumed along transmission line route.

A 9.0-mile (14.5-km) long overhead transmission line will be constructed to connect the Project to the existing electric power grid. It will extend from the Project substation to Point of Interconnect (POI) which is in the existing Ameren switchyard in the Vermilion Power Station. The transmission line permanent right-of-way (ROW) occupies approximately 17 acres (7 ha; assuming a 16 ft [5 m] wide ROW along entire route) and is located on privately-owned land. Up to 109 acres (44 ha) would be temporarily disturbed during transmission line construction, and permanent disturbance would be about 17 acres (7 ha; Table 2.1).

This site was selected based on several factors, including the following:

- Geographic location in central Illinois to serve regional electric power markets
- Commercially viable wind resource
- Nearby transmission with potential to integrate a wind generation facility
- Agricultural land use
- Willing landowners
- Community and county support
- Minimal environmental impacts

The turbine siting process initially considered land under agreement, wind resource, elevation, and county- and landowner-required setbacks. Within these limitations, the turbine siting goal was to maximize energy production for the Project site while minimizing environmental impacts.

CRWE has also conducted a detailed micro-siting analysis for the specific purpose of reducing potential impacts on Indiana bats, based on discussions with USFWS. During consultation with the USFWS, CRWE undertook a review of current turbines located within 2.5 miles (4 km) of the Middle Fork. Since the Middle Fork had previous occurrences of the Indiana bat (IDNR correspondence dated 4 December 2009), the presence of Indiana bat along the Middle Fork during the summer months was assumed. The micro-siting process focused on analyzing the connectivity of the Middle Fork with suitable Indiana bat habitat within areas of the Project which were 2.5 miles (4 km) or closer to the river. All proposed turbines located in these areas of the Project were moved at least 1000 ft (305 m) from connected habitats, as follows.

Forest and shrub shelterbelts, pasture, savannah, unmowed grassland, woodlots, and watercourses were identified as habitats which may provide summer foraging habitat for Indiana bats. Habitats were determined to be connected and potentially suitable for Indiana bats if they were within 1,000 ft (305 m) from other suitable habitat(s) (Exhibit 1). If habitats were connected to one another and the string of connected habitat was also connected to the Middle Fork, a 1,000-ft (305 m) setback from those habitats was established per USFWS recommendation (personal communication, November 2010, with Matt Sailor, USFWS).

2.1.1 Project Components

The Project will consist of several primary components, including wind turbines, access roads, transmission and communication equipment, storage areas, and control facilities. These components are discussed in detail below.

Wind Turbines

The Project will include approximately 134 GE 1.6 100-MW turbines. The GE 1.6 100-MW turbine is a three-bladed, upwind, horizontal-axis wind turbine. The turbine rotor and nacelle are mounted on top of a tubular tower. The machine employs active yaw control (designed to position the rotor to face the wind), active blade pitch control (designed to regulate turbine rotor speed), and a generator/power electronic converter system attached to a variable speed drive train designed to produce a nominal 60 hertz (Hz), 575 or 690 Volts (V) of electric power.

The GE 1.6 100-MW turbine has a nameplate rating of 1,600 kilowatts (kW). Each turbine is equipped with a wind speed and direction sensor that communicates to the turbine's control system when sufficient winds are present for operation. The turbine features variable-speed control and independent blade variable pitch to assure aerodynamic efficiency, and which functions as an aerodynamic control system. The GE 1.6 100-MW turbine begins operation in wind speeds of approximately 8 miles per hour (mph; 3.5 meters per second [m/s]) and reaches its rated capacity (1.6 MW) at a wind speed of approximately 28 mph (12.5 m/s). The turbine is designed to operate in wind speeds up to approximately 56 mph (25 m/s) and can withstand sustained wind speeds of more than approximately 100 mph (45 m/s). The color of all turbines, blades, and towers used for the Project will be white and the rotation direction, as an observer faces the turbines, will be clockwise.

Each turbine includes a Supervisory Control and Data Acquisitions (SCADA) communications system that permits automatic, independent operation and remote supervision, allowing continuous control of the wind farm to ensure optimal and efficient operation and early troubleshooting of problems. SCADA data provide detailed operating and performance information for each wind turbine, and CRWE maintains a database tracking each wind turbine's operational history.

Hubs, Towers, and Foundations

The rotor consists of three blades attached to a hub. The rotor blades are constructed of fiberglass and epoxy or polyester resin. The cast iron hub connects the rotor blades to the main shaft and transmits torque. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system, and other electrical and mechanical systems.

The GE 1.6-100 MW wind turbines use a 328-ft (100 m) rotor diameter with a rotor-swept area of approximately 84,496 ft^2 (7,854 m^2). The rotor speed would be 5.0 to 19.0 rpm and all rotors would rotate in the same direction.

The turbine nacelles are mounted on freestanding monopole tubular steel towers with a hub height of 328 ft (100 m) with a total height (tip height) of 492 ft (150 m). Each tower would consist of three sections manufactured from steel plates. All welds are made in automatically controlled power welding machines and are ultrasonically inspected during manufacturing per American National Standards Institute specifications. All surfaces are sandblasted and multiple layers of coating are applied for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. The steel door at the base of each tower also includes a low voltage safety light on a motion sensor for entry.

The turbine towers are connected by anchor bolts to underground concrete and rebar foundations. Geotechnical surveys and turbine tower load specifications dictate final design parameters of the foundations. A typical spread footer has a similar footprint to the tower diameter at grade, but may spread out below grade to as much as 62 x 62 ft (19 by 19 m) in size. A typical deep foundation is placed on an area approximately 31 x 31 ft (10 x 10 m) in size. Foundation type will be based on geotechnical surveys and may include spread footers or deep foundations. All foundations consist of anchor bolts, concrete, and reinforcing rebar. Specific site conditions may require subgrade modification to support the foundation.

2.1.2 Access Roads

The Project is accessed using existing county public roadways and privately-owned roads; CRWE will upgrade existing roads and constructed new roads to enable all-weather access to Project facilities. The main access route for the Project, including equipment deliveries, is via IL-49.

CRWE estimates that it will need to upgrade up to 65 mi (105 km) of existing roads and potentially construct approximately 38 mi (61 km) of new roads for the 134 turbines. Access roads will be approximately 16 ft (5 m) wide during the operational phase. During construction, primary component haul roads will typically be 20 ft (6 m) wide and turbine/crane access roads will typically be 40 ft (12 m) wide, providing the 35 ft (11 m) needed for movement of the large crane and additional clearance area for crane operation and drainage features. Disturbance width typically increases in steeper areas due to cuts and fills necessary to construct and stabilize roads on slopes. CRWE will work with the landowners to utilizing existing roads and to locate new access roads to minimize land use disturbance and avoid sensitive resources and steep roadway sections that exist near some railroad and roadway crossings topography to the extent possible, while maximizing transportation efficiency.

2.1.3 Communications and Collection System

A control panel inside the base of each turbine tower will house communication and electronic circuitry. A step-up transformer will be installed at the base of each turbine to raise the voltage from 575 or 690 V to distribution line voltage (34.5-kV). Generated electricity will move through an underground collection system to the Project substation. Both power and communication cables will be buried in trenches a minimum of 4 ft (1 m) deep. An estimated 82 miles (132 km) of underground collection system will be installed.

2.1.4 Substation and O&M Facility

A 34.5-kV/138-kV substation will be constructed and owned by CRWE. The substation is similar to substations used on transmission systems in the region and will be constructed and operated to industry standards. The substation main transformer will be installed on an 11 x 17 ft (3 x 5 m) concrete pad and the main control building will be installed on a 15 x 33 ft (6 x 10 m) concrete pad within a 3-acre parcel of land centrally located within the Project (see Figure 1.1). The substation will house transformers and other facilities to step-up medium voltage power from the collection system to high voltage for delivery to the 138-kV transmission line. The majority of the yard will be covered with crushed rock. The substation will be fenced with a 7.0 ft (2 m) high chain-link fence topped with three strands of barbed wire, for a total fence height of 8.0 ft (2 m). Access gates will be locked at all times and warning signs posted for public safety.

The Project Operations and Maintenance (O&M) facility will be located separately from the Project 34.5/138-kV substation (see Figure 1.1). The O&M building will be approximately 60 ft (18 m) wide and 102 ft (31 m) long and will be constructed of concrete and located on a concrete slab. The O&M building will contain all necessary plumbing and electrical collections needed for typical operation of offices and a maintenance shop.

Utilities such as electric service, water service, sewer service, telephone service, as well as access to a septic system, will be required at the site. Water might be supplied locally through the use of a well(s). Permits for the installation of the septic system and the well(s) will be acquired through the local health department.

2.1.5 Transmission Line

A 138-kV overhead transmission line associated with the Project will move power from the Project substation in a southeast direction through Vermilion County where it will tie into the existing Ameren switchyard at the Vermilion Power Station.

The transmission line will be approximately 9.0 miles (14.5 km) long (Figure 1.1). The construction ROW will be 100 ft (30 m) wide; the permanent ROW will be 16 ft (5 m) wide. The ROW will be routed through previously impacted (tilled) areas to minimize impacts to streams, wetlands, and other natural resources.

An estimated 100 transmission line poles will be installed, with an average span between poles of approximately 500 ft (152 m). Transmission line poles consist of primarily single steel poles structures, secured as necessary with guy wires. Pole height ranges from 61 to 88 ft (19 to 27 m). Poles will be set into a drilled hole in the soil or rock and then backfilled with select stone and granular soil fill. Setting depth will be 10 percent of the pole length plus 2 ft (<1 m) or deeper as specified by the design engineer. The poles will support both the steel-reinforced aluminum electrical conductor line and a composite fiber optic ground wire. Transmission lines will be constructed according to Avian Power Line Interaction Committee (APLIC) standards.

2.1.6 Facility Life Span

The Project's minimum life span after construction is expected to be about 20 years.

2.2 PROJECT CONSTRUCTION

Construction of the Project should take approximately nine to twelve months to complete once all permits have been obtained. CRWE will (1) order all necessary components, including wind turbine generators, foundation materials, electrical cable, and transformers; (2) complete micrositing of final turbine locations; (3) complete an American Land Title Association (ALTA) survey to establish locations of structures and roadways; and (4) complete soil borings, testing, and analysis for proper foundation design and materials.

The 134 turbines will be constructed using standard construction procedures and equipment used for other wind farms in the eastern U.S. Construction will entail the following activities, listed in typical order of occurrence:

1) Erosion control implementation;
2) Road and pad construction;
3) Foundation excavation and pouring concrete foundations for turbine towers, meteorological towers, transformers pads;
4) Trenching and placement of underground collection and communications cables;
5) Tower erection, nacelle and rotor installation;
6) Testing and commissioning; and
7) Final road grading, erosion control, and site clean-up.

A construction staging and laydown area, including Project offices, equipment, and employee parking areas, will be developed on approximately 12 acres (5 ha). A temporary concrete batch plant might be located adjacent to the staging area on approximately 3 acres (1 ha).

A well might be installed within the Project site to serve the necessary water requirements for the concrete batch plant. Water utilized for dust suppression will be taken from local creeks/ponds within the Project area. Portable self-contained restroom facilities will be provided and used by the contractor's personnel while on site. These facilities will be delivered, maintained, and replaced by a third party contractor. A septic system will be installed in the O&M facility.

2.2.1 Road Construction

Existing roads will be upgraded and new roads will be constructed in accordance with industry standards for wind farm roads and local building requirements. The roads will accommodate all-weather access by heavy equipment during construction and long-term use during operations and maintenance. New roads will be located in consultation with the landowner to minimize disturbance, maximize transportation efficiency, and avoid sensitive resources and unsuitable topography, where feasible. All new roads will be constructed for the specific purpose of Project construction, operation, and maintenance.

Roads will be designed, built, surfaced, and maintained to provide safe operating conditions at all times. The minimum travel way for access roads would be 16 ft (5 m). All roads will include road base, surface materials, appropriate drainage, and culverts. Surface disturbance will be contained within road ROWs, which will average 40 ft (12 m) along turbine/crane access roads. Disturbance width may increase in rugged topography due to cuts and fills necessary to construct and stabilize roads on slopes.

Topsoil removed during road construction will be stockpiled in elongated rows within road ROWs. Topsoil will be re-spread on cut-and-fill slopes and these areas will be revegetated as soon as possible after road construction is complete.

Construction will include temporary disturbances for crane pads at each turbine site, temporary travel roads for the cranes, temporary turning areas for oversized equipment at certain county and local road intersections, temporary laydown areas around each turbine, and for trenching in the underground electrical collection and communication system, and storage/stockpile areas. Construction of each turbine will include temporary impacts of approximately 12 ft (4 m) of gravel roadway on either side of the permanent roadway for 40 ft (12 m) of total width, a 40-ft x 120-ft (12-m x 37-m) gravel crane pad extending from the roadway to the turbine foundation, which would be graded to a minimum of 1 percent slope, and a 197-ft (60 m) radius rotor laydown area centered around the turbine foundation that would be graded to a maximum of 10 percent slope.

During construction, operation, and maintenance of the Project, traffic will be restricted to roads developed for the Project and designated existing roads. Use of unimproved roads will be restricted to emergency situations. Speed limits will be set to ensure safe and efficient traffic flow. Signs will be placed along the roads as necessary to identify speed limits, travel restrictions, and other standard traffic control measures.

2.2.2 Turbine Towers, Meteorological Towers, and Transformers Foundations Construction

Turbine towers will be anchor-bolted to concrete foundations. Foundations will be excavated using a backhoe, forms installed, and concrete poured. Anchor bolts will be embedded in the concrete, and the foundations will be allowed to cure prior to tower erection.

A permanent meteorological tower might be installed as part of operations. A permanent meteorological tower would be 328 ft (100 m) tall and installed on 4.0 ft (1.2 m) diameter pier foundations. Foundation depth will depend on local soil conditions. Foundations will be drilled using a truck-mounted drilling rig and then filled with concrete. Transformer foundations will be constructed using standard cut-and-fill procedures and by pouring concrete in a shallow slab or using a precast structure set on appropriate depth of structural fill.

2.2.3 Trenching and Placement of Underground Electrical and Communications Cables

Underground electrical and communications cables will be placed in approximately 4.0 ft (1 m) deep trenches. In some cases, trenches will run from the end of one turbine string to the end of an adjacent string to link more turbines together via the underground network. Electric collection and communications cables will be placed in the trench using trucks. Electrical cables will be installed first and the trench partially backfilled prior to placement of the communications cables. Trenches will be backfilled and the area re-vegetated concurrently with reclamation of other construction areas.

2.2.4 Tower Erection, Nacelle and Rotor Installation

Turbine tower assembly and erection will occur within the laydown area at each turbine site. Tower bottom sections will be lifted with a crane and bolted to the foundation, and then the middle and top sections will be lifted into place and bolted to the section below. Once the tower has been erected, the nacelle and then the rotor are hoisted into place.

2.2.5 Testing and Commissioning

Testing involves mechanical, electrical, and communications inspections to ensure that all systems are working properly. Performance testing will be conducted by qualified wind power technicians and will include checks of each wind turbine and the SCADA system prior to turbine commissioning. Electrical tests of the Project (i.e., turbines, transformers, and collection system) and transmission system (i.e., transmission line and substation) will be performed by qualified electricians to ensure that all electrical equipment is operational within industry and manufacturer's tolerances and installed in accordance with design specifications. All installations and inspections will be in compliance with applicable codes and standards.

2.2.6 Final Road Grading, Erosion Control, and Site Clean-up

Once construction is complete, all disturbed areas will be graded to the approximate original contour and any remaining trash or debris will be properly disposed of off-site. Areas disturbed during construction will be stabilized and reclaimed using appropriate erosion control measures, including site-specific contouring, reseeding, or other measures agreed to by landowners and designed and implemented in compliance with the Project's Storm Water Pollution Prevention Plan (SWPPP). Areas that are disturbed around each turbine during construction will revert to the original land use after construction except for a 100-ft (30-m) diameter area around each turbine that CRWE will maintain for operation and maintenance purposes. Upon the completion of construction the existing land use will be able to continue with very little impact from the Project.

During final road grading, surface flows will be directed away from cut-and-fill slopes and into ditches that outlet to natural drainages. CRWE will prepare and implement a SWPPP, which will include standard sediment control devices (e.g., silt fences, straw bales, netting, soil stabilizers, check dams) to minimize soil erosion during and after construction. Waste materials will be disposed of at approved and appropriate landfills. Following construction, CRWE will ensure that all unused construction materials and waste are picked up and removed from the Project area.

Contractors will provide trash barrels or dumpsters to collect all construction waste for proper disposal at an approved facility. No waste disposal by incineration will occur. The existing O&M building will be used to store parts and equipment needed for O&M. While CRWE does not anticipate the use of any liquid chemicals within the Project area, CRWE will inspect and clean up the Project area following construction to ensure that no solid (e.g., trash) or liquid wastes (e.g., used oil, fuel, turbine lubricating fluid) were inadvertently spilled or left on-site.

Cleanup crews will patrol the construction site on a regular basis to remove litter. Final site cleanup will be performed prior to shifting responsibilities to O&M crews. O&M crews will use dumpsters on site for daily maintenance waste.

2.3 PROJECT OPERATIONS, MAINTENANCE, DECOMMISSIONING, AND RESTORATION

2.3.1 Operations and Maintenance

CRWE will operate and maintain the Project. All turbines, collection and communications lines, substations, and transmission lines will be operated in a safe manner according to standard industry operation procedures. Routine maintenance of the turbines will be necessary to maximize performance and detect potential inefficiencies. CRWE and the turbine supplier will control, monitor, operate, and maintain the Project by means of the SCADA system, and regularly scheduled on-site inspections will be conducted. Any problems will be promptly reported to on-site O&M personnel, who will perform both routine maintenance and most major repairs. Most servicing will be performed up-tower, without using a crane to remove the turbine from the tower. Additionally, all roads, pads, and trenched areas will be regularly inspected and maintained to minimize erosion. CRWE anticipates that approximately 10 to 25 O&M staff will be employed throughout the life-of-project.

All maintenance activities will occur within areas previously disturbed by construction, so no new ground disturbance will occur during O&M of the Project. Turbine maintenance is typically performed up-tower, i.e., O&M personnel climb the towers and perform maintenance within the tower or nacelle and access the towers using pick-up trucks, so no heavy equipment in needed. In the unlikely event (may never occur) that a large crane would be needed for maintenance, vegetation will be cleared within the area previously disturbed during construction to provide for safe and efficient operation of the crane, but no soil disturbance will be necessary. Ground disturbing activities may include occasional need to access underground cable or communications lines.

Access roads will be maintained during O&M to prevent off-road detours due to ruts, mud holes, etc. Roads would be maintained as needed; it is anticipated that maintenance would occur twice per year but more frequent maintenance would be performed, if needed, to maintain roads in an condition acceptable to the county (for county roads) and to the landowner (for private roads). All fuels and/or hazardous materials will be properly stored during transportation and at the job site. Workers will be instructed to keep all job sites in a sanitary and safe condition. Workers will be expected to respect the property rights of private landowners.

Vegetation mowing will occur along Project roads and around turbines for vegetation control purposes.

The transmission line route and other Project areas will be inspected for hazard trees that may pose safety threats or potential damage to Project facilities. Hazard trees will be trimmed or cut as needed. Tree cutting will occur from November 1 through April 1 to avoid impacting any roosting bats, unless CRWE deems there is imminent threat of property damage and/or safety hazard were the tree to fall on Project facilities.

2.3.2 Decommissioning and Restoration

At the end of the Project's useful life, CRWE expects to explore alternatives for either repowering or decommissioning the Project. One option may be to continue operation of the Project, providing energy under a new long-term contract with a power purchaser or on a merchant basis. If it is determined that the wind turbines will not continue operation, be replaced or repowered after 20 years, the following sequence for removal of components will be implemented:

1) Turbines, transmission line, and substation will be dismantled and removed;
2) Pad-mounted transformers will be removed;
3) All turbine and substation foundations will be removed to a depth of 4 ft (1 m); and

4) All disturbed areas and access roads will be graded to as near as practicable the original contour, if the landowner requests that CRWE decommission these areas.

A decommissioning fund may be established based on the requirements of Vermilion and Champaign Counties and may cover dismantling of the turbines and towers, as well as land reclamation, monitoring of revegetation success, and reseeding if needed to ensure revegetation success. An independent expert, or Professional Engineer, may be engaged to assess the size of fund needed based on resale or salvage value of the Project components. This estimate, if required, will be re-assessed periodically and reported to Vermilion and Champaign Counties.

2.4 WILDLIFE PROTECTION MEASURES

CRWE proposes to implement a host of measures designed to avoid and minimize impacts to birds, bats, and the environment. These conservation and mitigation practices, which are a part of the proposed Project, are summarized below:

General

- All federal, state, and local environmental laws, orders, and regulations will be complied with.
- Prior to construction, all supervisory construction personnel will be instructed on the protection of wildlife resources including: (1) federal and state laws regarding plants and wildlife, including collection and removal and (2) the importance of these resources and the purpose and necessity of protecting them. This information will be disseminated through the contractor hierarchy to ensure that all appropriate staff members are aware of the correct procedures and responsibility to report wildlife incidences.
- CRWE has contributed to a conservation project designed in coordination with USFWS and the Illinois Department of Natural Resources (IDNR) that contributes to the recovery of the listed species. Invenergy has funded and facilitated a spring emergence and migration project to evaluate the movement of reproductive female Indiana bats from Blackball mine to their maternity sites.
- CRWE will monitor bird and bat fatalities at the site in accordance with the monitoring plan presented in the Monitoring and Adaptive Management Plan (MAMP-Appendix A), to verify the effectiveness of the avoidance, minimization, and mitigation strategies incorporated in the California Ridge Wind Energy Project.
- BHE has consulted and coordinated with USFWS and IDNR for mitigation activities related to bats, eagles, other raptors, and other migratory birds. As discussed under Section 2.1 and below, the Project has been sited such that potential impacts to these taxa are reduced. Additional measures to avoid/minimize impacts to birds and bats are presented in Section 4.4, below.

Surveys and Siting

The effects of pre-construction, construction, and operational activities were taken into account during the pre-development stage of this Project and were assessed by conducting wildlife surveys recommended by USFWS (USFWS 2010b). Pre-construction wildlife and habitat surveys within the Project area include:

- Fixed-point bird use surveys
- Acoustic bat surveys
- Land cover mapping and habitat characterization
- Bald eagle nest surveys

- As part of the Project's compliance with the MBTA, all habitats directly impacted by construction activities during the breeding season will be surveyed for nests by a trained biologist prior to construction. Particular attention will be given to detecting upland sandpiper (*Bartramia longicauda*), barn owl (*Tyto alba*), and loggerhead shrike (*Lanius ludovicianus*) nests, as recommended by the IDNR for these protected species.

CRWE has sited infrastructure to minimize and avoid adverse effects on federally-listed plants and summering Indiana bats, and to minimize impacts to migratory birds. Mitigation measures incorporated into Project siting include the following:

- Potentially-suitable foraging habitats for Indiana bat were evaluated for connectivity to one another and to the Middle Fork. If habitats were determined to be connected, a 1,000 ft (305 m) setback from those habitats was established to prevent the turbine sites from being connected to the Middle Fork.
- The Project has been sited in a previously disturbed landscape and to avoid critical habitats for sensitive species.
- Project facilities are located to avoid: (1) documented locations of any species of wildlife, fish, or plant protected under the federal ESA, (2) known local bird migration pathways and daily movement flyways, and (3) areas where birds are highly concentrated. The Project area is not known to have a high incidence of fog, mist, low cloud ceilings, and low visibility.
- Turbines are located to avoid: (1) known bat hibernation, breeding, and maternity/nursery colonies, migration corridors, and flight paths between colonies and feeding areas, (2) areas or features of the landscape known to attract raptors, and (3) potential avian mortality, as practicable.
- Fragmentation of wildlife habitat will be avoided through the use, where practical, of lands already disturbed, including using existing roadways.

Surface Water, Soils, and Vegetation

- Appropriate storm water management practices that do not create attractions for birds will be implemented. A SWPPP will be prepared to ensure that erosion is minimized during storm events and will be kept on-site at all construction sites, as well as in the construction contractors' offices. CRWE and its contractors will implement the SWPPP. To minimize damage to the land surface and property, contractors will limit the movement of crews and equipment to the Project site, including access routes, to that which is necessary for safe and efficient construction. When weather and ground conditions permit, construction-caused deep ruts will be leveled, filled and graded, or otherwise eliminated. Ruts, scars, and compacted soils will be loosened and leveled using a ripper or disc or other landowner-approved method. Damage to ditches, roads, and other features of the land will be repaired. Water bars or small terraces will be constructed along access road ditches on hillsides to minimize water erosion and to facilitate natural revegetation.
- All federal regulations concerning the crossing of waters of the U.S., as listed in Title 33 Code of Federal Regulations [C.F.R.] Part 323, will be complied with.
- Wind turbines and most ancillary facilities will be built on uplands, which avoid the surface water features and designated floodplains.
- Wind turbines will not be placed in areas containing waters of the U.S.
- Refueling and staging will occur at least 300 ft (91 m) from the edge of a channel bank at all stream channels. Sediment control measures will be utilized.

- Prior to construction, field surveys will be conducted to determine the presence of jurisdictional wetlands and streams within the footprint of each turbine location and ancillary facilities. Once the layout for the Project has been finalized, results of the field surveys and a summary of impacts will be submitted to the USACE, and the required authorizations/permits will be obtained.
- Roads, portions of roads, crane paths, and staging areas not required for operation and maintenance will be restored to the original contour and made impassable to vehicular traffic. Areas to be reclaimed will be contoured, graded, and seeded as needed to promote successful revegetation, provide for proper drainage, and prevent erosion. Seed mixtures will be developed based on best management practices for the region, requirements or recommendations by county, or specific requests by the landowner or easement requirements
- Contractors will be required to cover riparian areas with mats made of timber or similar material located along the transmission line ROW and minimize physical disturbance to riparian vegetation during construction.
- Equipment and vehicles will not cross riparian areas on the ROW during operation or decommissioning activities. Existing bridges or fords will be used to access the ROW on either side of riparian areas.
- During Project construction, riparian areas will be avoided, where feasible. If avoidance is not feasible, activities within riparian areas will be conducted in conformance with SWPPP requirements.
- During construction and operation of the Project, industry-standard best management practices (BMP) will be implemented to protect topsoil and adjacent resources and to minimize soil erosion. Practices may include containing excavated material, protecting exposed soil and stabilizing restored material, and re-vegetating areas as necessary.
- Existing roads and previously disturbed lands will be used where feasible, to reduce vegetation impacts within the Project area. Surface disturbance will be limited to that which is necessary for safe and efficient construction.
- All surface-disturbed areas will be restored to the approximate original contour and reclaimed in accordance with easement agreements.
- Removal or disturbance of vegetation will be minimized through site management (e.g., by utilizing previously disturbed areas, designating limited equipment/materials storage yards and staging areas, scalping) and reclaiming all disturbed areas not required for operations.
- Soil erosion control measures will be monitored, especially after storms, and will be repaired or replaced if needed.
- Construction activities in areas of moderate to steep slopes (≥15-20%) will be avoided, where possible.

Site Management

- All carrion discovered on-site during regular maintenance and monitoring activities will be removed to avoid attracting bald eagles and other raptors.
- Hunting, fishing, dogs, or possession of firearms by its employees and its designated contractor(s) in the Project area will be prohibited during construction, operation, and maintenance.
- Project personnel will be advised regarding speed limits on roads (25 mph [11 m/s]) to minimize wildlife mortality due to vehicle collisions.

- Potential increases in poaching will be minimized through employee and contractor education regarding wildlife laws. If violations are discovered, the offense will be reported to the IDNR and offending employee or contractor will be disciplined and may be dismissed by CRWE and/or prosecuted by the IDNR.
- Travel will be restricted to designated roads; no off-road travel will be allowed except in emergencies.

Collision Risk

- Unguyed, tubular towers and slow-rotating, upwind rotors will be used.
- Avian Power Line Interaction Committee suggested practices (2006) will be used to ensure that the transmission line is designed and constructed in a manner to minimize bird collision and electrocution risk.
- Collection and communication lines will be buried.
- Lighting will be minimized to that which is required by the Federal Aviation Administration (FAA). The FAA typically requires every structure taller than 200 ft (61 m) above ground level to be lighted, but in the case of wind power developments, FAA allows a strategic lighting plan that provides complete conspicuity to aviators but does not require lighting every turbine. CRWE will develop a lighting plan for the Project to be submitted for FAA approval. An estimated 60-65 percent of the Project's turbines will be designated for lighting with medium intensity dual red synchronously flashing lights for night-time use and daytime use, if needed. The turbines will be lighted only as required by FAA regulations, plus a low voltage, shielded light on a motion sensor at the entrance door to each turbine. To avoid disorienting or attracting birds or bats, FAA lighting on turbines will employ strobed, minimum-intensity lights as recommended by the Service (USFWS 2010a).
- During the late summer and fall swarming and migration seasons (August 1-September 30), California Ridge turbines will be curtailed at 15.2 mph (6.9 m/s) beginning half an hour before sunset and continuing until half an hour after sunrise. This curtailment schedule targets the seasons during which the majority of all bat mortalities have occurred at wind energy facilities (Arnett et al. 2008) and the nightly period during which bat activity was found to be the highest at the California Ridge Project area (BHE Environmental, Inc. 2010a). The fall migration season is also the season during which both reported Indiana bat fatalities at a wind energy facility occurred.

  Turbine blades will remain fully feathered (i.e., blades will be oriented parallel to the wind) so rotors will move very slowly prior to reaching the turbine cut-in speed. At cut-in wind speeds, the blades will pitch into the wind, rotor speeds will increase, and the generators will eventually close their electrical breaker and begin generating electricity at some slightly higher wind speed, when steady wind power is provided by the rotor to the generator.

  CRWE will test the effectiveness of this operational protocol through monitoring during the first three years of operation and once every three years thereafter (MAMP-Appendix A).

Fencing

- The substation and O&M building will be fenced as required for public safety, but no other fencing is proposed at this time. The public will continue to have access to portions of the Project area via public roads and private roads that are regularly open to the public.

Hazardous and Solid Wastes

- All applicable hazardous material laws and regulations existing or hereafter enacted or promulgated regarding these chemicals will be complied with and a Spill Prevention, Control, and Countermeasure Plan (SPCCP) will be implemented. The only hazardous chemicals anticipated to be on-site are the chemicals contained in diesel fuel, gasoline, coolant (ethylene glycol), and lubricants in machinery. Hazardous chemicals contained in diesel fuel, gasoline, coolant (ethylene glycol), and lubricants will not be stored in or near any stream, nor will any vehicle refueling or routine maintenance occur in or near streams. When work is conducted in and adjacent to streams, fuels and coolants will be contained in the fuel tanks and radiators of vehicles or other equipment.
- Construction activities will be performed using standard construction best management practices so as to minimize the potential for accidental spills of solid material, contaminants, debris, and other pollutants. Excavated material or other construction materials will not be stockpiled or deposited near or on stream banks.
- No burning or burying of waste materials will occur at the Project site. The contractor will be responsible for the removal of all waste materials from the construction area. All contaminated soil and construction debris will be disposed of in approved landfills in accordance with appropriate environmental regulations.

Fire Protection

- A fire protection system will be implemented, using industrial best practices, and in accordance with all applicable fire safety codes. CRWE will coordinate with fire, safety, and emergency personnel during all stages of the Project to promote efficient and timely emergency preparedness and response.
- A representative will be designated to be in charge of fire control during construction. The fire representative will ensure that each construction crew has appropriate types and amounts of firefighting tools and equipment, such as extinguishers, shovels, and axes available at all times.
- At all times during construction and operation, satisfactory spark arresters will be maintained on internal combustion engines.

Weeds

- Mechanical measures will be used to control noxious weeds in all surface-disturbed areas.

Noise

- Effective exhaust mufflers will be installed and properly maintained on all construction equipment. CRWE will require construction contractors to comply with federal limits on truck noise. Construction activities will take place mostly during daylights hours. Construction contractors will be required to ensure their employee and delivery vehicles are driven responsibly. CRWE and its contractors will adhere to a Project-wide speed limit of 25 mph (11m/s) or lower depending on the requirements of the specific equipment utilizing the roads. Nighttime construction work will be minimized, and when it does occur, it generally will be limited to relatively quiet activities.

3.0 AVIAN AND BAT RESOURCES

3.1 HABITAT DESCRIPTION

The Project area is located within the Vermilion River watershed in Champaign and Vermilion Counties, Illinois (Figure 1.2). This area falls within the Central Corn Belt Plains Ecoregion, which encompasses a large portion of central Illinois (Woods et al. 2007). The Central Corn Belt Plains Ecoregion is composed of vast glaciated plains; much of this region was historically dominated by tallgrass prairie, with groves of trees and marshes scattered across the level uplands. Topography within the Project area is flat to rolling, with elevations ranging from 200 to 250 ft (61 to 76 m) above sea level (approximately). The Middle Fork of the Vermilion River (Middle Fork) is located 1.5 miles (2.4 km) east of the Project area; the Project area is bounded on the west by rural farmland. One natural area declared by the IDNR, the Orchid Hill Natural-Heritage Landmark, exists within the southeast portion of the Project area (INPC 2008).

Western EcoSystems Technology, Inc (WEST) developed a land cover map for the Project area by delineating general vegetation types on aerial maps (Good et al. 2010). Land cover surveys were conducted to verify the land cover map during March 2009. Land use within the Project area is dominated (90.6%) by tilled and un-tilled agriculture, primarily corn (*Zea* spp.) and soybean (*Glycine max*) crops (Table 3.1). Due to high levels of disturbance and lack of native vegetation, agricultural habitats are of limited quality for birds and bats. Cultivated agriculture is rarely used as nesting habitat by birds, although certain, disturbance-tolerant species may forage in crops. Agricultural fields may attract large flocks of birds, such as blackbirds and Canada geese (*Branta canadensis*), during the fall migration and winter seasons (Erickson et al. 2002). Agricultural habitat does not provide roosting habitat for bats, but certain bat species, primarily big brown bat (*Eptesicus fuscus*) and evening bat (*Nycticeius humeralis*), may forage over agricultural fields within the Project area. Other bat species in the region may occasionally forage over crops within the Project area but are more likely to use forested and open water habitats (BCI 2010).

Table 3.1 Land Cover Types, Coverage, and Composition within the California Ridge Project Area, Based on Land Cover Surveys Conducted by WEST in March of 2009

Habitat	Acres [Hectares]	% Composition
Agriculture (Corn/Soybeans)	30,246.6 [12240.4]	90.2
Agriculture (Hay Fields)	117.3 [47.5]	0.4
Developed	509.2 [206.1]	1.5
Mowed Grassland	690.7 [279.5]	2.1
Open Water	9.8 [4.0]	<0.1
Pasture	236.6 [95.7]	0.7
Railroad Verge	84.3 [34.1]	0.3
Savannah	103.9 [42.0]	0.3
Shelterbelt (Shrubs)	72.5 [29.3]	0.2
Shelterbelt (Trees)	266.4 [107.8]	0.8
Unmowed Grassland	890.1 [360.2]	2.7
Woodlot	296.1 [119.8]	0.9
Total	**33,523.6 [13,566.5]**	**100.0**

The remaining land cover within the Project area is comprised of unmowed grassland (2.7%), mowed grassland (2.1%), developed areas (1.5%), and woodlot, shelterbelts (trees and shrubs), pasture, hayfields, savannah, railroad verge, and open area (3.5% combined) (Good et al. 2010). Unmowed grassland, mowed grassland, pasture, hayfields, savannah, and railroad verge may provide nesting habitat for grassland and passerine birds. However, these habitats exist only as small, isolated patches within the Project area. Similarly, the Project area contains only limited amounts of forested habitat (woodlot, shelterbelts). Forest fragments such as those found within the Project area are typically not considered high-quality nesting habitat for birds due to their limited size and abundance of edge habitat, which is associated with higher incidence of nest predation and parasitism (USGS 2011). These small patches of forest habitat may receive higher levels of bird use during migration, as forest fragments often provide stopover habitat for migrating passerines and other birds (Packett and Dunning 2009, as cited in Good et al. 2010). Forest fragments within the Project area may also provide limited amounts of foraging or roosting habitat for the nine bat species whose geographic distributions include Vermilion and Champaign Counties. Many of these species also forage along stream corridors or over water and may use the small areas of open water within the Project area (BCI 2010).

3.2 PRE-CONSTRUCTION AVIAN SURVEYS

3.2.1 Fixed-Point Bird Use Surveys

Fixed-point bird use surveys were conducted within the Project area by WEST from March 12, 2009 through February 15, 2010 (Good et al. 2010). Surveys were conducted weekly during the spring and fall migration seasons and monthly during the winter, to estimate the seasonal, spatial, and temporal use of the Project area by birds, particularly raptors. No surveys were conducted during the summer. Twenty-four survey events were conducted; 15 survey points, distributed throughout the Project area, were sampled for a period of 20 minutes during each survey event. Three hundred and sixty 20-minute fixed-point surveys were conducted: 180 in spring, 120 in fall, and 60 in winter. Results of these surveys are summarized below.

Forty-eight species were observed during all fixed-point surveys (Table 3.2), with an average species richness of 0.67 large bird species/2,625-ft [800-m] plot/20-min survey and 1.66 small bird species/328-ft [100-m] plot/20-min survey. The total number of species was greater in the spring (45 species) and fall (30) than in the winter (12). Three passerine species, European starling (*Sturnus vulagris*), brown-headed cowbird (*Molothrus ater*), and red-winged blackbird (*Agelaius phoeniceus*) composed 44 percent of all bird observations.

A total of 5,325 individual bird observations comprised of 1,469 separate groups was recorded during the surveys. Overall, use by large bird species was higher during the spring and fall (3.40 and 2.43 birds/2,625-ft [800-m] plot /20-min survey, respectively) than during the winter (1.05 birds/2,625-ft [800-m] plot /20-min survey; Table 3.3). Small bird use followed a similar pattern, with higher use in the spring and fall (9.10 and 10.53 birds/328-ft [100-m] plot /20-min survey, respectively) than in the winter (4.58 birds/328-ft [100-m] plot /20-min survey).

Waterbirds

Great blue heron (*Ardea herodias*) was the only waterbird species observed; use by this species was 0.04 birds/2,625-ft [800-m] plot /20-min survey in spring (Table 3.3). Waterbirds were not recorded in the fall or winter. Of the 7 great blue herons observed flying, 85.7 percent were below and 14.3 percent were within the rotor-swept area.

Waterfowl

Waterfowl had the highest use in the winter (0.15 birds/2,625-ft [800-m] plot /20-min survey), compared to other seasons (spring: 0.05; fall: <0.01). Canada goose was the only waterfowl species observed in the fall or winter, and comprised approximately 80 percent of waterfowl use in spring. Mallards (*Anas platyrhynchos*) accounted for the remaining spring waterfowl use. Of the 11 waterfowl observed flying, 90.9 percent were below and 9.1 percent were within the rotor-swept area.

Shorebirds

Shorebirds had higher use in the spring (2.37 birds/2,625-ft [800-m] plot /20-min survey) than in the fall (1.62), and were not observed during winter surveys. About 66 percent of spring shorebird use was due to use by American golden plover (*Pluvialis dominica*), but this species was observed during less than 3.3 percent of spring surveys, indicating that a few large groups were observed. Of the 509 shorebirds observed flying, 100 percent were below the rotor-swept area.

Raptors

Sixty-five individual raptors (excluding vultures) comprised of six species were recorded. Raptor use was fairly uniform among seasons, with 0.20 birds/2,625-ft [800-m] plot /20-min survey in the fall, 0.18 in the spring, and 0.15 in the winter (Table 3.3). Red-tailed hawk (*Buteo jamaicensis*) was the most commonly observed raptor species in the spring and winter (0.09 and 0.12 birds/2,625-ft [800-m] plot /20-min survey, respectively), while American kestrel (*Falco sparverius*) had slightly higher use in the fall (0.08 birds/2,625-ft [800-m] plot /20-min survey for American kestrels compared to 0.07 for red-tailed hawks). Of the 57 raptors observed flying, 71.9 percent were below, 21.1 percent were within, and 7.0 percent were above the rotor-swept area.

Data collected during fixed-point count surveys did not indicate the presence of important eagle use areas (i.e. nests and breeding territories, communal roosts and foraging concentrations, migration corridors and stopovers) within the Project area (Good et al. 2010). An additional survey was conducted in May 2011 to evaluate habitat along the Vermilion River for important eagle use areas (see Section 3.2.2).

Passerines

Passerines made up the greatest number of observations, comprising approximately 75 percent of all observations. As mentioned above, passerine (small bird) use was much higher in the fall and spring than in the winter. European starling had the highest use by any one species in the fall (5.47 birds/328-ft [100-m] plot /20-min survey) and winter (3.30) (Table 3.3). In the spring, three species had markedly higher use: common crackle (*Quiscalus quiscula*; 1.78 birds/328-ft [100-m] plot /20-min survey), brown-headed cowbird (1.69), and red-winged blackbird (1.62). A total of 2,712 passerines was observed flying in 684 groups within the 328-ft (100-m) plot; all small bird species were observed below the rotor-swept area.

Spatial Use of the Project Area

Flight paths for waterbirds, waterfowl, shorebirds, raptors, and vultures were digitized and mapped. No obvious flyways or concentration areas were observed. Large bird use was higher at point 11 (14.1 birds/2,625-ft [800-m] plot /20-min survey) compared to use at the remaining points, where use ranged from 0.58 to 3.96 birds/2,625-ft [800-m] plot /20-min survey. Passerine use, focused within 100 m of the point, was highest at points five and 11 (17.6 and 21.1 birds/328-ft [100-m] plot /20-min survey, respectively), where the majority of passerine use was comprised of European starling, red-winged blackbird, brown-headed cowbird, and common grackle. Passerine use ranged from 3.08 to 13.6 birds/328-ft [100-m] plot /20-min survey at the remaining points.

Sensitive Species

Four sensitive species were recorded during fixed-point bird use surveys. Three upland sandpipers, a state-endangered species (IDNR 2009) and a federal species of concern (USFWS 2008), were observed within the Project area. Ten northern harriers (*Circus cyaneus*) and one osprey (*Pandion haliaetus*), also both Illinois state-endangered species (IDNR 2009), were recorded during fixed-point surveys. In addition, 283 American golden plovers were observed in eight groups. While this species is not federally listed, it is a species of concern on the federal priority species lists (USFWS 2004). The number of state endangered species observations may represent repeated observations of the same individual in some cases.

Table 3.2 Total Number of Individuals and Groups, by Season and Overall, for each Bird Type, Raptor Subtype, and Species Observed during Fixed-Point Bird Use Surveys at the California Ridge Project Area, March 12, 2009-February 15, 2010

		Spring		Fall		Winter		Total	
Species/Type	**Scientific Name**	**No. Grp**	**No. Ind**	**No. Grp**	**No. Ind**	**No. Grp**	**No. Ind**	**No. Grp**	**No. Ind**
Waterbirds		**6**	**7**	**0**	**0**	**0**	**0**	**6**	**7**
Great blue heron	*Ardea herodias*	6	7	0	0	0	0	6	7
Waterfowl		**3**	**9**	**1**	**1**	**5**	**359**	**9**	**369**
Canada goose	*Branta canadensis*	2	7	1	1	5	359	8	367
Mallard	*Anas platyrhynchos*	1	2	0	0	0	0	1	2
Shorebirds		**110**	**426**	**22**	**195**	**0**	**0**	**132**	**621**
American golden-plover	*Pluvialis dominica*	8	283	0	0	0	0	8	283
Killdeer	*Charadrius vociferus*	97	138	22	195	0	0	119	333
Upland sandpiper	*Bartramia longicauda*	3	3	0	0	0	0	3	3
Wilson's snipe	*Gallinago delicata*	2	2	0	0	0	0	2	2
Raptors		**28**	**32**	**19**	**24**	**7**	**9**	**54**	**65**
Accipiters		**0**	**0**	**2**	**2**	**1**	**1**	**3**	**3**
Sharp-shinned hawk	*Accipiter striatus*	0	0	2	2	1	1	3	3
Buteos		**15**	**18**	**7**	**8**	**5**	**7**	**27**	**33**
Red-tailed hawk	*Buteo jamaicensis*	14	17	7	8	5	7	26	32
Rough-legged hawk	*Buteo lagopus*	1	1	0	0	0	0	1	1
Northern harrier	*Circus cyaneus*	5	5	4	4	1	1	10	10
Falcons		**7**	**8**	**6**	**10**	**0**	**0**	**13**	**18**
American kestrel	*Falco sparverius*	7	8	6	10	0	0	13	18
Other Raptors		**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**
Osprey	*Pandion haliaetus*	1	1	0	0	0	0	1	1

Species/Type	Scientific Name	Spring No. Grp	Spring No. Ind	Fall No. Grp	Fall No. Ind	Winter No. Grp	Winter No. Ind	Total No. Grp	Total No. Ind
Vultures		**16**	**23**	**17**	**19**	**0**	**0**	**33**	**42**
Turkey vulture	*Cathartes aura*	16	23	17	19	0	0	33	42
Upland Gamebirds		**16**	**17**	**0**	**0**	**0**	**0**	**16**	**17**
Northern bobwhite	*Colinus virginianus*	1	1	0	0	0	0	1	1
Ring-necked pheasant	*Phasianus colchicus*	15	16	0	0	0	0	15	16
Doves/Pigeons		**53**	**86**	**22**	**48**	**4**	**43**	**79**	**177**
Mourning dove	*Zenaida macroura*	52	84	22	48	3	31	77	163
Rock pigeon	*Columba livia*	1	2	0	0	1	12	2	14
Large Corvids		**7**	**12**	**1**	**5**	**2**	**2**	**10**	**19**
American crow	*Corvus brachyrhynchos*	7	12	1	5	2	2	10	19
Passerines		**906**	**2,184**	**182**	**1,513**	**37**	**305**	**1,125**	**4,002**
American goldfinch	*Carduelis tristis*	18	26	20	38	0	0	38	64
American robin	*Turdus migratorius*	94	182	30	68	0	0	124	250
Barn swallow	*Hirundo rustica*	40	71	7	37	0	0	47	108
Blue jay	*Cyanocitta cristata*	1	2	3	7	0	0	4	9
Brown-headed cowbird	*Molothrus ater*	119	411	9	200	0	0	128	611
Brown thrasher	*Toxostoma rufum*	3	3	1	1	0	0	4	4
Cedar waxwing	*Bombycilla cedrorum*	1	2	0	0	0	0	1	2
Chipping sparrow	*Spizella passerina*	14	15	1	1	0	0	15	16
Cliff swallow	*Petrochelidon pyrrhonota*	0	0	3	14	0	0	3	14
Common grackle	*Quiscalus quiscula*	120	387	7	30	0	0	127	417
Common yellowthroat	*Geothlypis trichas*	7	9	0	0	0	0	7	9
Dickcissel	*Spiza americana*	10	17	1	2	0	0	11	19

Species/Type	Scientific Name	Spring		Fall		Winter		Total	
		No. Grp	No. Ind	No. Grp	No. Ind	No. Grp	No. Ind	No. Grp	No. Ind
Eastern kingbird	*Tyrannus tyrannus*	6	8	0	0	0	0	6	8
Eastern meadowlark	*Sturnella magna*	105	131	10	13	0	0	115	144
European starling	*Sturnus vulgaris*	48	168	34	780	10	228	92	1,176
Gray catbird	*Dumetella carolinensis*	2	2	0	0	0	0	2	2
Horned lark	*Eremophila alpestris*	87	123	18	44	20	46	125	213
House finch	*Carpodacus mexicanus*	2	3	0	0	0	0	2	3
House sparrow	*Passer domesticus*	17	47	4	11	1	1	22	59
Indigo bunting	*Passerina cyanea*	5	5	0	0	0	0	5	5
Lapland longspur	*Calcarius lapponicus*	16	105	0	0	5	20	21	125
Northern cardinal	*Cardinalis cardinalis*	8	9	1	1	0	0	9	10
Purple martin	*Progne subis*	0	0	1	30	0	0	1	30
Red-winged blackbird	*Agelaius phoeniceus*	140	402	11	143	1	10	152	555
Song sparrow	*Melospiza melodia*	16	21	0	0	0	0	16	21
Tree swallow	*Tachycineta bicolor*	7	12	13	84	0	0	20	96
Unidentified sparrow		0	0	1	2	0	0	1	2
Unidentified warbler		0	0	1	1	0	0	1	1
Vesper sparrow	*Pooecetes gramineus*	20	23	6	6	0	0	26	29
Other Birds		**4**	**4**	**1**	**2**	**0**	**0**	**5**	**6**
Chimney swift	*Chaetura pelagica*	2	2	0	0	0	0	2	2
Northern flicker	*Colaptes auratus*	2	2	1	2	0	0	3	4
Overall		**1,149**	**2,800**	**265**	**1,807**	**55**	**718**	**1,469**	**5,325**

Table 3.3 Mean Bird Use[1], Percent of Total Composition (%), and Frequency of Occurrence (%), by Season and Overall, for each Bird Type, Raptor Subtype, and Species Observed during Fixed-Point Surveys at the California Ridge Project Area, March 12, 2009-February 15, 2010

	Mean Use			% Composition			% Frequency		
Species/Type	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**	**Spring**	**Fall**	**Winter**
Waterbirds	**0.04**	**0**	**0**	**1.1**	**0**	**0**	**3.3**	**0**	**0**
Great blue heron	0.04	0	0	1.1	0	0	3.3	0	0
Waterfowl	**0.05**	**<0.01**	**0.15**	**1.5**	**0.3**	**14.3**	**1.7**	**0.8**	**5.0**
Canada goose	0.04	<0.01	0.15	1.1	0.3	14.3	1.1	0.8	5.0
Mallard	0.01	0	0	0.3	0	0	0.6	0	0
Shorebirds	**2.37**	**1.62**	**0**	**69.6**	**66.8**	**0**	**51.7**	**18.3**	**0**
American golden-plover	1.57	0	0	46.2	0	0	3.3	0	0
Killdeer	0.77	1.62	0	22.5	66.8	0	48.3	18.3	0
Upland sandpiper	0.02	0	0	0.5	0	0	1.7	0	0
Wilson's snipe	0.01	0	0	0.3	0	0	1.1	0	0
Raptors	**0.18**	**0.20**	**0.15**	**5.2**	**8.2**	**14.3**	**13.9**	**15.0**	**11.7**
Accipiters	**0**	**0.02**	**0.02**	**0**	**0.7**	**1.6**	**0**	**1.7**	**1.7**
Sharp-shinned hawk	0	0.02	0.02	0	0.7	1.6	0	1.7	1.7
Buteos	**0.10**	**0.07**	**0.12**	**2.9**	**2.7**	**11.1**	**7.8**	**5.8**	**8.3**
Red-tailed hawk	0.09	0.07	0.12	2.8	2.7	11.1	7.2	5.8	8.3
Rough-legged hawk	<0.01	0	0	0.2	0	0	0.6	0	0
Northern harrier	0.03	0.03	0.02	0.8	1.4	1.6	2.8	3.3	1.7
Falcons	**0.04**	**0.08**	**0**	**1.3**	**3.4**	**0**	**3.9**	**5.0**	**0**
American kestrel	0.04	0.08	0	1.3	3.4	0	3.9	5.0	0
Other Raptors	**<0.01**	**0**	**0**	**0.2**	**0**	**0**	**0.6**	**0**	**0**
Osprey	<0.01	0	0	0.2	0	0	0.6	0	0
Vultures	**0.13**	**0.16**	**0**	**3.8**	**6.5**	**0**	**8.9**	**14.2**	**0**
Turkey vulture	0.13	0.16	0	3.8	6.5	0	8.9	14.2	0
Upland Gamebirds	**0.09**	**0**	**0**	**2.8**	**0**	**0**	**8.9**	**0**	**0**
Northern bobwhite	<0.01	0	0	0.2	0	0	0.6	0	0
Ring-necked pheasant	0.09	0	0	2.6	0	0	8.3	0	0
Doves/Pigeons	**0.48**	**0.40**	**0.72**	**14.1**	**16.4**	**68.3**	**23.3**	**18.3**	**6.7**

Species/Type	Mean Use			% Composition			% Frequency		
	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter
Mourning dove	0.47	0.40	0.52	13.7	16.4	49.2	23.3	18.3	5.0
Rock pigeon	0.01	0	0.20	0.3	0	19.0	0.6	0	1.7
Large Corvids	**0.07**	**0.04**	**0.03**	**2.0**	**1.7**	**3.2**	**3.9**	**0.8**	**3.3**
American crow	0.07	0.04	0.03	2.0	1.7	3.2	3.9	0.8	3.3
Overall (Large Birds)	**3.40**	**2.43**	**1.05**	**100**	**100**	**100**			
Passerines	**9.08**	**10.52**	**4.58**	**99.8**	**99.8**	**100**	**94.4**	**78.3**	**45.0**
American goldfinch	0.11	0.32	0	1.2	3.0	0	6.7	16.7	0
American robin	0.78	0.52	0	8.5	4.9	0	33.9	22.5	0
Barn swallow	0.34	0.22	0	3.8	2.1	0	19.4	5.0	0
Blue jay	0	<0.01	0	0	<0.1	0	0	0.8	0
Brown-headed cowbird	1.69	1.67	0	18.6	15.8	0	47.2	7.5	0
Brown thrasher	0	<0.01	0	0	<0.1	0	0	0.8	0
Cedar waxwing	0.01	0	0	0.1	0	0	0.6	0	0
Chipping sparrow	0.04	<0.01	0	0.4	<0.1	0	3.3	0.8	0
Cliff swallow	0	0.12	0	0	1.1	0	0	2.5	0
Common grackle	1.78	0.22	0	19.5	2.1	0	41.7	5.0	0
Common yellowthroat	0.03	0	0	0.3	0	0	2.2	0	0
Dickcissel	0.06	0.02	0	0.6	0.2	0	2.8	0.8	0
Eastern kingbird	0.04	0	0	0.5	0	0	3.3	0	0
Eastern meadowlark	0.31	0.05	0	3.4	0.5	0	24.4	4.2	0
European starling	0.68	5.47	3.30	7.4	52.0	72.0	20.0	22.5	11.7
Gray catbird	0.01	0	0	0.1	0	0	1.1	0	0
Horned lark	0.51	0.37	0.77	5.6	3.5	16.7	32.2	15.0	31.7
House finch	0.02	0	0	0.2	0	0	1.1	0	0
House sparrow	0.26	0.09	0.02	2.9	0.9	0.4	8.9	3.3	1.7
Indigo bunting	0.03	0	0	0.3	0	0	2.8	0	0
Lapland longspur	0.49	0	0.33	5.4	0	7.3	7.2	0	8.3
Northern cardinal	0.05	<0.01	0	0.5	<0.1	0	4.4	0.8	0
Purple martin	0	0.25	0	0	2.4	0	0	0.8	0
Red-winged blackbird	1.62	0.43	0.17	17.8	4.1	3.6	48.9	6.7	1.7

Species/Type	Mean Use			% Composition			% Frequency		
	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter
Song sparrow	0.09	0	0	1.0	0	0	6.1	0	0
Tree swallow	0.04	0.66	0	0.5	6.2	0	3.3	10.0	0
Unidentified sparrow	0	0.02	0	0	0.2	0	0	0.8	0
Unidentified warbler	0	<0.01	0	0	<0.1	0	0	0.8	0
Vesper sparrow	0.10	0.05	0	1.1	0.5	0	8.3	5.0	0
Other Birds	**0.02**	**0.02**	**0**	**0.2**	**0.2**	**0**	**1.7**	**0.8**	**0**
Chimney swift	<0.01	0	0	<0.1	0	0	0.6	0	0
Northern flicker	0.01	0.02	0	0.1	0.2	0	1.1	0.8	0
Overall (Small Birds)	**9.10**	**10.53**	**4.58**	**100**	**100**	**100**			

[1] Number of large birds/2,625-ft [800-m] plot /20-min survey, Number of small birds/328-ft [100-m] plot/20-min survey

3.2.2 Bald Eagle Nest Surveys

A bald eagle nest survey was conducted in May 2011 by WEST to evaluate areas within 2.0 miles (3.2 km) of proposed turbine locations for use by nesting bald eagles, with a focus on potential nesting habitat along the Vermilion River (Ritzert et al. 2011). All suitable eagle nesting habitats within the 2.0-mile (3.2-km) buffer that were not previously surveyed during the avian surveys in 2009 (Good et al. 2010) were surveyed from public roads in 2011. Biologists used binoculars and spotting scopes to search for bald eagle nests and conducted 20-minute fixed-point count surveys similar to Reynolds et al. (1980) at 17 point count stations to record bald eagle use. Fixed-point count surveys were used because leaf-out had already occurred and searchers' ability to detect nest structures was limited. Point count locations were focused near areas of potential nesting and foraging habitat near the Middle Fork; however, public roads were not present along some portions of the river. Additional areas within the 2.0-mile (3.2-km) buffer that were not surveyed for nesting raptors in 2009 were surveyed by driving public roads to confirm lack of suitable bald eagle nesting habitat and document any new raptor nest structures.

Habitat within the Project area was dominated by tilled agriculture and generally lacked potential nesting habitat for bald eagles. Potential nesting and foraging habitat was present outside the Project area along the Middle Fork. However, no bald eagles or bald eagle nest structures were observed during the 2011 survey. In addition, no new raptor nests were identified within the 2.0-mile (3.2-km) turbine buffer. Detection ability during the survey was reduced by leaf-out and the lack of public roads near some portions of the Vermillion River limited where point count surveys could be conducted (Ritzert et al. 2011).

3.3 PRE-CONSTRUCTION BAT SURVEYS

3.3.1 Acoustic Surveys

Acoustic surveys of bat activity within the Project area were conducted by BHE Environmental, Inc. from August 5 to November 4, 2009 (BHE Environmental, Inc. 2010a). Surveys designed to detect ultrasonic bat calls within the Project area were implemented in accordance with methods, goals, and objectives established in coordination with the IDNR. Ultrasonic detectors (Anabat II with CF ZCAIM) were mounted on three meteorological (MET) towers within the Project area to assess bat activity during the fall migration period. Habitat surrounding each MET tower differed slightly. MET Tower 1 was situated in a corn field adjacent to a bean field. MET Tower 2 was in an old field adjacent to a pond and corn and bean fields. MET Tower 3 was in a bean field adjacent to a road. Anabat detectors were mounted at 7 ft (2 m) and 190 ft (58 m) above ground level on MET Towers 1 and 3; MET tower 2 had only one detector, mounted at 7 ft (2 m). Each Anabat unit was programmed to collect data every night for 91 consecutive nights, from approximately 30 minutes prior to civil sunset to 30 minutes after civil sunrise. Due to background noise, memory card space, and Anabat malfunctions, recording did not occur on all nights at each tower. However, the Anabats recorded on 219 of the 274 total nights (80%). Results of these surveys are summarized below.

Passes were tallied as either high (≥35 kHz) or low (<35 kHz) frequency based on characteristic frequency and, when possible, identified to one of five species groups. Hoary bats (*Lasiurus cinereus*), big brown bats, silver-haired bats (*Lasionycteris noctivigans*), and occasionally red bats (*Lasiurus borealis*) and evening bats produce calls with characteristic frequencies below 35 kHz. Little brown bats (*Myotis lucifugus*), northern long-eared bats (*Myotis septentrionalis*), Indiana bats, tri-colored bats (*Perimyotis subflavus* [formerly eastern pipistrelles, *Pipistrellus subflavus*]) and often red bats and evening bats produce calls with a characteristic frequency at or above 35 kHz. Some species produce unique call sequences and can be identified to species (hoary bats and tri-colored bats), while others produce sequences too similar to be distinguished from other species. Because of the difficulty in distinguishing some species with similar call sequences (big brown bats from silver-haired bats, red bats from evening bats, and those species in the genus *Myotis* [little brown bats, northern long-eared bats, and Indiana bats]), these species were grouped. The five species groups potentially in the Project area include 1) hoary bats, 2) big brown/silver-haired bats, 3) red/evening bats, 4) little brown/northern long-eared/Indiana bats, and 5) tri-colored bats.

The Anabat at MET Tower 2 recorded 239 bat passes during 77 nights, averaging 3.10 + 6.07 bat passes per night. The Anabat at MET Tower 3 recorded 537 bat passes during 83 nights, averaging 6.47 + 7.67 bat passes per night. The Anabat at MET Tower 1 filled with background noise on all nights except two; consequently, data from this Anabat were excluded from further analysis. Table 3.4 presents the species composition and seasonality of the bat passes. It is important to note that each bat pass does not necessarily represent each bat present within the survey area; a single bat may be recorded several times, or pass the Anabat without being detected. These results are instead representative of relative levels of bat activity.

Table 3.4 Summary of Bat Passes Recorded at MET Towers 2 and 3 Each Month between August and October, 2009.

MET Tower	Month	Hoary bat	Big brown/ Silver-haired bat	Red/Evening bat	*Myotis* spp.	Tri-colored bat	Unknown bats	Total Passes
2	August	1	44	15	24	3	2	88
	September	0	119	0	3	4	11	137
	October	0	4	2	1	0	6	13
3	August	44	78	91	1	8	5	227
	September	18	189	49	1	8	27	292
	October	0	14	2	0	0	2	18
Total MET 2		1	167	17	28	7	19	239
Total MET 3		62	281	142	2	16	34	537
Total		**63**	**448**	**159**	**30**	**23**	**54**	**776**

While bat passes were recorded throughout all hours of the night, the majority of bat passes were recorded during the first half of the night, with 59 percent and 63 percent of all passes being recorded at MET Towers 2 and 3, respectively, within six hours of civil sunset. The number of bat passes peaked a second time around the ninth hour after sunset at MET Tower 3.

Throughout the three month sampling period, the number of bat passes recorded varied substantially from night to night. The total number of bat passes recorded each night ranged from zero (numerous nights in October at both towers) to 35 (September 30) at MET Tower 2 and 27 (September 10) at MET Tower 3. The number of bat passes recorded per night was the least variable in October, when the number of passes varied between 0 and 4 in a night at MET Tower 2 and 0 and 6 at MET Tower 3. The greatest variation occurred in September at both MET towers.

Though microphones were placed at both 7 ft (2 m) and 190 ft (58 m), one each at the three towers, sample size and other variables such as habitat differences (i.e., corn [MET Tower 1] and bean fields [MET Tower 3] compared to fallow field with a pond [MET Tower 2]) made quantitative comparisons between activity detected at the different heights impossible. Bat passes were examined for species group composition, activity throughout the night, and activity changes each week throughout the fall season. The majority (73% at MET Tower 2 and 83% at MET Tower 3) of echolocation calls recorded were generated by the low frequency group (<35 kHz), which includes hoary bats, big brown bats, silver-haired bats, and occasionally red bats and evening bats. All but evening bats are relatively large-bodied, less maneuverable bats that tend to forage in open habitats where there are fewer obstacles (Brooks and Ford 2005). Insects are less abundant in open areas, and bats adapted to forage in open areas tend to have lower frequency calls, which travel farther than higher frequencies, thus increasing the search range of the bat (Altringham 1996). In addition, because low frequency vocalizations travel farther than those at high frequencies, the detectors likely record low-frequency bats at a greater distance from the microphone than high-frequency bats.

Arnett et al. (2006) and Redell et al. (2006) reported greater high frequency group activity at low elevations, and greater low frequency group activity at high elevations. Based upon the relative number of ultrasound calls recorded, results from these studies suggest that during the fall migration bats with high frequency calls (smaller bats) are less active at rotor-swept height than bats with low frequency calls (larger bats). This is consistent with results of studies that suggest different species of bats partition their use of habitats vertically (Kalcounis et al. 1999; Hayes and Gruver 2000). Results from California Ridge may indicate patterns similar to these studies; however, microphone height is only one possible explanation for the different proportions of bats found at each tower.

Acoustic data, such as these described for the California Ridge Wind Energy Project, are useful in characterizing bat communities and populations at a study site. However, these data are not reliable for definitively determining species presence at a site because of the similarity in echolocation frequencies between species, and patterns shared among species. As such, these data are most often used to determine bat activity at the genus level or, indirectly, by call frequency groupings, as discussed above. Furthermore, acoustic data cannot be used to estimate local population sizes of bat species in a specific geographic area because there is no way to determine how many bats made the calls that were recorded (e.g., a single bat can fly by a detector multiple times), nor can the sex or age of a bat be determined from acoustic data (Kunz et al 2007).

3.4 ADDITIONAL SITE-SPECIFIC BIRD AND BAT INFORMATION

3.4.1 Birds

Christmas bird counts (CBC) were conducted in both Champaign and Vermilion Counties in 2010 (National Audubon Society, Inc 2010). In the Champaign County count circle, a total of 66 species were recorded. Canada goose and European starling were by far the most frequently-observed species. In the

Middle Fork River Valley count circle (Vermilion County), 70 species were recorded. In the Forest Glen Preserve count circle (Vermilion County), 51 species were recorded. Canada goose, American crow (*Corvus brachyrhynchos*), and European starling were by far the most frequently-observed species for both of these counts.

One breeding bird survey (BBS) route, the Dailey route, is located near the Project area, in Vermilion County (USGS 2008). A total of 101 species has been recorded along this route during surveys from 1966-2007. House sparrow (*Passer domesticus*), common grackle, eastern meadowlark (*Sturnella magna*), red-winged blackbird, European starling, American robin, horned lark (*Eremophilia alpestris*), and ring-necked pheasant (*Phasianus colchicus*) were the most frequently-observed species.

Consultation with USFWS and IDNR identified several listed bird species which may occur within the Project area. The only ESA-listed species was the whooping crane (*Grus americana*); members of an experimental population may potentially pass through the Project area during migration, as Illinois is located within the migration route of this population (USFWS correspondence dated 14 May 2009). State-listed bird species included: least bittern (*Ixobrychus exilis*), northern harrier, barn owl, short-eared owl (*Asio flammeus*), upland sandpiper, loggerhead shrike, and black-billed cuckoo (*Coccyzus erythrophtalmus*). The Project area may provide suitable nesting habitat for barn owl, upland sandpiper, and loggerhead shrike (IDNR correspondence dated 4 December 2009).

Although no longer ESA-listed, bald eagles remain protected under BGEPA and were therefore discussed during consultation. The closest known bald eagle (*Haliaeetus leucocephalus*) nest is located on the North Fork River just above Lake Vermilion, approximately seven miles (11 km) east of the Project area. It is thought likely that new nests will be established along the North Fork, Middle Fork, and Salt Fork Rivers during the Project's life, given the increasing bald eagle population in Illinois. However, no other nests are known at this time (IDNR correspondence dated 4 December 2009).

3.4.2 Bats

A total of 12 species of bats occur in Illinois. Nine species, all members of the family Vespertilionidae, have geographic distributions that include Vermilion and Champaign counties: big brown bat, silver-haired bat, red bat, hoary bat, little brown bat, northern long-eared bat, Indiana bat, tri-colored bat, and evening bat (BCI 2010; Table 3.4). Of these species, only the Indiana bat is listed under the ESA as endangered. The northern long-eared bat is currently under review by the USFWS for listing under the ESA, and a separate request has been submitted for a status review of the little brown bat.

Table 3.5 Bats Potentially Present within the California Ridge Project Area during Summer, Winter, and Migration (Summer/Fall)

Species	Federal status	Abundance	Potential Seasonal Presence within the California Ridge Project Area		
			Summer	Winter	Migration
Big brown bat	None	Common	X	X	X
Silver-haired bat	None	Common	X		X
Eastern red bat	None	Common	X		X
Hoary bat	None	Limited distribution, uncommon	X		X
Little brown bat	Status review	Common	X		X

Northern long-eared bat	Petitioned for listing	Common	X		X
Indiana bat	Endangered	Rare	X		X
Evening bat	None	Limited distribution, uncommon	X		X
Tri-colored bat	None	Common	X		X

Indiana bat summer maternity colonies have been documented in forested riparian tracts along the Middle Fork of the Vermilion River and the Big Four Ditch in Ford County, north of the Project area. Maternity colonies are also known to occur along the Little Vermilion River in the southern half of Vermilion County (IDNR correspondence dated 4 December 2009). The IDNR postulates that Indiana bats traverse or roost in all segments of the Vermilion River system which provide appropriate habitat. The closest known hibernaculum is Blackball Mine located LaSalle County, approximately 99 mi (158 km) northwest of the Project area. Indiana bats using the Middle Fork for summer habitat most likely migrate from hibernation sites in southwestern Indiana and Kentucky, although a banding study in the 1970's indicated that at least some LaSalle County bats move south towards the Middle Fork. Because the actual winter hibernation sites of Middle Fork Indiana bats are unknown, individuals may potentially migrate across or through the Project area. The Project area does not appear to contain summer nursery or roosting habitat for Indiana bats, although some individuals roosting along the Middle Fork may forage above fields within the Project area (IDNR correspondence dated 4 December 2009). During consultation, the USFWS recommended a 1000 ft (305 m) setback from connected foraging habitats to avoid impacts to these foraging individuals, and CRWE has micro-sited turbines in accordance with this recommendation (see Section 2.1. above).

4.0 POTENTIAL IMPACTS TO BIRDS AND BATS

4.1 BIRDS

4.1.1 Impacts from the California Ridge Project

The Project is sited within previously altered habitat that is dominated by tilled and un-tilled agriculture, and developed areas, which comprise 92.1 percent of the area. The area also receives regular vehicular traffic and human activity, especially during the growing season. CRWE has committed to placing turbines within tilled and untilled agricultural areas and avoiding placing turbines within pasture and grassland habitats. The area with the highest diversity of landcover in the region is located along the Middle Fork of the Vermillion River, which is located outside of the Project area (Good et al. 2010).

Habitat Fragmentation and Displacement during Construction and Decommissioning

Construction of the Project will temporarily disturb approximately 774 acres (312 ha); 117 acres (36 ha) will remain disturbed throughout the life of the Project. Because the Project is sited in a largely agricultural setting and facilities have been micro-sited to avoid native habitats, fragmentation of native habitats from Project construction will be low. Incidental injury/ mortality and disturbance of birds due to elevated levels of human activity during construction and decommissioning are also expected to be very low.

The large majority of birds detected during surveys within and near the Project area were common species adapted to human disturbance (Good et al. 2010, National Audubon Society, Inc. 2010, USGS 2008); these species are less likely to be displaced due to Project activities (Shaffer and Johnson 2008 and Kerlinger 2002). Avian habitat within the Project area is predominately disturbed or fragmented, with a high ratio of edge habitat to interior habitat. Additionally, pre-construction surveys indicate that bird use and diversity in the Project area is relatively low. Displacement effects from Project construction and decommissioning are therefore expected to be low.

Incidental injury or mortality of juvenile birds may occur if construction occurs in non-tilled areas during the breeding season. However, nesting habitat for ground- and shrub-nesting birds is limited within the Project area, due to the predominance of active agriculture, and CRWE has incorporated several strategies in the Project siting process and construction plans, discussed in Section 2.3.3, which are designed to minimize these potential impacts. Direct injury or mortality during construction and decommissioning is expected to be low.

Displacement and Collision-related Mortality during Operations

Although Project operations have the potential to cause displacement of birds from the Project area, bird species sensitive to disturbance currently exhibit low use of the Project area and minimal suitable habitat for these species is present, as discussed above. The majority of birds occurring within the Project area are members of common, disturbance-tolerant species. Therefore, it is unlikely that displacement impacts from the turbines would greatly alter the composition of the area's avian community. For species that are displaced, it is unclear if displacement impacts would persist for the life of the Project; certain species may adapt to the presence of the turbines (The Ornithological Council 2007). Studies of displacement impacts to birds from operating turbines are limited; clear and consistent patterns of impacts have yet to be established (Poulton 2010).

Northern harrier, a prominent, state-endangered, grassland species, was observed using the Project area during the migration seasons. Displacement of migrating northern harriers from wind turbines has not been documented. Breeding northern harriers showed lower than expected use of the Buffalo Ridge, MN Phase 2 wind project at small (within 328 ft [100 m]) and large (344-17,598 ft [105-5,364 m]) scales in a

1998 Before/After-Control/Impact (BACI) study of grassland bird use (Johnson et al. 2000). However, use of the Phase 2 area at a small scale by northern harriers was not significantly different than expected in 1999, nor was use of Phase 2 or 3 areas at a large scale different than expected in 1999.

Low numbers of upland sandpipers (three individuals), also a state-endangered, grassland species, were observed within the Project area. The potential for Project operation to displace upland sandpipers is difficult to assess. However, the only post-construction study currently available for a wind-energy facility where upland sandpipers were present documented no significant difference in use of the facility prior to construction and use during operation (Johnson et al. 2000).

One osprey (state-endangered) was recorded within the Project area. This species is typically found in close association with water resources such as lakes and rivers (Good et al. 2010a). Because open water habitat is extremely limited (<0.1%) within the Project area and this species is considered an uncommon migrant and occasional summer resident in Illinois (Good et al. 2010a), displacement impacts to osprey from the Project are unlikely.

The operating turbines will also pose a risk of bird mortalities from collisions. Based on the results of post-construction mortality studies at similar facilities, the Project should have fatality rates similar to those observed at other western and Midwestern facilities, within the range of 0.44 to 11.83 b/t/y. A comparison of the California Ridge pre-construction avian survey results to other available pre-construction survey reports indicates that surveys within the Project area detected many fewer birds and fewer species than have generally been detected at other Midwest wind energy sites. Publically-available pre-construction surveys for wind projects in Illinois are extremely limited; however, surveys at several other agricultural wind energy project areas in Wisconsin reported much higher numbers of birds detected for given levels of survey effort. Survey results are not directly comparable across these sites due to variations in sample plot size, timing of surveys, and other differences in study design. Instead, these data provide a high-level reference of bird detections over given periods of survey effort for Midwest wind projects. Survey hours represent the additive total effort; effort of independent search parties, even those searching simultaneously, contributes as separate time periods.

Over a total of 120 survey hours at the Project area, 5,325 birds comprised of 48 species were observed. At the Glacier Hills wind energy site, located in an agricultural landscape in Wisconsin, a total of 59,643 birds of 151 species were observed over 123.5 survey hours (Cutright 2009). Over a total of 188.3 survey hours at the Forward Energy Center, WI, 6,522 birds of 134 species were observed in forested plots, 3,950 birds of 98 species were observed in grassland plots, and 2,808 birds of 105 species were observed in wetland plots (Kerlinger et al. 2007a). At the Ledge Wind Resource Area, WI, a total of 14 survey hours in 2008 recorded 5,707 birds of 46 species and a total of 371.67 survey hours in 2009 recorded 52,435 birds of 59 species (Derby et al. 2010). Pre-construction surveys at the Cedar Ridge Wind Farm, WI, detected 52,956 birds of 120 species over a total of 275.3 survey hours (Guarnaccia and Kerlinger 2008). At the Blue Sky and Green Field Wind Energy Projects, WI, a total of 79.5 survey hours were conducted at each project area. Surveys detected 31,136 birds of 125 species at Blue Sky and 16,211 birds of 116 species at Green Field (Gruver et al. 2009).

Raptor passage rates at the Project area were similar to those recorded at other Midwest sites. Plot sizes varied slightly across studies, but the results of other pre-construction surveys provide a relative comparison of raptor use per 20 minutes of survey effort. During the California Ridge avian surveys, a total of 65 raptors comprised of six species were observed; raptor use averaged 0.20, 0.15, and 0.18 raptors/plot/20 min survey in the fall, winter, and spring, respectively. At Buffalo Ridge, MN, raptor use averaged 0.78, 0.22, 0.64, and 0.60 raptors/plot/20 min survey in the fall, winter, spring, and summer, respectively (Johnson et al. 2000). At Black Fork, OH, raptor use averaged 0.13 and 0.26 raptors/plot/20 min survey in the fall and spring, respectively (Ecology and Environment 2009 as cited in Good et al. 2010a). At Grand Ridge, IL, raptor use averaged 0.20, 0.10, and 0.32 raptors/plot/20 min survey in the fall, winter, and spring, respectively (Derby et al. 2009 as cited in Good et al. 2010a). At Buckeye Wind, Ohio, raptor use averaged 0.11 and 0.20 raptors/plot/20 min survey in the fall and spring, respectively (Stantec 2009). The number of raptor species detected has been similar across Midwest sites, ranging from 4 to 13 species (Kerlinger et al. 2007a; Derby et al 2010; Guarnaccia and Kerlinger 2008; Cutright 2006 and 2009).

Given the low numbers of birds and bird species detected, the moderate raptor use rate, and the placement of turbines away from the Middle Fork of the Vermilion River and associated native habitats, mortality rates are likely to be at the low end of the known range (0.44 to 11.83 b/t/y). Studies at the Crescent Ridge site, located in an agricultural landscape in Illinois, reported mortality rates of 0.49 b/t in fall 2005 and 0.47 b/t in spring 2006 (Kerlinger et al. 2007b). However, recent post-construction studies at the Blue Sky Green Field (Gruver et al. 2009) and Cedar Ridge (BHE Environmental, Inc. 2010b) facilities in Wisconsin have demonstrated that avian mortality rates at the high end of this range may occur at facilities sited in agricultural habitats.

Bird fatality rates at the Project area are likely to peak during the spring and fall migration seasons, as has been observed at most wind energy facilities (Johnson et al. 2002 as cited in NWCC 2010). Passerines, both resident and migrant, are likely to constitute the greatest number of fatalities in the Project area, as this avian group represents the majority (75%) of mortalities at wind turbines nationwide and was by far the group most frequently observed during surveys within and near the Project area (Good et al. 2010, National Audubon Society, Inc. 2010, USGS 2008). Night-migrating passerines may be at a higher risk, as this group has accounted for over 50 percent of avian fatalities at certain sites, but no particular species or group of species has been identified as incurring greater numbers of fatalities (Erickson et al. 2002). Birds taking off at dusk or landing at dawn, or birds traveling in low cloud or fog conditions (which lower the flight altitude of most migrants) are likely at the greatest risk of collision (Kerlinger 1995). Nationally, these mortalities have not been known to result in a significant population level impact to any one species, mainly because the migratory species with relatively high collision mortality are regionally abundant. Additionally, no large scale night migration related mortality events have been observed at wind farms as have been seen at communications towers (Erickson et al. 2002).

Collision risk is likely to be much lower for other bird groups in the Project area. Very few waterbirds or waterfowl were observed during the pre-construction avian surveys; higher numbers of shorebirds were observed, primarily killdeer (*Charadrius vociferous*) and American golden plover (Good et al. 2010). However, national research has demonstrated that waterbirds rarely collide with inland turbines (Everaert 2003 and Kingsley and Whittam 2007 as cited in NWCC 2010), perhaps because of the consistently high (150-1500 m) altitudes at which waterbirds migrate over land (Kerlinger 1995). No American golden plover fatalities were documented at the Fowler Ridge wind farm (Good et al. 2011), although they are known to occur on that site, so risk to this species is low. Risk to waterfowl may be increased at the Project area during the winter months if the croplands within the Project area attract large flocks of Canada geese (Erickson et al. 2002). Raptor use of the Project area was observed to be relatively low during the pre-construction surveys. No strong association with topographic features within the Project area was noted for raptors. The most frequently-observed raptor species were red-tailed hawk and American kestrel, both common species in the Midwest (Good et al. 2010). Given the lack of major raptor migration routes through the Project area and the absence of abundant prey communities (Good et al. 2010), raptor fatality rates at the California Ridge site are expected to be lower than or similar to those at other Midwest sites, not likely to exceed one or two strikes a year (Poulton 2010).

Results of the avian studies in the Project area show only four species regularly flew within the rotor-swept area (Table 4.1); however, overall use by these species was low, and thus the calculated exposure index was also low. Therefore, no particular species is expected to be at high risk from the Project.

Table 4.1 Relative Exposure Index for Species Observed Flying within Rotor-Swept Area during Fixed-Point Bird Use Surveys, March 12, 2009-February 15, 2010

Species	No. of Groups Flying	Overall Mean Use	% Flying	% Flying within Rotor-Swept Area at Initial Obs.	Exposure Index	% Flying within Rotor-Swept Area at Any Time
Red-tailed hawk	21	0.1	84.4	44.4	0.04	48.1
Turkey vulture	33	0.08	100	38.1	0.03	47.6
Canada goose	4	0.08	52.9	11.1	<0.01	11.1
Great blue heron	6	0.01	100	14.3	<0.01	14.3

Concerns expressed by the USFWS and IDNR regarding avian resources within the Project area focused primarily on collision risks during the migration season to listed species and certain other migratory birds. The USFWS and IDNR both expressed concern for migrating American golden plovers, a migratory bird and species of concern on the federal priority species lists and whooping cranes, an ESA-listed endangered species with an experimental, non-essential population that migrates across Illinois. USFWS also expressed concern for Smith's longspur (*Calcarius pictus*), a migratory bird species which may pass through the Project area. The IDNR expressed concern for several state-listed species which are known or have the potential to occur near or within the Project area: least bittern, northern harrier, barn owl, short-eared owl, upland sandpiper, loggerhead shrike, and black-billed cuckoo. IDNR also expressed concern for Henslow's sparrow (*Ammodramus henslowii*), a recently de-listed migratory bird.

Three of the above-listed species (American golden plover, upland sandpiper, and northern harrier) were observed within the Project area during pre-construction surveys (Good et al. 2010). None of these species were observed flying in the rotor-swept area. Although northern harriers typically fly at heights below the rotor-swept area of turbines, as demonstrated during pre-construction surveys within the Project area (Good et al. 2010), they have occasionally been documented as fatalities at other wind energy facilities (Erickson et al. 2001). The potential therefore exists for northern harrier mortalities to occur at the Project, particularly during migration, but mortalities are expected to be few considering the low use of the Project area by the species. Johnson et al. (2000) documented no upland sandpiper mortalities at the Buffalo Ridge, MN, wind energy facility, despite presence of the species. Osprey are considered an uncommon migrant and occasional summer resident in Illinois and the potential therefore exists for ospreys to collide with turbines at any wind energy facility in Illinois during migration. Risk to ospreys within the Project area is expected to be low based on the low observed use of the Project area (one individual; Good et al. 2010a). All of the state-listed species observed within the Project area are considered to be at low collision risk due the results of other post-construction mortality studies and the species' low observed use of the rotor-swept area.

The closest known bald eagle nest is located approximately seven miles (11 km) east of the Project area; therefore, the Project is unlikely to pose any direct threat to the nesting bald eagles or their hunting territory (IDNR correspondence dated 4 December 2009). However, bald eagle nests have been increasing in Illinois and if any undocumented bald eagles begin nesting along the Middle Fork of the Vermillion River during the life of the Project, those bald eagles may be at risk of collision (K. Shank, IDNR; pers. comm. with WEST). There may also be a collision risk for migrating bald eagles, as the species is known to frequently fly over land during migration. Neither bald eagles nor important eagle-use areas were detected during pre-construction avian surveys within the Project area, although they have been recorded during breeding bird surveys and Christmas bird counts in Champaign and Vermilion Counties (Good et al. 2010, National Audubon Society, Inc. 2010, USGS 2008). Because additional surveys in 2011 did not indicate the presence of eagle-use areas along the segment of the Vermilion River adjacent to the Project area, the Project likely poses low risk to bald eagles at this time.

4.2 BATS

4.2.1 Impacts from the California Ridge Project

All Bats

Pre-construction acoustic bat surveys indicated a moderate level of bat activity within the Project area. Compared to the 4.85 average bat passes per detector night recorded during the fall at the California Ridge site, 6.78 bat passes per detector night were recorded at the Cedar Ridge site in Wisconsin (BHE Environmental, Inc. 2007 as cited in BHE Environmental, Inc. 2010a), 1.99 bat passes were recorded per detector night at the Blue Creek site in Ohio (BHE Environmental, Inc. 2009 as cited in BHE Environmental, Inc. 2010a), and 12.4 bat passes per detector night were recorded at the Buckeye Wind site in Ohio (Stantec 2009). Activity at the Project area was highly variable, as has often been the case at other studies (Erickson et al. 2002), but followed temporal and seasonal patterns similar to the results of several other studies (BHE Environmental, Inc. 2010a). Most bat activity within the Project area occurred during the first half of the night, which has also been demonstrated in studies by Arnett et al. (2006), Redell et al. (2006), and BHE Environmental, Inc. (2007; as cited in BHE Environmental, Inc. 2010a). Seasonally, bat activity in the Project area peaked during early to mid-September (BHE Environmental, Inc. 2010a). For most bat species summering in central Illinois, autumn migration typically occurs between August and September (Cryan 2003); the higher level of bat activity observed at the Project area in August and September may therefore be associated with dispersal from summer habitat, juvenile bats becoming volant, the onset of breeding, and migration to winter habitats.

Impacts to bats within the Project area are expected to primarily occur during the operational phase of the Project. Construction and decommissioning activities are not expected to require the removal of trees or old buildings, making it unlikely that roosting or nesting bats would be disturbed or incur mortalities during these phases of the Project. Once the Project is operational, however, turbines will present a risk of bat mortality due to collisions or barotrauma. Due to the lack of unique bat species or habitat features which may attract bats, it is expected that bat mortality within the Project area will follow patterns similar to those observed at other Midwest wind energy facilities but mortality rates should be lower due to Project siting and micro-siting and due to the wildlife protection measures that are built into the Project design. Bat mortalities in the Midwest have mostly occurred in the swarming and migration seasons, typically between mid-July and mid-September (Kerlinger et al. 2007b, Johnson et al. 2003, Howe et al. 2002, BHE Environmental, Inc. 2010b, and others). Migratory tree bat species have comprised the majority of fatalities in the Midwest and nationally (Erickson et al. 2002; Kunz et al. 2007). Mortality risk at the Project is therefore expected to primarily affect bats that are migrating through the Project area during the late summer or early fall. Additionally, certain weather conditions, including low wind speeds, warmer temperatures, and high cloud ceilings, are likely to increase the risk of bat mortality at the Project area, as these conditions have been demonstrated to coincide with nights of high bat mortality at wind energy facilities (Kunz et al. 2007, Gruver et al. 2009).

The lack of forested habitat and open water within the Project area may reduce risk to bats, as most bat species in Illinois prefer forests and bodies of open water for foraging and migration stopover roosting habitat (BCI 2010). Bats migrating through the vicinity of the Project area may prefer the Middle Fork and Salt Fork Vermilion Rivers and associated forests compared to the open landscape within the Project area. The Project has been sited to avoid high-quality bat habitat all together, but the presence of the turbines, even in open, non-forested areas, poses a risk of bat mortality. Bat mortality has been documented at Midwest wind energy facilities in agricultural areas during the migration season, demonstrating that some migrating bats will fly over open land (Good et al 2011, Parnham 2010, Kerlinger et al. 2007b, Johnson et al. 2003, Howe et al. 2002, and BHE Environmental, Inc. 2010b). Bat migration patterns and behaviors, and subsequently, indicators of bat fatality risk at wind energy sites, are not well understood (Poulton 2010). However, CRWE has used the best science available to incorporate avoidance, minimization, and mitigation strategies (described in Section 2.3.3) into the siting, design, and operation strategies for this Project, in an attempt to reduce bat risk at the Project area to the best of our current understanding.

Indiana Bats

The potential for take of Indiana bats at the site is primarily limited to the migration season and is unlikely to occur, as discussed below.

The Project is unlikely to cause the take of Indiana bats during the summer maternity season due to lack of suitable forested or open water habitat in the Project area and the manner in which CRWE has developed the Project (USFWS consultation meeting on October 14th, 2010). Based on the known patterns of bat fatalities at wind farms described above, an assessment of potential risk to Indiana bats at the Project involves evaluation of the site-specific data in terms of species presence/probable absence, seasonal distribution, and activity levels (Kunz et al. 2007), as well as a comparison to regional patterns.

<u>Direct Effects:</u>

The potential direct effects of the Project could include direct mortality of bats due to collisions with turbines or barotrauma, or latent mortality if a bat is injured but does not immediately die.

Based on the analysis of seasonal distribution of Indiana bats in the region, no direct effects are expected to occur during the winter months because Indiana bats are not active during the winter months and the nearest known Indiana bat hibernacula are located approximately 99 mi (158 km) northwest from the Project. Take is unlikely to occur during the summer breeding season, because: (1) there is no summer maternity habitat in the Project area, (2) all Project turbines have been sited at least a mile from the Middle Fork of the Vermilion River, and (3) all foraging habitat connected to the river has been avoided by 1000 ft (305 m) or more. Murray and Kurta (2004) radio-tracked Indiana bats foraging 0.3 to 2.6 miles (0.5 to 4.2 km) from nursery colonies, and the bats were never observed to cross open areas while foraging or traveling to a foraging site. The USFWS has recommended that a 1000 ft (305 m) setback from connected habitats adequately protects bats foraging during the summer months (personal communication, November 2010, with Matt Sailor, USFWS).

Available information indicates that take of Indiana bats is also unlikely to occur during the spring migration periods. Mortality data from other post-construction studies show that most bat fatalities occur during the fall migration period, and the only two documented Indiana bat fatalities occurred during fall (Parham 2010). The majority (80%) of the *Myotis* detections at the Project area occurred in August, during the fall migration season (BHE Environmental, Inc. 2010a). Furthermore, since there is no summer maternity habitat in the Project area, the project would not be a destination for spring migrating females.

In April, 2011, Invenergy funded a project to evaluate spring migration and dispersal of female Indiana bats from the Blackball Mine hibernaculum. One of the goals of the study was to substantially expand our understanding of the spring migratory behavior of reproductive female Indiana bats that winter in the Blackball Mine, with an emphasis on determining their daily and final destinations, and the importance of landscape and cover features when selecting a route of travel. Fifty-two female Indiana bats were fitted with radio transmitters and released from the mine site on April 11 and April 13, 2011. Movements of these bats were tracked using radio receivers located on the ground and in aircraft.

Preliminary results suggest that nearly 70 percent of the transmitted bats were tracked to their summer destination, thereby establishing a series of new records for the species. The timing of spring emergence, dispersal distances, and direction of travel were determined, and preliminary analysis suggests that the migrating bats are restricting their movements to areas of tree cover (personal communication, June 2011, with Al Hicks, Vesper Environmental). Since turbines will be located away from woodlots, migrating bats will not be exposed to the rotors, and the potential for take is avoided.

As for any wind project within Indiana bat range, there is a potential for migrating Indiana bats to occur within the Project area during the spring and fall migration. Based on previous studies and site-specific data it is unlikely that Indiana bat mortality will occur during the spring migration season; a low level of mortality risk may exist during the fall migration season.

Little information is available regarding the circumstances under which Indiana bats may be at risk of collision or barotrauma with wind turbines. However, Indiana bat fatalities at wind turbines are rare events. Of over 3,000 bat fatalities recorded at wind projects within the range of Indiana bat, only two Indiana bat fatalities have been reported (Parham 2010; Good et al. 2011). Both fatalities occurred at the Fowler Ridge wind farm during September and in an agricultural setting. The estimated number of Indiana bats that were impacted at the Fowler Ridge site could be higher than two, but the actual number is unknown.

For wind projects in the eastern and midwestern United States within the range of Indiana bat that have been monitored, overall bat mortality estimates have ranged from approximately 5 to 64 bats per turbine per year (Table 4.2). Overall, approximately 73 percent of the fatalities have been of hoary bats, red bats, or silver-haired bats; approximately 9.3 percent have been *Myotis* species (Table 4.3).

During preconstruction acoustic surveys at the Project area, an average of less than 4 percent (0.4 to 12.7%) of the bat passes detected was attributed to *Myotis* calls. Only 30 *Myotis* calls were detected during the 219-night study (BHE Environmental, Inc. 2010a). Data from the California Ridge acoustic study inconclusively supported the patterns documented at other wind sites, where high-frequency bats, including *Myotis*, typically fly below the rotor-swept area.

In addition to Project siting and turbine setbacks to avoid potential Indiana bat habitat, CRWE will raise cut-in speeds to 15.2 mph (6.9 m/s) from August 1 through September 30 from 0.5 hour before sunset until 0.5 hour after sunrise. Raising cut-in speeds has been shown to significantly reduce bat fatalities at wind energy facilities (Arnett et al. 2009, Baerwald et al. 2009) and is expected to further reduce risk to any Indiana bats migrating through the Project area during fall. Furthermore, CRWE will monitor the effectiveness of this avoidance measure at reducing bat fatalities and will use adaptive management (see Appendix A-MAMP) so that risks to all bats in general and Indiana bats in particular are avoided/minimized.

The analysis of possible direct effects indicates that Indiana bat take at the Project is unlikely, due to the incorporation of avoidance and minimization measures into the proposed action. In particular, project siting and the incorporation of cut-in speed adjustments will reduce the risk of potential interactions with the species. Monitoring and adaptive management measures presented in the MAMP (Appendix A) will evaluate the effectiveness of these measures over the life of the Project.

Table 4.2 Summary of Bat Mortality Reported from Wind Project Monitoring Studies within Indiana Bat Range

Project Name, State	No. of Turbines	Estimated No. of Bat Fatalities/ Turbine/Year	95% Confidence Interval	Study Period	Reference
Buffalo Mountain, TN	3	20.8	19.5-22.1[5]	9/29/00-9/30/03	Fielder 2004
Buffalo Mountain, TN	18	63.9	Nr	4-12/05	Fielder et al. 2007
Mountaineer, WV	44	47.5	31.8-91.6[5]	4/4-11/2203	Kerns and Kerlinger 2004
Mountaineer, WV	44	37.7[1]	31.2-45.1[5]	8/2-9/13/04	Arnett et al. 2005
Crescent Ridge, IL	33	4.9[2]	4.36-5.46	9-11/05; 3-5/06; 8/06	Kerlinger et al. 2007b
Myersdale, PA	20	25.1[1]	20.1-32.7[5]	8/2-9/13/04	Arnett et al. 2005
Maple Ridge, NY	120	24.5	14.3-34.7	6/17-11/15/06	Jain et al. 2007
Maple Ridge, NY	195	15.5	14.1-17.0	4/30-11/14/07	Jain et al. 2008
Maple Ridge, NY	195	8.2	7.4-9.0	4/05-11/9/08	Jain et al. 2009
Pennsylvania, PA	10	30.1	28.1-33.4[6]	2007	Capouillez and Librandi-Mumma 2008
Casselman, PA	23	32.2	20.8-51.4	7/26-10/10/08	Arnett et al. 2009b
Mount Storm, WV	82	24.2[3]	17.1-33.1	7/18-10/17/08	Young et al. 2009a
Mount Storm, WV	132	28.6[4]	18.7-40.5	3/23-6/14; 7/16-10/8/09	Young et al. 2009b, 2010
Average		**27.9**			

[1] estimate for the 6-week study period
[2] estimate based on simulated searcher efficiency
[3] estimate for the 12-week study period
[4] estimate based on combination of spring and fall results
[5] reported as 90% CI
[6] reported as 99% CI
Nr = not reported by authors

Table 4.3 Number of Bat Species Fatalities Found at Wind Project Monitoring Studies within Range of Indiana Bat

Species (**Myotis*)	Fatalities (Percentage of Total)								
	Buffalo Mountain	**Mountaineer**	**Mount Storm**	**Crescent Ridge**	**Myersdale**	**Maple Ridge**	**PGC**	**Casselman**	**Total**
Hoary Bat	44 (12.1)	244 (25.9)	172 (36.3)	6 (28.6)	138(46.2)	337 (46.8)	61 (28.9)	46 (31.1)	1048 (33.0)
Red Bat	222 (61.2)	312 (33.2)	89 (18.8)	6 (28.6)	82 (27.4)	83 (11.5)	67 (31.8)	27 (18.2)	888 (28.0)
Silver-haired Bat	20 (5.5)	52 (5.5)	75 (15.8)	8 (38.1)	18 (6.0)	126 (17.5)	30 (14.2)	39 (26.4)	368 (11.6)
Tri-colored Bat	71 (19.6)	199 (21.1)	68 (14.3)	0 (0.0)	23 (7.7)	0 (0.0)	33 (15.6)	17 (11.5)	411 (12.9)
Little Brown Bat*	0 (0.0)	107 (11.4)	41 (8.6)	0 (0.0)	9 (3.0)	106 (14.7)	10 (4.7)	14 (11.5)	287 (9.0)
Big Brown Bat	3 (0.8)	15 (1.6)	19 (4.0)	0 (0.0)	18 (6.0)	44 (6.1)	10 (4.7)	4 (2.7)	113 (3.6)
Northern Long-eared Bat*	0 (0.0)	6 (0.6)	1 (0.2)	0 (0.0)	2 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	9 (0.3)
Seminole Bat	2 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.1)
Unidentified bat	1 (0.3)	6 (0.6)	9 (0.2)	1 (4.8)	9 (3.0)	24 (3.3)	0 (0.0)	1 (0.7)	51 (1.6)
Total	**363**	**941**	**474**	**21**	**299**	**720**	**211**	**148**	**3177**

Indirect Effects

Indirect effects of the proposed Project could include loss of foraging, roosting, maternity, or wintering habitat due to cutting trees during Project construction. The proposed Project is not expected to have indirect effects due to habitat loss on the Indiana bat, because all turbines will be located in agricultural fields (previously disturbed, non-forested habitats) and with sufficient buffer (1,000 ft [305 m] from connected foraging habitats) to reduce the potential to impact foraging individuals. Access road, collection line, transmission line, and other facilities construction would not require tree cutting. Additionally, there are no known caves, karst formations, or other suitable hibernaculum habitat, or known maternity colonies in the Project area (USFWS consultation meeting on October 14th, 2010, and IDNR correspondence dated 4 December 2009).

An indirect benefit of the proposed action is the development and implementation of a conservation project developed in coordination with USFWS and IDNR. Invenergy has funded and facilitated a spring emergence and migration project to evaluate the movement of reproductive female Indiana bats from Blackball mine to their maternity sites (see Section 4.3 below). Results from the study will be available in the late summer of 2011.

4.3 OFF-SITE HABITAT CONSERVATION

4.3.1 Conservation Project Goals

The goals of the off-site conservation project are to benefit the listed Indiana bat by assisting the USFWS and other parties in siting wind energy projects in the future so as to avoid key migratory areas; it will help further the understanding of the species' life history characteristics; and it will help identify key roosting habitats that can be protected from future disturbances and degradation. Furthermore, this conservation project will provide information on the movement of reproductive females that can be used to reduce direct impacts to reproductive females and thus facilitate the propagation of the species. The identification of movement corridors, stopover sites, and maternity sites also allows for the conservation of preferred habitats.

4.3.2 Background

Since wind energy projects located in Illinois are within the range of the Indiana bat, Invenergy has worked closely with USFWS to develop conservation strategies that will reduce potential project impacts on the species. During recent consultations over these projects, the USFWS expressed an interest in better understanding Indiana bat movements from the northernmost hibernaculum in the state—the Blackball Mine, located in LaSalle County. Understanding Indiana bat movements from the mine will inform future mitigation actions, including the siting of future wind projects to avoid migratory corridors. Both the USFWS and IDNR have expressed interest in undertaking conservation actions to evaluate Indiana bat movements; however, the agencies have to date been unable to conduct conservation projects due to budget constraints.

Invenergy developed and implemented this conservation project to mitigate unavoidable direct impacts to the general bat community from the Project and other Invenergy wind projects, as well as any unexpected or unseen direct or indirect impacts to Indiana bats.

4.3.3 Conservation Project

As discussed with USFWS and IDNR, Invenergy has funded and facilitated a spring emergence and migration project to evaluate the movement of reproductive female Indiana bats from Blackball Mine to their maternity sites. The conservation project commenced in the spring of 2011 and was conducted by Vesper Environmental working collaboratively with the USFWS and the IDNR.

The goal of the conservation project was to evaluate the migratory patterns of reproductive female Indiana bats that winter at the Blackball Mine. Specifically, the conservation project was designed to:

- Determine the timing and direction of movement immediately upon leaving the hibernaculum and its relationship to the first day roost;
- Determine the relationship between the heading to the first day roost and the heading to the summer maternity sites;
- Identify corridors, if any, used by migrating females while dispersing from the hibernaculum to the summer maternity sites;
- Determine if the selection of routes is driven by cover (corridors) or by a desire to minimize travel time (straight line); and
- Identify and map the locations of the summer maternity sites.

The conservation project incorporated into the proposed action will benefit the listed species by assisting USFWS and other parties in siting wind energy projects in the future so as to avoid key migratory areas, it will help further the understanding of the species' life history characteristics, and it will help identify key roosting habitats that can be protected from future disturbances and degradation. Furthermore, this conservation project will provide information on the movement of reproductive females that can be used to reduce direct impacts to reproductive females and thus facilitate the propagation of the species. The identification of movement corridors, stopover sites, and maternity sites also allows for the conservation of preferred habitats.

4.4 AVOIDANCE, MINIMIZATION, AND MITIGATION

4.4.1 Summary of Measures Incorporated into the Siting and Design Processes

This section presents a summary of the avoidance, minimization, and mitigation measures developed through consultation with USFWS and IDNR that CRWE has built into the siting and design processes of the proposed Project and which are discussed in detail in Section 2.4 above.

The siting and micro-siting processes incorporated considerations to avoid, minimize, and mitigation impacts to birds and bats, especially Indiana bats, by placing the Project in an agricultural setting and avoiding native habitat. Potentially-suitable foraging habitats for Indiana bat were evaluated for connectivity to one another and to the Middle Fork of the Vermilion River. If habitats were determined to be connected, a 1,000 ft (305 m) setback from those habitats was established to prevent the turbine sites from being connected to the Middle Fork of the Vermilion.

CRWE has incorporated wildlife conservation measures into the proposed Project to reduce the impacts to birds and bats, especially Indiana bats (see Section 2.4). The planning and development stages of the Project have incorporated industry best practices, guidance from the USFWS Interim Guidelines (USFWS 2003), the Wind Turbine Guidelines Federal Advisory Committee (USFWS 2010b), APLIC (2006), and consultation with USFWS and the IDNR. Additionally, CRWE developed and is implementing an off-site conservation project (Section 4.3) to mitigate unavoidable direct impacts to the general bat community from the Project, as well as any unexpected direct or indirect impacts to Indiana bats.

The avoidance and minimization measures incorporated in the siting and design processes, described above, are the primary methods of reducing potential avian and bat impacts at the Project. Overall impacts to birds and bats are expected to be low at the Project area, based on the agricultural landscape, moderate levels of bird and bat use, lack of attractive habitat characteristics, infrequent use by protected species (Good et al. 2010, BHE Environmental, Inc. 2010a), and implementation of the above-listed avoidance and minimization measures. Bird and bat fatality rates at the Project are expected to be at the lower ends of the fatality ranges reported at Midwest wind energy facilities (0.31-7.17 birds/MW/year, 0.47-11.83 birds/turbine/year and 0.18-24.6 bats/MW/year, 0.12-40.5 bats/turbine/year; Poulton 2010).

4.4.2 Turbine Operational Protocols

CRWE proposes the following turbine operational protocols to avoid/minimize impacts to Indiana bats and bats in general.

1) Raise cut-in speeds on all turbine to 15.2 mph (6.9 m/s) from ½ hour before sunset until ½ hour after sunrise from August 1 through September 30
2) Keep turbine blades fully-feathered until the cut-in wind speed is reached

The rationale for this avoidance/minimization strategy is presented below.

Raised Cut-in Speeds

Three recent studies have shown that increasing turbine cut-in speed significantly reduces bat fatalities caused by wind turbines (Baerwald et al. 2009; Arnett et al. 2009b; Good et al. 2011) (Table 4.4).

The first study was conducted at the Summerview wind farm in southwestern Alberta, Canada, in 2007. The project site is about 5,058 acres (2,023 ha) located in cultivated mixed agriculture and pasture. The project consists of 39 Vestas V80 1.8-megawatt (MW) turbines with 262-ft (80-m) diameter rotors mounted on 213-ft (65-m) towers arrayed in eight northwest/southeast-trending strings. Fatality rates of all bats were studied in 2005 and 2006 and were high both years, at approximately 21.7 bats/turbine (12.1 bats/MW) in 2005 and 26.3 bats/turbine (14.3 bats/MW) in 2006. Most fatalities occurred between August 7 and September 9 both years.

The research study was conducted in 2006 and 2007 between July 15 and September 30 to encompass the period of impact for hoary and silver-haired bats, the species with the highest fatality rates at this site. Turbine operation was altered only in 2007; 2006 data were used as the baseline.

Normal cut-in speed for the Vestas V80 turbine is 8.9 mph (4.0 m/s). For 15 experimental turbines, cut-in speed was raised to 12.3 mph (5.5 m/s); six additional turbines were idled (i.e., blade pitch angle was changed so that rotors were nearly motionless during low wind speeds). Experimental turbines were selected by dividing the project into four quadrants and randomly selecting turbines within each quadrant. During the study, eight turbines that were operated normally comprised the control group.

Weekly carcass searches were conducted at the 29 study turbines. Actual number of carcasses found was adjusted for searcher efficiency and carcass removal to estimate fatality rates (Baerwald et al. 2009). Searches were conducted on a 171-ft (52-m) diameter plot.

A similar study was conducted at the Casselman wind farm near Rockwood, Somerset County, Pennsylvania, in 2008. The project site is located in second growth deciduous forest, open hay pasture, and open grassland of a reclaimed coal mine. The project consists of 23 General Electric (GE) 1.5-MW turbines with 253-ft (77-m) diameter rotors mounted on 262-ft (80-m) towers arrayed in two strings. Fatality rates of all bats were studied in 2008. The research study was conducted between July 26 and October 10, 2008, to encompass the period of highest impact for all bats.

Normal cut-in speed for the GE 1.5-MW turbine is 7.8 mph (3.5 m/s). The research component of this study evaluated the effects of raised cut-in speeds on bat fatality rates at 12 turbines. For each of the 12 experimental turbines, cut-in speed was raised to 11.2 mph (5.0 m/s) or 14.5 mph (6.5 m/s), and/or turbines were allowed to operate normally. Treatment received by each turbine was changed nightly, so each night, each treatment was randomly assigned to four turbines. Over the course of 15 nights, each treatment occurred at each turbine five times, in random order.

Daily carcass searches were conducted at the 12 study turbines. Actual number of carcasses found was adjusted for searcher efficiency, carcass removal, and carcass distribution to estimate fatality rates. Searches were conducted on variable diameter plots up to a maximum of 197 ft (60 m) depending on surrounding vegetation.

The Fowler Ridge study was conducted at a large wind farm (600 MW) in Benton County, Indiana, in 2010. The project site is located in agricultural fields (corn, soybeans, hay) in a predominantly agricultural environment with little topographic relief or forest cover. Phase I consists of 122 Vestas V82 1.65-MW turbines and 40 Clipper C96 2.5-MW turbines, for a total of 301 MW of energy capacity. Phase II consists of 133 1.5-MW GE SLE Turbines with a total capacity of 199.5 MW. Phase III consists of 60 Vestas V82 1.65-MW turbines (99 total MW of capacity). While the three turbine types varied in size, the normal cut-in speed for all turbines at the site was 7.8 mph (3.5 m/s). The research study was conducted between August 1 and October 15, 2010, to encompass the period when impacts to bats were expected to be highest.

The research component of this study evaluated the effects of raised cut-in speeds on bat fatality rates at 27 turbines. The proportion of turbines selected for curtailment studies was representative of the proportion of each turbine type across the project area. For nine experimental turbines, cut-in speed was raised to 11.2 mph (5.0 m/s), nine additional experimental turbines had raised cut-in speeds of 14.5 mph (6.5 m/s), and nine turbines were allowed to operate normally. In addition, there were nine other control turbines that were not included in the study and not rotated among the treatments. Treatment received by each turbine was changed weekly, so each week, each treatment was randomly assigned to nine of the 27 turbines in the study. Over the course of 10 weeks, each treatment occurred at each turbine for 3-4 weeks, in random order.

Daily carcass searches were conducted at the 36 study turbines on cleared 262 x 262-ft (80 x 80-m) search plots. Actual number of carcasses found was adjusted for searcher efficiency and carcass removal to estimate overall project related fatality rates. Observed fatality rates were compared among the treatment groups.

All three research studies showed that turbines operated with raised cut-in speeds killed fewer bats than the normally operating turbines by 44 to 93 percent (Baerwald et al. 2009; Arnett et al. 2009b; Good et al. 2011).

Table 4.4 Summary of Research Study Results, Alberta, Canada; Casselman, Pennsylvania; and Fowler Ridge, Indiana

Alberta, 39 Vestas Turbines, July 15 – September 30, 2007, 171 ft (52 m) plot, weekly searches			
Control	Treatment	Treatment	Results
8 turbines, normal operation 8.9 mph (4.0 m/s) cut-in speed	15 turbines, 12.3 mph (5.5 m/s) cut-in speed	6 turbines, idling blades pitched to reduce rotation in low wind speeds	Treatment turbines killed fewer bats Raised cut-in speed = 7.6 $\pm$ 2.0 bats/turbine Idling = 8.1 $\pm$ 3.1 bats/turbine control = 19.0 $\pm$ 2.7 bats/turbine No difference between experimental treatments
Casselman, PA, 23 GE Turbines, July 26 – October 9, 2008, July 26 – October 8, 2009; variable plots up to 197 ft (60 m), daily searches			
Control	Treatment	Treatment	Results
412 turbines, normal operation, 7.8 mph (3.5 m/s cut-in speed)	12 turbines, 11.2 mph (5.0 m/s) cut-in speed	12 turbines, 14.5 mph (6.5 m/s) cut-in speed	Treatment turbines killed fewer bats Raised 11.2 mph (5.0 m/s) cut-in speed = 0.27 (95% CI: 0.07-1.05) bats/turbine Raised 14.5 mph (6.5 m/s) cut-in speed = 0.53 (95% CI: 0.20-1.42) bats/turbine Control = 2.04 (95% CI: 1.19-3.51) bats/turbine No detectable difference between experimental treatments 11.2 mph (5.0 m/s) cut-in speed most cost-effective way to reduce bat mortalities at a wind farm
Fowler Ridge, IN; 182 Vestas V82 1.65-MW, 40 Clipper C96 2.5-MW turbines, 133 1.5-MW GE SLE Turbines; April 13 – October 15, 2010, variable plots, weekly and daily searches			
Control	Treatment	Treatment	Results
18 turbines, normal operation, 7.8 mph (3.5 m/s cut in speed)	9 turbines, 11.2 mph (5.0 m/s) cut-in speed	9 turbines, 14.5 mph (6.5 m/s) cut-in speed	Treatment turbines killed fewer bats Raised 11.2 mph (5.0 m/s) cut-in speed = 7.0 (95% CI: 7.0-9.1) bats/turbine Raised 14.5 (6.5 m/s) cut-in speed = 3.0 (95% CI: 1.8-4.2) bats/turbine Control = 14.0 (95% CI: 11.6-16.5) bats/turbine Experimental treatments showed approximately 50% and 78% reduction in bat mortality

Available literature and discussions with researchers (Good et al 2011; personal communications, June 2011, with Chris Hein, Bat Conservation International, and Erin Baerwald, University of Calgary) show that no take of Indiana bats has been observed at turbine cut-in speeds above 11.0 mph (5.0 m/s). Available data indicate that take of *Myotis* may occur at turbine cut-in speeds of 14.3 mph (6.5 m/s)(Table 4.5); however, no information exists to indicate such take was of listed Indiana bats. Higher cut-in speeds have not yet been tested, but, given that there's only one *Myotis* fatality at turbines with cut-in speeds of 14.3 mph (6.5 m/s) and that most high frequency bat calls are recorded below rotor-swept area (see Section 3.3.1 in the ABPP), *Myotis* fatalities are expected to be unlikely at cut-in speeds of 15.2 mph (6.9 m/s).

Table 4.5 *Myotis* fatalities for which turbine cut-in speed is known

	Turbine Cut-in Speed/*Myotis* Fatalities[1]			
Project	Fully operational (3.5 or 4.0 m/s cut-in speeds)	5.0 m/s	5.5 m/s	6.5 m/s
Fowler Ridge (Indiana bat)[2]	0	1	na	0
Casselman (all little brown bats)[2]	3	0	na	1
Alberta (various species)[2]	8	na	5	na
Total	11	1	5	1

[1]Table reports *Myotis* fatalities for which the turbine treatment under which the fatality occurred is known; for Fowler Ridge and Casselman all such fatalities were Indiana bat and little brown bat, respectively.
[2] Sources: Fowler Ridge (Good et al. 2011); Casselman (personal communication, June 9, 2011, with Chris Hein, Bat Conservation International); Alberta (personal communication, June 9, 2011, with Erin Baerwald, University of Calgary).
na - cut-in speed was not tested in study
0 - cut-in speed was tested and no *Myotis* fatalities occurred

Proposed Nightly Period of Restricted Turbine Operations

CRWE proposes to raise cut-in speeds from 0.5 hour before sunset to 0.5 hour after sunrise, which is the nighty period of bat activity at the Project site.

Proposed Season of Restricted Turbine Operations

CRWE proposes to implement the restricted turbine operations from August 1 through September 30 based on the seasonal period of bat activity observed during acoustic monitoring at the Project site (Table 4.6; BHE Environmental, Inc. 2010a). The majority of bat activity detected during the fall period occurred in August and September. At both detector towers, activity was moderate in August, peaked in September, and declined to greatly reduced levels in October. Twenty-four of the 28 total recorded *Myotis* calls were recorded in August; only 10 HF calls, once of which was identified as a *Myotis* call, were recorded in October. Overall activity was highest during the week of September 16 at tower 2 and during the week of September 2 at tower 3. Individual nights with the greatest amount of activity were September 30 at tower 2 and September 10 at tower 3.

Table 4.6 Minimum, maximum, and mean number of bat passes recorded at MET Towers 2 and 3 each month between August and October, 2009.

MET Tower	Month	No. of Nights (n)	Total No. of Passes	Min. No. of Passes/Night	Max. No. of Passes/Night	Mean No. of Passes/Night
2	August	25	89	0	14	3.56
	September	17	137	0	35	8.06
	October	31	13	0	4	0.42
3	August	27	227	1	25	8.41
	September	30	292	0	27	9.73
	October	26	18	0	6	0.69

Blades to Remain Fully-Feathered until Cut-in Wind Speeds are Reached

While there is one recent study on the effects of partial blade feathering on bat mortality at wind farms, CRWE is proposing full-feathering, and thus the results of the study are not applicable to CRWE's proposal. Fully-feathered is the same as fully-curtailed. While the details of feathering and cut-in from the other studies that have studied the effects of raising cut-in speeds on bat mortality rates are unclear, it is thought that cut-in speed means the wind speed at which a breaker "cuts in" and the generator begins generating power. Turbines require that the blades are already catching the wind and rotating steadily using wind power before the turbine will cut-in, so the risk to bats actually starts at some lower wind speed when the blades begin to pitch into the wind and pick up speed. The blades are designed so that, at that time, the pressure differential in front of and behind the blade creates lift which causes the rotor to turn; the low pressure zone is also thought to cause bat fatalities through barotrauma. Under CRWE's proposal, however, the blades will remain fully-feathered until the cut-in wind speed is reached, will not be rotating under wind power, and will not have the large pressure differentials on the blades. When GE turbine blades are fully-feathered rotation is typically 1 to 2 rpm. No take of Indiana bats is expected from fully-feathered turbines.

Although bat fatality is likely to be moderate or low at the Project, the turbine curtailment strategy is expected to further reduce risk to bats using the Project area during the fall migration season (Arnett et al. 2009a, Baerwald et al. 2009). The available data indicate that take of listed Indiana bats is unlikely to occur at the Project (see Section 4.2.1). Curtailment actions demonstrated to be effective at reducing mortality risk for common *Myotis* species should also be effective for Indiana bats, reducing risk to this ESA-listed species to discountable levels. Similarly, curtailment should reduce risk of collision for any bat species which may become listed in the future, including the northern long-eared bat and the little brown bat. CRWE will test the effectiveness of this operational protocol at reducing bat fatalities by conducting three years of intensive monitoring (MAMP-Appendix A).

Additionally, CRWE will coordinate annually with the Whooping Crane Eastern Partnership to track the passage of Whooping Cranes through the Project vicinity.

CRWE will monitor bird and bat fatalities at the site in accordance with the monitoring plan presented in Section 5.0 and the MAMP (Appendix A), to verify the effectiveness of the avoidance, minimization, and mitigation strategies incorporated in the Project.

5.0 MONITORING AND ADAPTIVE MANAGEMENT

5.1 POST-CONSTRUCTION MONITORING

Post-construction avian and bat mortality monitoring will be conducted in accordance with the monitoring plan in the MAMP (Appendix A) beginning in the first year of Project operations to help CRWE monitor actual mortality rates of birds and bats at the facility. Monitoring will also help determine the effectiveness of avoidance, minimization, and mitigation measures in reducing mortality at the facility.
The results of post-construction monitoring efforts intended to provide an estimate of overall fatality at a facility can be influenced by several sources of bias during field-sampling. To provide corrected estimates of overall fatality rates, the methodology of mortality monitoring efforts must account for important sources of field-sampling bias. Important sources of bias include 1) fatalities that occur on a highly periodic basis, 2) carcass removal by scavengers, 3) searcher efficiency, 4) failure to account for the influence of site conditions (e.g., vegetation) in relation to carcass removal and searcher efficiency rates, and 5) fatalities or injured birds or bats that may land or move to areas not included in the search plots (Kunz et al. 2007). CRWE's proposed post-construction mortality monitoring plan methodology is designed to account for these sources of bias and adapt to preliminary results such that effectiveness, efficiency, and accuracy of the study is maximized.

Post-construction mortality monitoring at the Project will involve standardized carcass searches (first three years of operations), follow-up standardized carcass searches (once every three years thereafter), searcher efficiency trials, and carcass removal trials. Standardized carcass searches will allow statistical analysis of the search results and calculation of overall fatality estimates. Carcass searches will be conducted during the first three years of Project operation by a consultant and by specifically-trained CRWE personnel to establish baseline fatality estimates of bird and bat fatality. Follow-up carcass searches will be conducted by trained CRWE personnel or contractors during the fall season (August 1-September 30) once every three years to confirm that no significant increase in overall bird or bat mortality has occurred relative to the baseline mortality estimates. Searcher efficiency and carcass removal rates are two sources of field bias in mortality studies that have been proven to be highly variable and site- and researcher-specific; mortality estimators are highly sensitive to these parameters (Huso 2010). Kunz et al. (2007) and the USFWS (2010) Wind Turbine Guidelines Advisory Committee both strongly recommend that all mortality studies should conduct searcher efficiency and carcass removal trials that follow accepted methods and address the effects of differing vegetation types. Fatality estimates will be determined using a fatality estimator which corrects for searcher efficiency and carcass removal biases. Fatality estimates will be expressed both in terms of fatalities/turbine/season & year, and in terms of fatalities/MW/season & year and accompanied by precision and variance estimates, to facilitate comparison with other studies.

Post-construction monitoring will also include American golden plover surveys during the first two years of project operation to determine the timing and behavior patterns associated with the species' use of the Project area during the spring migration. If plovers are observed in the Project area, additional mortality monitoring will be conducted during the first two years of project operation to determine if plover fatalities occur. Refer to the MAMP (Appendix A) for a complete methodology description for the California Ridge post-construction monitoring studies.

5.2 REPORTING

Specific methods for each survey and the conservation project will be described in survey report documents. All post-construction monitoring results and indicators of this ABPP's effectiveness will be summarized in annual reports and submitted to the USFWS. These reports will include fatality estimates and data summaries. Reports will also include a discussion of the apparent effectiveness of this ABPP at meeting the established goals (Section 1.1) and suggestions for improvement, if necessary. In addition to the survey and conservation project reports, CRWE will promptly report fatalities of ESA-listed species to the USFWS.

5.3 ADAPTIVE MANAGEMENT FRAMEWORK

The California Ridge ABPP represents a process through which CRWE plans to reduce impacts to birds and bats at the wind energy facility while maintaining optimal Project operation and generating electricity from the renewable, non-polluting wind. CRWE has sited the Project and incorporated mitigation into the proposed action to avoid, minimize, and mitigate impacts to birds and bats, and take of Indiana bats is unlikely. The effectiveness of these measures will be informed by post-construction fatality monitoring of fatality rates (MAMP-Appendix A). The Project will be managed under an adaptive management plan to enable the results of post-construction monitoring and research to influence the minimization and mitigation measures of the Project. Changes to the Project’s minimization and mitigation plan may be triggered by certain events, but no changes to the agreed upon turbine operational protocols will occur without USFWS concurrence (except temporary cessation of turbine operations for maintenance). Specific events and changes are defined in adaptive management section of the Project’s MAMP (Appendix A). The adaptive management plan will apply throughout the life of the Project; on-going evaluation and adaptation of the Project will provide effective measures for avoiding and reducing impacts to birds and bats.

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Appendix A

Monitoring and Adaptive Management Plan

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Tables

1.0 BACKGROUND AND GOALS

California Ridge Wind Energy Wind Development LLC (CRWE) has voluntarily prepared an Avian and Bat Protection Plan (ABPP) for the California Ridge Wind Energy Project to avoid and reduce impacts to bird and bat species from the Project. Specific goals of the ABPP are to: (1) identify measures that will avoid and reduce potential impacts to birds and bats during construction, operation, maintenance, and decommissioning of the Project, (2) ensure the potential impacts to ESA-listed bat species are reduced to the point where take is unlikely, and (3) outline effective post-construction monitoring and adaptive management procedures to guide management actions for the life of the Project.

This Monitoring and Adaptive Management Plan (MAMP) has been developed in conjunction with the California Ridge ABPP to provide a means of assessing the effectiveness of the ABPP in meeting the above-stated goals. Included in the MAMP for this Project are: a post-construction mortality monitoring plan (monitoring), an American golden plover monitoring plan (monitoring), and an adaptive management plan (adaptive management). The overall conservation strategy includes a conservation project—a spring emergence study at the Blackball Mine—designed to provide conservation benefit to Indiana bats through increasing our understanding of bat movement from the hibernaculum (see Section 4.3 of the ABPP).

2.0 MORTALITY MONITORING PLAN

2.1 MONITORING GOALS

The goals of post-construction monitoring are to determine overall bird and bat fatality rates at the California Ridge Wind Energy Project and evaluate the circumstances under which fatalities occur. Post-construction monitoring results also provide the triggers for adaptive management, described in Section 3 in this MAMP.

2.2 SPECIES TO BE MONITORED

The post-construction monitoring plan will address all bird and bat species fatalities observed within the California Ridge Project Area. Based on the analysis provided in Section 4.2.1 of the California Ridge ABPP, Indiana bat (*Myotis sodalis*) mortalities are unlikely to occur at the Project, and thus the monitoring plan is designed to detect carcasses and calculate all bat (and bird) fatality estimates with enough precision to determine if the operational protocols are effective in reducing all bat fatalities at the California Ridge wind facility and compared to other operating projects. Within the overall bat and bird fatality estimates, estimates by species will be made, if possible, based on the number of carcasses detected. Monitoring designed to detect Indiana bat carcasses is not proposed because 1) Indiana bat fatalities are unlikely, 2) such a study would require extensive ground surveys and considerable expense for the purposes of detecting an unlikely event, 3) the proposed study could detect Indiana bat fatalities, and 4) more extensive monitoring could be implemented, as described in the adaptive management plan (Section 3 of this MAMP), should one of the adaptive management triggers be met.

2.3 PERMITS AND WILDLIFE HANDLING PROCEDURES

2.3.1 Permits

State and federal collecting/salvaging permits will be acquired from the Illinois Department of Natural Resources (IDNR) and the U.S. Fish and Wildlife Service (USFWS) by CRWE's consultants and CRWE prior to commencement of the study to enable searchers to collect and handle carcasses in compliance with laws pertaining to the collection and possession of wildlife and migratory birds.

2.3.2 Wildlife Handling Procedures

All carcasses found will be labeled with a unique number, individually bagged, and retained in a freezer at the California Ridge Operations and Maintenance building. A copy of the original data sheet for each carcass will be placed in the bag with each frozen carcass. The carcasses may be used in searcher efficiency and carcass removal trials. In the event that a carcass of an ESA- or state-listed species is found, CRWE will arrange to submit the carcass to the appropriate authorities. If an injured bird or bat is found, the animal will be sent to a local wildlife rehabilitator, when possible.

2.4 MONITORING

2.4.1 Study Design

The results of post-construction monitoring efforts at wind facilities intended to provide an estimate of overall fatality at a facility can be influenced by several sources of bias during field-sampling. To provide corrected estimates of overall fatality rates, the methodology of mortality monitoring efforts must account for important sources of field-sampling bias, including 1) fatalities that occur on a highly periodic basis, 2) carcass removal by scavengers, 3) searcher efficiency, 4) failure to account for the influence of site conditions (e.g. vegetation) in relation to carcass removal and searcher efficiency rates, and 5) fatalities or injured birds or bats that may land or move to areas not included in the search plots (Kunz et al. 2007). CRWE's proposed post-construction mortality monitoring plan methodology is designed to account for these sources of bias and adapt to preliminary results such that effectiveness, efficiency, and accuracy of the study is maximized.

Post-construction mortality monitoring at the California Ridge facility will involve baseline standardized carcass searches, follow-up standardized carcass searches, searcher efficiency trials, and carcass removal trials. Standardized carcass searches will allow statistical analysis of the search results, calculation of overall fatality estimates, and assessment of correlations between fatality rates and potentially-influential variables (e.g., season, location). Intensive carcass searches will be conducted during the first three years of Project operation by a consultant and by specifically-trained CRWE personnel to establish baseline fatality estimates of bird and bat fatality. After the first three years of monitoring, CRWE will have baseline data from which to measure changes in overall bird and bat fatalities. Follow-up carcass searches will be conducted by trained CRWE personnel during the fall season (August 1-September 30) once every three years to confirm that no significant increase in overall bird or bat mortality has occurred relative to the baseline mortality estimates. Searcher efficiency and carcass removal trials are critical for developing appropriately corrected and unbiased fatality estimates. Searcher and carcass removal rates are two sources of field bias in mortality studies that have been proven to be highly variable and site- and researcher-specific; mortality estimators are highly sensitive to these parameters (Huso 2010). Kunz et al. (2007) and the USFWS Wind Turbine Guidelines Advisory Committee (USFWS 2010) both strongly recommend that all mortality studies should conduct searcher efficiency and carcass removal trials that follow accepted methods and address the effects of differing vegetation types.

Focus Species

The post-construction monitoring study design is intended to enable detection of all bird and bat species that may occur within the Project area, as well as support the development of fatality estimates for all bird and bat species found during the mortality searches.

Sample Size

Standardized carcass searches will be conducted at 30 of the 134 turbines. This sample size optimizes field survey effort while maximizing expected confidence in the data and associated results. Table A-1, below, was developed using a mean bat fatality rate and mean standard deviation calculated from results of studies at other wind energy facilities within the Indiana bat range. Bat fatality rates were used because they have been much more variable than bird fatality rates at wind facilities (Poulton 2010); a sample size adequate for confidence in bat data will therefore also be adequate for confidence in bird data. This table presents the 95 percent confidence intervals associated with a variety of sample sizes and demonstrates the diminishing returns in confidence as sample size is increased. A sample size of 60 turbines would require twice the survey effort but would not confer twice as much confidence in results as sampling of the 30 turbines would. When extrapolated over the entire facility (134 turbines), the upper confidence limit fatality estimate for a sample size of 30 turbines is not appreciably different than those for larger sample sizes. Sample sizes smaller than 30 turbines have increasingly larger confidence intervals, and may also result in datasets which have higher standard deviations (further decreasing confidence).

Table A. 1 Confidence Intervals of Turbine Sample Sizes for Post-Construction Monitoring[1]

No. of Turbines Searched	Mean Fatality (bats/turbine/year)	95% Confidence Limits		95% Confidence Interval
		Low	High	
10	27.9	20.0	35.8	7.9
20	27.9	22.8	33.0	5.1
30	27.9	23.8	32.0	4.1
40	27.9	24.4	31.4	3.5
50	27.9	24.8	31.0	3.1
60	27.9	25.1	30.7	2.8
80	27.9	25.4	30.4	2.5
100	27.9	25.7	30.1	2.2

[1] For this analysis, mean fatality estimate and mean standard deviation of datasets were obtained from a subset of the post-construction monitoring studies presented in Table 4.2 of the California Ridge ABPP which reported the necessary data.

During follow-up studies (discussed below under Timing and Duration) conducted every three years by trained CRWE personnel, a sample size of 15 turbines will be studied. This sample size is adequate for follow-up studies, as the purpose of these studies is to provide fatality estimates which can be compared against the baseline estimate established during the first year of monitoring to confirm that no significant increase in overall bird or bat mortality has occurred. A significant increase is defined as a measurable, statistically significant ($p \leq 0.10$) increase in estimated fatality relative to the baseline fatality estimate. A sample size of 15 turbines will meet the goal of detecting significant increases, as differences small enough that their detection requires a sample size of 30 turbines instead of 15 are unlikely to be biologically-justifiable as significant.

The 30 turbines to be sampled will be determined using a stratified random sampling approach. These 30 sample turbines will include turbines located in the eastern part of the Project area, per USFWS recommendation. The 15 turbines to be sampled for follow-up studies will be selected from the initial 30 sample turbines using a stratified random sampling approach. Selecting the follow-up sample turbines from the baseline sample turbines will reduce the introduced variables (i.e. location) and provide a more accurate comparison of fatality rates between study years.

Search Intervals

Search intervals will be once weekly for each of the 30 sample turbines during the spring and fall periods of intensive monitoring. Search intervals will be once weekly for each of the 15 sample turbines during the follow-up studies. The turbine search schedule and order will be randomized so that each turbine's search plot will be sampled at differing periods during the day. If more or less intensive monitoring is deemed necessary following initial data collection (carcass searches and carcass removal trials) at the site, the search intervals will be modified accordingly. The WTGAC guidelines recommend that "carcass search intervals should be adequate to answer applicable questions at an appropriate level of precision to make general conclusions about the project" (USFWS 2010b). A weekly search interval for fatality monitoring was deemed adequate by Kunz et al. (2007) and studies have demonstrated that a weekly search interval provides effective mortality monitoring and adequately estimates impacts from wind energy facilities (Gruver et al. 2009, Young et al. 2009), such that the added effort associated with more frequent intervals is not warranted.

2.4.2 Field Methods

Plot Size, Vegetation Mowing, Visibility Classes

Search plots measuring 256 x 256 ft (78 x 78 m) will be established at the base of each sampled turbine. The methods used to establish this search plot size are recommended for detecting carcasses of both birds and bats by the WTGAC (USFWS 2010b) and are supported by several other studies that have indicated that the majority of bird and bat carcasses typically fall within 100 ft (30 m) of the turbine or within 50 percent of the maximum height of the turbine (Kerns and Kerlinger 2004, Arnett 2005, Young et al. 2009, Jain et al. 2007, 2008, 2009, Piorkowski and O'Connell 2010, and USFWS 2010). This plot size will exceed one-half the maximum turbine rotor height of the California Ridge turbines (246 ft [75 m]). This should minimize the number of fatalities or injured birds or bats which land or move outside of the search plots and thereby reduce the number of bird or bat carcasses that would be undetected, causing underestimation of overall fatality.

Each search plot will be centered on a turbine location. Thirteen transects will be established in each plot for complete survey coverage. Vegetation will be mowed in each plot prior to the beginning of each study period to improve searcher efficiency. Although the majority of vegetation within each search plot is expected to consist of row crops or fallow fields, visibility classes will be established if vegetation type and density vary sufficiently. If necessary, visibility classes will be mapped within each plot, and searches will be designed to preferentially include areas of higher visibility to maximize searcher efficiency. Searcher efficiency and carcass removal rates will be determined for each visibility class.

Timing and Duration

Baseline standardized carcass searches will be conducted at the California Ridge site for a total of four weeks in the spring (April 15 through May 15) and eight weeks during the fall (August 1 through September 30) during the first year of Project operation. Baseline carcass searches will be conducted by both a consultant and specifically-trained CRWE personnel. Trained CRWE personnel will then conduct follow-up carcass searches for eight weeks during the fall (August 1 through September 30) every three years to confirm that no significant increase in overall bird or bat mortality has occurred relative to the baseline study.

Standardized Carcass Searches

All carcass searches will be conducted by a biologist or appropriately-trained CRWE personnel, experienced in conducting fatality search methods, including proper handling and reporting of carcasses. Searchers will be familiar with and able to accurately identify bird and bat species likely to be found at the California Ridge Project area. Any unknown birds and bats or suspected Indiana bats discovered during fatality searches will be sent to a qualified, USFWS-approved bird or bat expert for positive identification. During searches, searchers will walk at a rate of approximately 2 mph (45 to 60 m per minute) while searching 10 ft (3 m) on either side of each transect.

For all carcasses found, data recorded will include:

- Date and time;
- Initial species identification;
- Sex, age, and reproductive condition (when possible);

- GPS location;
- Distance and bearing to turbine;
- Substrate/ground cover conditions;
- Condition (intact, scavenged);
- Any notes on presumed cause of death; and
- Wind speeds and direction and general weather conditions for nights preceding search.

A digital picture of each detected carcass will be taken before the carcass is handled and removed. As previously mentioned, all carcasses will be labeled with a unique number, bagged, and stored frozen (with a copy of the original data sheet) at the California Ridge Operations and Maintenance building.

Bird and bat carcasses found in non-search areas (e.g. near a California Ridge turbine not included in the study) will be coded as "incidental finds" and documented as much as possible in a similar fashion to those found during standard searches. Maintenance personnel will be informed of the timing of standardized searches and, in the event that maintenance personnel find a carcass or injured animal, these personnel will be trained on the collision event reporting protocol. Any carcasses found by maintenance personnel will also be considered incidental finds. Incidental finds will be included in survey summary totals, but will not be included in the mortality estimates.

Searcher Efficiency and Carcass Removal Trials

Searcher efficiency trials will be used to estimate the percentage of all bird and bat fatalities that are detected during the carcass searches. Similarly, carcass removal trials will be used to estimate the percentage of bird and bat fatalities which are removed by scavengers prior to being located by searchers. When considered together, the results of these trials will represent the likelihood that a bird or bat fatality which falls within the searched area will be recorded and considered in the final fatality estimates.

Trials will be conducted during each study period by placing "trial" carcasses in the search subplots (one trial during the spring monitoring season and two trials during the fall monitoring season) to account for changes in personnel, searcher experience, weather, and scavenger densities. A total of 50 searcher efficiency trial carcasses, 25 birds of variable sizes and 25 bats, will be placed in subplots according to randomly-selected distances and azimuths from each turbine prior to the carcass search on the same day. Per WTGAC (USFWS 2010) guidelines, this is the maximum number of carcasses that can be distributed across a sample size of 30 turbines without exceeding the limit of two trial carcasses per turbine, and with some allowance for variation in number of trial carcasses placed at each turbine. Searcher efficiency and carcass removal trials will be limited to one spring and two fall trials to avoid saturating the site with carcasses and potentially artificially inflating the carcass removal rate by attracting scavengers.

Each trial carcass will be discretely marked and labeled with a unique number so that it can be identified as a trial carcass. Prior to placement, the date of placement, species, turbine number, distance and direction from turbine, and visibility class (if applicable) will be recorded. Species such as house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*) may be used to represent small-sized birds; rock doves (*Columba livia*) and commercially raised hen mallards (*Anas platyrhynchos*) or hen pheasants (*Phasianus colchicus*) may be used to represent medium to large-sized birds. Non-listed bat species carcasses recovered during the study will be re-used in the searcher efficiency trials, if allowed by permit. Brown mice (*Mus* or *Peromyscus* spp.) may be used to represent bats if bat carcasses are not available. If vegetation classes are established, trial carcasses will be placed in a variety of vegetation classes so that searcher efficiency rates can be determined for each class. No more than two trial carcasses will be placed simultaneously at a single turbine.

Searcher efficiency trials will be conducted blindly; the searchers will not know when trials are occurring, at which search turbines trial carcasses are placed, or where trial carcasses are located within the subplots. The number and location of trial carcasses found by searchers will be recorded and compared to the total number placed in the subplots. Searchers will be instructed prior to the initial search effort to leave carcasses, once discovered to be trial carcasses, in place. The number of trial carcasses available for detection (non-scavenged) will be determined immediately after the conclusion of the trial.

Searcher efficiency of the consultant searchers and CRWE searchers will be combined to generate the estimate of searcher bias for calculation of baseline fatality estimates. Searcher efficiency rates will be spot-checked each year of follow-up monitoring to ensure that initial estimates continue to be valid. Spot-check trials will use 20 carcasses (10 bird and 10 bat) as there will be fewer (15) sample turbines at which to place the carcasses. All other methods will remain the same. The follow-up searcher efficiency rates will be compared to the baseline searcher efficiency rates using a t-test (significant $p \leq 0.10$) to determine if searcher efficiency has changed appreciably such that adjustments to the follow-up monitoring studies should be made.

Carcass removal trials will be conducted immediately following searcher efficiency trials using the same trial carcasses. Trial carcasses will be left in place by searchers, and monitored for a period of up to 30 days. Carcasses will be checked on days 1, 2, 3, 4, 5, 6, 7, 10, 14, 20, and 30. The status of each trial carcass will be recorded throughout the trial. Carcass removal rates will also be spot-checked each year of follow-up monitoring to ensure that initial estimates continue to be valid. The follow-up carcass removal rates will be compared to the baseline carcass removal rates using a t-test (significant $p \leq 0.10$) to determine if carcass removal has changed appreciably such that adjustments to the follow-up monitoring studies should be made.

CRWE Personnel Training

CRWE searchers will be full-time CRWE employees who will be trained by qualified biologists in conducting: (1) standardized carcass searches and search protocols; (2) bird and bat identification and procedures to confirm identifications of rare species; and (3) wildlife handling procedures for all dead or injured wildlife discovered at the Project.

Standardized Carcass Searches: CRWE searchers will be trained by a qualified biologist of CRWE's choice, most likely the consulting biologist conducting the baseline mortality monitoring. Training will include:

- Location, size, and configuration of each search plot and how to record carcass location;
- Knowledge of the visibility classes within each plot;
- Start and stop points and width of search transects;
- Search/walking speed;
- Practice searches with planted carcasses;
- Familiarity with data sheets;
- Recording data and observations that assist with data interpretation;
- Photographing carcasses; and
- Procedures for handling, storing, and transmitting bat carcasses for positive identification.

Statistical tests (t-test, significant $p \leq 0.10$) will be conducted to (1) compare baseline fatality estimates determined using data collected by trained CRWE personnel to estimates determined using data collected by the consultant and (2) compare searcher efficiency rates of the trained CRWE personnel to searcher efficiency rates of the consultant. These tests will confirm that CRWE personnel are adequately trained and qualified to accurately conduct follow-up carcass searches.

Bird and Bat Identification: CRWE searchers will be permitted to handle bird and bat carcasses as described in Section 2.3.1 in this monitoring plan. Any unknown carcass or those requiring additional study for identification (e.g., feather spot, bat wing, *Myotis* bats) will be labeled with a unique identification number, bagged, and retained for future reference. All unknown birds and bats or any suspected Indiana bats will be collected and provided to a qualified, USFWS-approved bird or bat expert for inspection and identification verification.

Wildlife Handling Procedures: Prior to April 15 of each year, CRWE will conduct training sessions for Project personnel to ensure that wildlife handling procedures described in Section 2.3.2 in this monitoring plan are properly implemented.

2.4.3 Statistical Methods for Estimating Fatality Rates

The methodology for estimating overall bird and bat fatality rates will largely follow the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). Huso (2010) has recently proposed an estimator which may offer less bias than the Erickson estimator. The positive bias and different sensitivity to searcher efficiency and carcass removal rates associated with the Huso estimator may make comparisons to estimates derived using the Erickson or Shoenfeld (2004) estimators, which tend towards negative biases, problematic. The bird and bat fatality rates presented in the California Ridge Avian and Bat Protection Plan (ABPP) were mostly calculated from studies which used either the Erickson or Shoenfeld estimators or modifications thereof (the calculations and assumptions of these estimators are very similar). Therefore, maintaining the same biases and assumptions in estimating overall bird and bat fatality at the California Ridge site will be useful for developing fatality estimates that can be compared to other sites and used to determine if any of the adaptive management triggers have been met.

Following Erickson et al. (2003), the estimate of the total number of wind turbine-related casualties will be based on four components: (1) observed number of casualties, (2) searcher efficiency, (3) scavenger removal rates, and (4) estimated percent of casualties that likely fall in non-searched areas, based on percent of area searched around turbine. Variance and 90 percent confidence intervals will be calculated using bootstrapping methods (Erickson et al. 2003 and Manly 1997 as presented in Young et al. 2009). Calculations and analyses will be conducted separately for medium/large birds, small birds, and bats, to provide results specific to each group.

Mean Observed Number of Casualties (c)

The estimated mean observed number of casualties (c) per turbine per study period will be calculated as:

$$c = \frac{\sum_{j=1}^{n} c_j}{n}$$

where n is the number of turbines searched, and c_j is the number of casualties found at a turbine. Incidental mortalities (those found outside of the search plots or by maintenance personnel) will not be included in this calculation, nor in the estimated fatality rate.

Estimation of Searcher Efficiency Rate (p)

Searcher efficiency (p) will represent the average probability that a carcass was detected by searchers. The searcher efficiency rates will be calculated by dividing the number of trial carcasses observers found by the total number which remained available during the trial (non-scavenged). Searcher efficiency will be calculated for each season, for varying distances from the turbine, and for each vegetation class, if applicable.

Estimation of Carcass Removal Rate (t)

Carcass removal rates will be estimated to adjust the observed number of casualties to account for scavenger activity at a site. Mean carcass removal time (t) will represent the average length of time a planted carcass remained at the site before it was removed by scavengers. Mean carcass removal time will be calculated as:

$$t = \frac{\sum_{i=1}^{s} t_i}{s - s_c}$$

where *s* is the number of carcasses placed in the carcass removal trials and s_c is the number of carcasses censored. This estimator is the maximum likelihood (conservative) estimator assuming the removal times follow an exponential distribution and there is right-censoring of the data. For the California Ridge study, any trial carcasses still remaining at 30 days will be collected, yielding censored observations at 30 days. If all trial carcasses are removed before the end of the search period, then s_c will be zero and the carcass removal rate will be calculated as the arithmetic average of the removal times. Carcass removal rate will be calculated for each season.

Search Area Adjustment (A)

Although a complete-coverage methodology will be used, certain areas may be excluded from searching due to safety or access limitations. The adjustment for any areas which were not searched (A) will be approximated as:

$$A = \frac{\sum_{k=1}^{12} \frac{c_k}{p_k \, s_k}}{\sum_{k=1}^{12} \frac{c_k}{p_k}}$$

where c_k is the observed number of casualties found in the k^{th} 10m distance band from the turbine, p_k is the estimated searcher efficiency rate in the k^{th} 10m distance band from the turbine, and s_k is the proportion of the k^{th} 10m distance bands that were sampled across all turbines.

Estimation of the Probability of Carcass Availability and Detection (π)

Searcher efficiency and carcass removal rates will be combined to represent the overall probability (π) that a casualty incurred at a turbine would be reflected in the post-construction mortality study results. This probability will be calculated as:

$$\pi = \frac{t \cdot p}{I} \cdot \left[\frac{\exp\left(^1/_t\right) - 1}{exp\left(^1/_t\right) - 1 + p} \right]$$

where *I* is the interval between searches. For this study, I=7 for baseline carcass searches during the spring and fall periods and for follow-up fall carcass searches.

Estimation of Facility-Related Mortality (m)

Mortality estimates will be calculated using the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). The estimated mean number of casualties/turbine/study period (m) will be calculated by dividing the estimated mean observed number of casualties/turbine/study period (c) by π, an estimate of the probability a carcass was not removed and was detected, and then multiplying by *A*, the adjustment for the area within the search plots which was not searched:

$$m = A \cdot \frac{c}{\pi}$$

2.5 DATA ANALYSIS AND REPORTING

2.5.1 Data Analysis

Analysis of data collected during the post-construction mortality study will include spring and fall season fatality estimates for all birds and bats to the taxonomic level where fatality estimates can be calculated (i.e., it is difficult to calculate representative fatality rates from very small numbers of carcasses so species- and genus-level fatality calculations may not be possible for some species/genera). *Myotis* fatality estimates will be calculated when supported by sufficient observed mortality. Data analysis will be performed to assess fatality estimates by turbine location. Data may also be analyzed to determine the influence of factors such as date and location on bird and bat fatality rates. These relationships may influence turbine operation, as described in Section 3.2 of this MAMP.

A variety of statistical tests may be applied to the data to analyze the patterns of fatality rates in relationship to species/genera/taxa, season, and location. Statistical tests applied to the data may include: ANOVA, tabular summary, graphical representation (least squares, regression, interaction plot, etc), t-test, univariate association analyses (Pearson's and Spearman's rank correlations, linear regression), multivariate regression, chi-square goodness-of-fit and test of independence, and F test. Tests will be selected based on the parameter(s) under analysis, the ability of the data to meet test assumptions, and the suitability of tests for different forms of data. Comparisons between baseline overall bird and bat fatality estimates and those of follow-up studies will be evaluated using t-tests. In general, p values equal to or less than 0.10 will be considered significant.

While statistical tests will not be used to correlate fatalities with weather variables, CRWE will qualitatively evaluate fatality events with regards to notable weather events.

2.5.2 Reporting

CRWE will provide an annual mortality monitoring report to the USFWS following the completion of each year of post-construction monitoring. The report will include fatality estimates and data summaries. Fatalities will be expressed both in terms of fatalities/turbine/season and in terms of fatalities/MW/season, as recommended by the WTGAC (USFWS 2010) to facilitate comparison with other studies. The reports will include all data analyses, including correlation analyses and overall fatality estimates, and a discussion of monitoring results and their implications. In addition to the mortality monitoring reports, CRWE will promptly report any fatalities of ESA-listed species to the USFWS.

3.0 AMERICAN GOLDEN PLOVER MONITORING PLAN

3.1 MIGRATION MONITORING

3.1.1 Monitoring Goals

The goals of American golden plover migration monitoring are to determine the timing of the species' use of the Project area during the spring migration and to assess the general behavior and movement patterns of the species within the Project area.

3.1.2 Study Design

American golden plover migration monitoring will be conducted between April 1 and May 20 of the first two years of Project operation. This survey period coincides with the peak spring migration stopover period for American golden plovers in the upper Midwest. Four survey transects will be established bisecting the Project area; two transects will follow north-south roads and the other two will follow east-west roads. Transect locations will be determined using aerial photography and knowledge of the Project area. Surveys will be conducted four days per week; two transects will be surveyed each day so that each transect is surveyed two times per week.

Observers will drive transects at approximately 15-20 mph (6.7-8.9 m/s) while looking for birds on both sides of the road. Observation points will be established approximately each mile along the transects. Observers will stop at each observation point and scan the surrounding area with binoculars to determine if American golden plovers are present. Stops will last for no more than three minutes unless plovers are observed. No unplanned stops will be made unless plovers are spotted. Data collected for all individuals and flocks detected during surveys will include: date, time, location, habitat, weather conditions, number of individuals observed, behavior (e.g. resting, feeding, etc.), flight height, and direction of flight. If American golden plovers are observed during a transect survey, observers will spend approximately 30 minutes collecting additional data on plover behavior and flight height/direction at up to two observation locations per day. Surveys will begin at 0800 am and end when the transects have been completed.

Weather conditions (e.g. temperature, wind speed, cloud cover) will be recorded at the beginning and end of each transect survey.

3.1.3 Data Analysis and Reporting

American golden plover observations will be used to determine the dates during which plovers are present in the Project area. The locations and number of birds for each observation will be mapped to determine areas of plover use within the Project area. Habitat characteristics recorded at each observation and at the observation points will be analyzed to assess plover selection of different habitats within the Project area. Behavioral observation data will be analyzed to determine flight paths between areas of use, average flight heights within the Project area, and time spent flying in the rotor-swept area by plovers. Monitoring data and results will be included in the annual monitoring report provided to the USFWS, as described in Section 2.5.2, above.

3.2 MORTALITY MONITORING

3.2.1 Monitoring Goals

The goals of American golden plover mortality monitoring are to detect fatalities of spring-migrating American golden plovers from the Project and, if applicable, develop an estimate of overall plover mortality from the Project.

3.2.2 Study Design

American golden plover mortality monitoring will be conducted during the four-week spring monitoring period (April 15 through May 15, a portion of the American golden plover stopover period when plovers are likely to be moving through) during the first two years of Project operation if plovers are observed within the Project area during the transect surveys. If initiated, plover mortality monitoring will be conducted largely according to the study design described in Section 2.4, above. The same 30 study turbines will be searched during plover mortality monitoring, although the search interval at each turbine will be increased from once a week to twice a week.

Any other carcasses found incidentally during plover mortality monitoring will be recorded as well.

3.2.3 Data Analysis and Reporting

Analysis of the plover mortality monitoring data will be conducted as described for the overall mortality monitoring in Section 2.5.1, above. The results of the searcher efficiency and carcass removal trials conducted during the spring mortality monitoring will be applied to the results of the plover mortality monitoring to develop a plover fatality estimate, if necessary. Should plover mortality monitoring be conducted during the second year of project operation (when spring mortality monitoring is not scheduled), searcher efficiency and carcass removal trials will be conducted during the plover monitoring. Fatality estimates will not be developed for other species found as incidental fatalities. Results of the plover mortality monitoring will be included in the annual monitoring report provided to the USFWS, as described in Section 2.5.2, above.

4.0 ADAPTIVE MANAGEMENT

4.1 ADAPTIVE MANAGEMENT GOALS

The goals of the adaptive management plan are to enable the incorporation of results from the post-construction monitoring efforts into the Project's avoidance, minimization, and mitigation plan. Certain trigger events and subsequent changes to the avoidance, minimization, and mitigation plan have been defined as a part of the adaptive management plan, to guide the adaptive process. Adaptive management will provide effective measures to meet the Project's ABPP goals of avoiding and reducing impacts to birds and bats.

4.2 ADAPTIVE MANAGEMENT PLAN

To enable the results of post-construction monitoring to influence and improve the avoidance, minimization, and mitigation measures of the Project, certain trigger events and the subsequent changes or actions have been established. Changes to the Project's minimization and mitigation plan may be triggered by certain events, but no changes to the agreed upon turbine operational protocols will occur without USFWS concurrence (except temporary cessation of turbine operations for maintenance).

The events that would trigger changes to the avoidance, minimization, and mitigation plan presented herein would be:

- Take of any Indiana bats or other ESA-listed species;
- Take of any bald or golden eagles; or
- Identification of one or more variable(s) with a consistent and strong negative relationship to bat mortality.

If take of any Indiana bats or other ESA-listed species occurs at the Project, the following actions will be taken:

1) CRWE will, working with a trained wildlife biologist, promptly identify and store the carcass after its discovery.
2) USFWS will be notified within one business day of the discovery.
3) CRWE and the USFWS will meet and confer to determine, based on the available data, the circumstances under which the fatality occurred.
4) If a particular cause for the mortality can be identified, CRWE will develop specific mitigation measures in consultation with USFWS to address the occurrence, including, but not limited to, raising cut-in speeds on a specific turbine or group of turbines during specified wind conditions or periods of the year.
5) CRWE will conduct follow-up post-construction monitoring as described in Section 2 of this MAMP during fall in the subsequent year to assess whether cut-in speed adjustments or other mitigation measures are sufficient to reduce impacts to ESA-listed species.
6) CRWE and USFWS will determine the need to pursue additional ESA permits or authorizations in view of new information.

If a bald or golden eagle take occurs at the Project, the following actions will be taken:

1) CRWE will, working with a trained wildlife biologist, promptly identify and store the carcass after its discovery.
2) USFWS will be notified within one business day of the discovery.

3) CRWE and the UWFWS will meet and confer to determine, based on the available data, the circumstances under which the fatality occurred.
4) If a particular cause can be identified, CRWE will develop specific mitigation measures in consultation with USFWS.
5) CRWE will conduct follow-up post-construction monitoring as described in Section 2 of this MAMP in the fall of the subsequent year to assess whether mitigation measures are sufficient to reduce impacts to bald and golden eagles.
6) CRWE and USFWS will determine the need to obtain additional BGEPA permits or authorizations in view of new information.

If, through post-construction monitoring, one or more variable(s), including but not limited to a specific period of the night, seasonal period, temperature, wind speed[s], pressure, etc, that has a consistent and strong negative relationship to bat mortality is identified, the following actions will be taken:

1) Curtailment protocol will be lifted and turbines will be fully operational when the identified variable(s) is present in site conditions.

This adaptive management plan will apply throughout the life of the Project to provide effective avoidance, minimization, and mitigation measures for avoiding and reducing impacts to birds and bats.

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Bird and Bat Conservation Strategy for California Ridge Wind Energy II's California Ridge II Wind Energy Project, Vermilion County, Illinois

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April 2013

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1 INTRODUCTION

California Ridge Wind Energy II LLC (CRWE II) is developing the California Ridge II Wind Energy Project (Project or Phase II) located adjacent to the California Ridge Wind Energy Project (Phase I) in Vermilion County, Illinois (Figure 1.1). The Project will be a maximum of approximately 50 megawatts (MW) in size, consisting of up to 31 GE 1.75 MW wind turbines. The Project will interconnect to the regional electrical system through a substation adjacent to the 138kV transmission line near the Project area. Currently, most of the Project parcels are in agricultural land (95%). Only a small portion of the approximately 5,200-acre (2,104-ha) Project area will host wind farm facilities. It is estimated that approximately 186 acres (75 ha) within the Project area (non-contiguous) would be temporarily disturbed by the construction of the Project turbines. Of this area, only approximately 29 acres (12 ha) would remain permanently disturbed for the 20–year life of the Project.

1.1 Purpose of the Bird and Bat Conservation Strategy

Wind energy is one of the fastest growing sources of renewable energy in the United States, is the most economically competitive form of renewable energy, and is generally viewed as an environmentally friendly alternative to nuclear and fossil fuel power plants (AWEA 2008; NRC 2007). However, construction and operation of wind energy projects has the potential to impact migratory bird and bat populations through habitat fragmentation, displacement, and mortality due to collision with or proximity to wind turbine blades (NWCC 2010).

After completing a detailed analysis of the proposed Project, CRWE II concludes that construction and operation of the Project is unlikely to result in the “take” of any Endangered Species Act (ESA)-listed species. This Bird and Bat Conservation Strategy (BBCS) was developed to document (1) the results of CRWE II’s avoidance and conservation measures that will make take of ESA-listed species unlikely to occur, while reducing potential impacts to other bird and bat species. This BBCS is a living document that will evolve in response to Project conditions throughout the life of the Project.

Specific goals of the California Ridge II BBCS are to:

1) Develop measures that, when implemented at the Project, will avoid and reduce potential impacts to birds and bats during construction, operation, maintenance, and decommissioning of the Project;

2) Ensure the potential impacts to ESA-listed bat species are reduced to the point where take is unlikely;

3) Describe effective post-construction monitoring and adaptive management procedures to guide management actions for the life of the Project;

4) Develop a protocol for consistent, ongoing communication and reporting to U.S. Fish and Wildlife Service (USFWS or the Service) and Illinois Department of Natural Resources (IDNR); and

5) Outline CRWE II’s efforts to implement recommendations and best practices contained with the USFWS Land-Based Wind Energy Guidelines (WEG, USFWS 2012a) and the Draft Eagle Conservation Plan Guidance (USFWS 2011a).

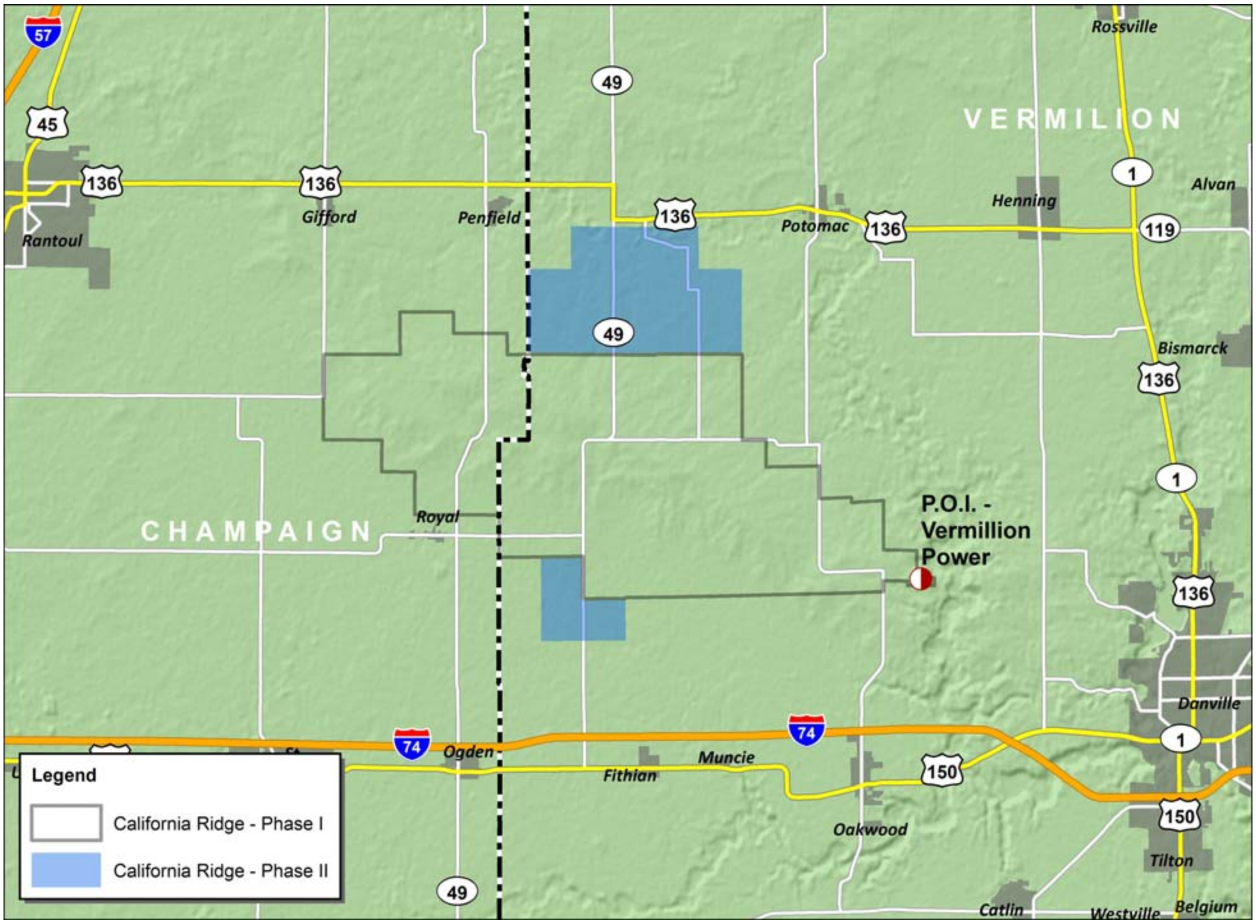

Figure 1.1 California Ridge II Wind Energy Project

1.2 Consultation History

CRWE conducted extensive consultation with the USFWS for Phase I of the project (CRWE 2011), and Phase II is designed to incorporate similar wildlife avoidance and minimization measures as Phase I. On July 25, 2012, and January 15, 2013, CRWE met with the USFWS to discuss plans for the Phase II Project. CWRE also met with the Illinois Department of Natural Resources in April 2013.

1.3 Regulatory Framework

1.3.1 <u>Endangered Species Act</u>

The Endangered Species Act (ESA) of 1973 [16 U.S.C. §§ 1531 *et seq*.] provides for the listing, conservation, and recovery of endangered and threatened species. The USFWS possesses responsibility for implementing the ESA to protect terrestrial species and resident fish species.

Section 9 of ESA prohibits the unauthorized "take" of listed species. Take is defined broadly by ESA to mean "*to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect*" a listed species. The term "harm" has been further defined in agency regulations to mean habitat modification that actually kills or injures a listed species.

The 1982 amendments to the ESA established a provision in Section 10 of the ESA that allows for "incidental take" of endangered and threatened species of wildlife by non-Federal entities. Incidental take is defined by the ESA as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" [50 Code of Federal Regulations (CFR) §402.02]. Section 10 of the ESA establishes a program whereby persons seeking to pursue activities that otherwise could give rise to liability for unlawful "take" of federally-protected species as defined in Section 9 of the ESA, may receive an Incidental Take Permit (ITP), which exempts them from such liability. Under Section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species, as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

As described above, CRWE II intends this BBCS to serve as the basis for the development of a technical assistance letter with USFWS to document that take of listed species is unlikely to occur if the Project is designed and operated pursuant to the measures contained in the BBCS. Measures taken to avoid and reduce impacts to listed species were developed based on the results of pre-construction site characterization and survey efforts (corresponding to Tiers 1-3 in the USFWS guidelines) and best available scientific information. These measures are described in Section 2.4. Additionally, post-construction monitoring will be conducted at the Project (corresponding to Tier 4 in the USFWS guidelines, see the Monitoring and Adaptive Management Plan [MAMP], Appendix A) and the Project will be managed under an adaptive management framework to enable CRWE II to respond appropriately should unexpected impacts to ESA-listed species occur (MAMP, Appendix A).

1.3.2 Migratory Bird Treaty Act

Among other things, the Migratory Bird Treaty Act (MBTA, 16 U.S.C. §§ 703-712) prohibits the taking of listed migratory birds. The MBTA implements four treaties that prohibit take, possession, transportation, and importation of all migratory, native birds (plus their eggs and active nests) occurring in the wild in the U.S. except for the house sparrow, European starling, rock pigeon, and any recently listed unprotected species in the Federal Register (70 Fed. Reg. 12710).

The USFWS regards voluntary adherence to its WEG (USFWS 2012a) and communications as evidence of due care with respect to avoiding, minimizing, and mitigating adverse impacts to species protected under the MBTA, should a violation of the MBTA occur. Through this BBCS, CRWE II is voluntarily describing its approach to selecting a site with minimal wildlife habitat (Tier 1), studying MBTA species that may be at potential risk from the Project within the Project area (Tiers 2 and 3), committing to measures to avoid and minimize impacts on species protected under the MBTA, monitoring the effect of the Project on migratory birds (Tier 4), and implementing an adaptive management strategy to respond to unanticipated impacts.

To avoid and minimize impacts to MBTA-listed species, CRWE II will implement this BBCS in consultation with the Service and IDNR. This BBCS incorporates applicable conservation measures based on the WEG (USFWS 2012a). These guidelines contain materials to assist in evaluating possible wind power sites, wind turbine design and location, and pre- and post-construction studies to identify and/or assess potential impacts to wildlife. Measures to be taken to avoid and minimize impacts to migratory birds are described in Section 2.4 of this BBCS.

1.3.3 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA, 16 U.S.C. §§ 668-668d) prohibits the take of bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles unless pursuant to regulations. BGEPA defines the take of an eagle to include a broad range of actions, including "*…to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb.*" The term "disturb" is defined in regulations found at 50 CFR 22.3 to include to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior. Measures to be taken to avoid and minimize impacts to eagles are described below.

The USFWS published a final rule (Eagle Permit Rule) on September 11, 2009 under the Bald and Golden Eagle Protection Act (BGEPA) (50 C.F.R. 22.26) authorizing limited issuance of permits to take bald eagles and golden eagles. The final rule notes that wind power is an industry sector for which programmatic permits are appropriate. The USFWS more recently published and is revising, based on public comment, the Draft Eagle Conservation Plan Guidance (USFWS 2011a), which explains the USFWS's approach to issuing programmatic permits to individual wind companies or broad, wind industry-wide permits for ongoing take of eagles under this authority, and provides guidance to permit applicants (project proponents).

To avoid and minimize impacts to eagles, CRWE II will implement this BBCS in consultation with the Service. This BBCS incorporates applicable conservation measures based on the USFWS Draft Eagle Conservation Plan Guidance (January 2011). These guidelines contain materials to assist in evaluating potential eagle risk, avoiding and minimizing eagle risk, and mitigating eagle impacts. Surveys conducted to identify and assess potential risk to eagles from the Project are described in Section 3.2.1. Measures taken to avoid and minimize impacts to eagles are described in Section 2.4 of this BBCS.

1.4 BBCS Term

This BBCS will be in effect through development, construction, operation, maintenance, and decommissioning of the Project (Term). This Term will cover the 20-year minimum functional life of the turbines following completion of construction, and potential extended operations and/or decommissioning of the Project. CRWE II will update this BBCS, as needed, through adaptive management (MAMP, Appendix A) throughout the Term. Should the Project be re-powered at the end of the Project's expected life, CRWE II will re-initiate consultation with the Service and IDNR. The BBCS's avoidance and minimization measures (Section 2.4) and monitoring and adaptive management plans (MAMP, Appendix A) will remain in effect until the Project is decommissioned.

1.5 BBCS Project Area

This BBCS applies to all those lands leased by CRWE II for construction, operation, and decommissioning of Project. These lands include the locations for up to 31 turbines and associated facilities.

2 PROJECT DESCRIPTION

2.1 Project Area, Siting, and Facilities Siting

The Project area is located in Vermilion County, Illinois, in the townships of Middlefork, Pilot and Oakwood (Figure 1.1). The Project will be approximately 50 MW in size, consisting of up to 31 GE 1.75 MW wind turbines (Figure 2.1). The Project will interconnect to the Vermilion Power Station via the 9.3-mile (14.5-km) transmission line constructed during Phase I.

The Project would encompass approximately 5,200 acres (2104 hectares [ha]) of privately owned land. The village of Ogden is located near the Project area. CRWE II is responsible for all land acquisition and has obtained the necessary easements from landowners for the development, construction, and operation of all 31 turbines and associated facilities.

Currently, all of the Project parcels are privately owned and in agricultural use, and only a portion of the Project area will actually host wind farm facilities. Construction of the Project will temporarily disturb an area of 4.0 acres (1.6 ha) or less per turbine. Nearly all of the disturbed acreage will be reclaimed to preconstruction conditions (mostly cropland; see section 3.1 below) following construction; approximately 0.25-0.5 acre (0.1-0.2 ha) per turbine will remain disturbed during Project operation. Approximately 29 acres (12 ha), included within the Project area but not contiguous, will be directly affected by the construction and use of the proposed 31 Project turbines, and access roads.

The Project will apply for a Building Permit with the Vermilion County Board during the spring of 2013.

2.1.1 <u>Project Components</u>

The Project will consist of several primary components, including wind turbines, access roads, communications and collection system, as well as a shared substation and O&M facility with California Ridge Wind Energy LLC. These components are discussed in detail below.

2.1.1.1 <u>Wind Turbines</u>

The Project will include up to 31 GE 1.75 MW turbines or similar turbine of approximately equivalent size and design. The GE 1.75 MW turbine is a three-bladed, upwind, horizontal-axis wind turbine. The turbine rotor and nacelle are mounted on top of a tubular tower. The machine employs active yaw control (designed to position the rotor to face the wind), active blade pitch control (designed to regulate turbine rotor speed), and a generator/power electronic converter system attached to a variable speed drive train designed to produce a nominal 60 hertz [Hz], 575 or 690 Volts (V) of electric power.

The GE 1.75 MW turbine has a nameplate rating of 1750 kilowatts (kW). Each turbine is equipped with a wind speed and direction sensor that communicates to the turbine's control system when sufficient winds are present for operation. The turbine features variable-speed control and independent blade variable pitch to assure aerodynamic efficiency, and which functions as an aerodynamic control system. The turbine begins operation in wind speeds of approximately 8 miles per hour (mph; 3.5 meters per second [m/s]) and reaches its rated capacity at a wind speed of approximately 28 mph (12.5 m/s). The turbine is designed to operate in wind speeds up to approximately 56 mph (25.0 m/s) and can withstand sustained wind speeds of more than approximately 100 mph (44.7 m/s). The color of all turbines, blades, and towers used for the Project will be white and the rotation direction, as an observer faces the turbines, will be clockwise.

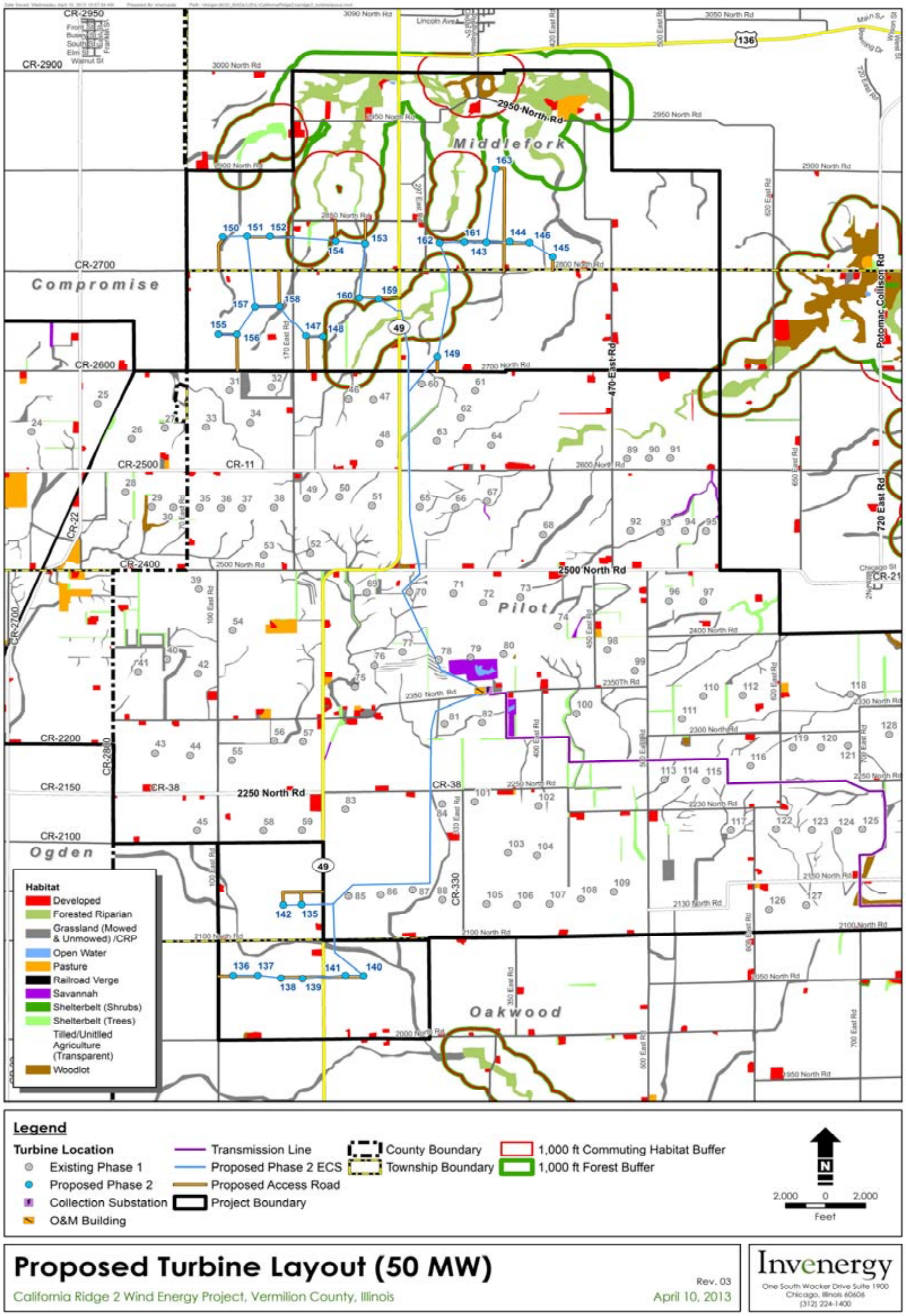

Figure 2.1 Turbine and Other Facilities Locations

Each turbine includes a Supervisory Control and Data Acquisitions (SCADA) communications system that permits automatic, independent operation and remote supervision, allowing continuous control of the wind farm to ensure optimal and efficient operation and early troubleshooting of problems. SCADA data provide detailed operating and performance information for each wind turbine, and CRWE II maintains a database tracking each wind turbine's operational history.

The rotor consists of three blades attached to a hub. The rotor blades are constructed of fiberglass and epoxy or polyester resin. The cast iron hub connects the rotor blades to the main shaft and transmits torque. The hub is attached to the nacelle, which houses the gearbox, generator, brake, cooling system, and other electrical and mechanical systems.

The GE 1.75 MW wind turbines use a maximum 328-foot (100-m) rotor diameter with a rotor-swept area of approximately 84,497 feet^2 (7850 m^2). The rotor speed would be 10 to 16 rpm and all rotors would rotate in the same direction.

The turbine nacelles are mounted on freestanding monopole tubular steel towers with a maximum hub height of 328 feet (100 m). Each tower will consist of either four or five sections manufactured from steel plates. All welds are made in automatically controlled power welding machines and are ultrasonically inspected during manufacturing per American National Standards Institute specifications. All surfaces are sandblasted and multiple layers of coating are applied for protection against corrosion. Access to the turbine is through a lockable steel door at the base of the tower. The steel door at the base of each tower also includes a low voltage safety light on a motion sensor for entry.

The turbine towers are connected by anchor bolts to an underground concrete and rebar foundation. Geotechnical surveys and turbine tower load specifications dictate final design parameters of the foundations, which may include spread footers or deep foundations. A typical spread footer has a similar footprint to the tower diameter at grade, but may spread out below grade to as much as 65 x 65 feet (20 x 20 m) in size. A typical deep foundation is placed on an area approximately 25 x 25 feet (8 x 8 m) in size. All foundations consist of anchor bolts, concrete, and reinforcing rebar. Certain specific site conditions may require subgrade modification to support the foundation.

2.1.1.2 Access Roads

Each wind turbine will be accessible via all-weather gravel access roads connected to public roads. These roads will be approximately 16.0 feet (4.9 m) wide and low profile to allow cross-travel by farm equipment. CRWE II has worked closely with the landowners in locating access roads to minimize land use disruptions to the extent possible.

2.1.1.3 Communications and Collection System

A control panel inside the base of each turbine tower houses communication and electronic circuitry. A step-up transformer will be installed at the base of each turbine to raise the voltage from 575 or 690 V to distribution line voltage (34.5 kV). Power will run through an underground collection system at a minimum depth of four feet (1.2 m) to the Project feeder system that will feed power to the point of interconnection. Both power and communication cables will be buried in trenches on private property or public rights-of-way (ROWs) at a minimum depth of four feet

(1.2 m). Collection lines will deliver the power from the wind farm to the Phase I Project substation.

2.1.1.4 Substation and O&M Facility

The existing Phase I substation and O&M facility will also be used for California Ridge II.

2.1.1.5 CRWE II Transmission Line and Switchyard

The Project will make use of the transmission line and switchyard constructed during Phase I to interconnect to the Vermilion Power Station.

2.1.2 Facility Life Span

The Project's minimum life span after construction is expected to be 20 years.

2.2 Project Construction

During construction, several types of light, medium, and heavy-duty construction vehicles will travel to and from the Project area. Private vehicles will also be used by the construction personnel. At this time, CRWE II estimates that there will be 75 large truck trips per day and up to 200 small-vehicle (pickups and automobiles) trips per day in the area during peak construction periods for each phase. Of the 75 large truck trips, approximately 20 are expected to be wind turbine component deliveries. The balance is comprised of concrete, aggregate, and miscellaneous delivery trucks. Construction of the Project is expected to take between eight to ten months, with peak construction period lasting four to six months. The highest traffic volume will occur during the construction peak, when the majority of the foundation and tower assembly is taking place.

Pre-construction, construction, and post-construction activities for the Project include:

- Ordering all necessary components, including wind turbine generators, foundation materials, electrical cable, and transformers;
- Completing an American Land Title Association survey to establish locations of structures and roadways;
- Completing soil borings, testing, and analysis for proper foundation design and materials;
- Constructing access roads to be used for construction and maintenance;
- Installing tower foundations;
- Installing underground cables;
- Placing towers and setting wind turbine generators;
- Commissioning wind turbines; and
- Commencing commercial operation.

2.2.1 Civil Works

Project construction will require various types of civil works and physical improvements to the land. These civil works include the following:

- Improving existing county and township roads;

- Constructing roads adjacent to the wind turbine strings to allow construction and continued servicing of the wind turbines;
- Clearing and grading for wind turbine tower foundation installations; and
- Trenching for underground cabling to connect the individual wind turbines.

The Project will include construction of up to approximately 8.5 miles (13.7 km) of new gravel access roads located on participating parcels. No asphalt or other paving is anticipated on the Project access roads. Access roads will be located between towers, offset as necessary to allow for adequate crane access. The roads will be approximately 16.0 feet (4.9 m) wide and low profile to allow cross-travel by farm equipment. CRWE II has worked closely with the landowners to locate these access roads to minimize land use disruptions to the extent possible. All roads will include appropriate drainage and culverts while still allowing for the crossing of farm equipment. Once construction is completed, the roads will be regraded, filled, and surfaced with gravel as needed.

Temporary disturbances during construction of the Project include crane pads at each turbine, temporary travel roads for the cranes, temporary laydown areas around each turbine, trenching in the underground electrical collection system, and storage/stockpile areas. Construction of the GE 1.75 MW wind turbine will include temporary impacts of an additional 12 feet (4 m) of gravel roadway on either side of the permanent access road (40 feet [12-m] total width), a 40- by 120-foot (12- by 37-m) gravel crane pad extending from the access road to the turbine foundation, which will be graded to a minimum of 1%, and a 150-foot (46-m) diameter rotor laydown area centered around the turbine foundation, which will be graded to a maximum of 5% slope.

A construction staging and laydown area of approximately 8 acres (3 ha) will likely be used for the Project. There will be a local supply of concrete to construct the turbine foundations. After completion of construction, all disturbed areas will be finish-graded, and any remaining trash or debris will be properly disposed of off-site. Erosion control measures, including site-specific contouring, reseeding, or other measures agreed to by the landowners, will be used to control runoff and erosion in conformance with the Project's storm water pollution prevention plan. Temporary work areas surrounding each turbine will revert to the original land use. After construction, the Project will allow for the continued agricultural uses on private land under easement.

2.2.2 Commissioning

The Project will undergo detailed inspection and commissioning procedures for each component of the wind turbines, the Supervisory Control and Data Acquisitions system, communication system, meteorological system, collection lines, and the high voltage transmission line.

2.2.3 Expected Commercial Operation Date

CRWE II anticipates that the Project may begin operation anywhere from the fourth quarter of 2013 to the second quarter of 2014, pending completion of permitting, agency approvals, and other development activities.

2.3 Project Operations, Maintenance, Decommissioning, and Restoration

2.3.1 Operations and Maintenance

CRWE II will perform Project O&M for the anticipated 20-year life of the Project. CRWE II and the turbine supplier will control, monitor, operate, and maintain the Project by means of the Supervisory Control and Data Acquisitions system, and regularly scheduled on-site inspections will be conducted. CRWE II anticipates that approximately 20 to 30 O&M staff will be employed full-time throughout the life of the Project.

All maintenance activities will occur within areas previously disturbed by construction, so no new permanent ground disturbance will occur during O&M of the Project. Turbine maintenance is typically performed up-tower (i.e., O&M personnel climb the towers and perform maintenance within the tower or nacelle) and O&M personnel access the towers using pick-up trucks, so no heavy equipment in needed. In the rare event that a large crane would be needed for maintenance, vegetation would be cleared within the area previously disturbed during construction to provide for safe and efficient operation of the crane, but no tree removal or soil disturbance would be necessary. Ground-disturbing activities may include occasional need to access underground cable or communications lines. Vegetation mowing will occur along Project roads and around turbines for vegetation control purposes.

2.3.2 Decommissioning and Restoration

At the end of the Project's useful life, CRWE II expects to explore alternatives for either repowering or decommissioning the Project. One option may be to continue operation of the Project, providing energy under a new long-term contract with a power purchaser or on a merchant basis. If it were determined that the wind turbines would not be replaced or repowered after 20 years, the following sequence for removal of components will be implemented:

- Turbines and substation will be dismantled and removed;
- Pad-mounted transformers will be removed;
- All turbine and substation foundations will be removed to a depth of 4 feet (1.2 m); and
- All disturbed areas and access roads will be graded to as near as practicable the original contour, if the landowner requests that CRWE II decommission these areas.

A decommissioning fund may be established based on the requirements of Vermilion County. The fund would cover dismantling of the turbines and towers, land reclamation, monitoring of revegetation success, and reseeding if needed to ensure revegetation success.

2.4 Avoidance and Minimization Measures

2.4.1 Summary of Measures Incorporated into the Project Siting Process

In assessing the feasibility of developing Phase II of the California Ridge Wind Energy Project, CRWE II had a preliminary environmental analysis (Good et al. 2012a) conducted to evaluate potential concerns associated with the Phase II Project. The analysis found that due to the Project's placement in an agricultural setting, impacts to bird and bat resources could be avoided and minimized to low levels through the use of turbine micro-siting.

During the Project's turbine micro-siting process, CRWE II incorporated numerous considerations to avoid and minimize impacts to bird and bat resources while locating turbines to provide benefit to local landowners and communities. As part of the siting process, CRWE II considered the results of the pre-construction (Tier 1-3) studies and recommendations from USFWS and IDNR regarding the Project layout. Additionally, CRWE II made a good faith effort to incorporate the WEG (USFWS 2012a). All turbines will be located in tilled agricultural areas so that impacts to native habitat will be limited to access road and collection system corridors (Figure 2.1). Potentially-suitable foraging habitats for Indiana bat (*Myotis sodalis*) were evaluated for connectivity to one another and to the Middle Fork of the Vermilion River. If habitats were determined to be connected, a 1,000 foot (305-m) setback from those habitats was established to prevent the turbine sites from being connected to the Middle Fork of the Vermilion. CRWE II has also committed to a 1,000-foot (305-m) setback from potential commuting habitat for Indiana bats as defined by the USFWS within and adjacent to the Project area.

2.4.2 Summary of Measures Incorporated into the Project Design

Based on site-specific scientific data collected through the pre-construction surveys (Tier 1-3) and the recommendations obtained from IDNR and USFWS, CRWE II has designed the Project to minimize impacts to wildlife while maximizing Project output. Additionally, the Project design and development stages will incorporate and implement industry best management practices based on the WEG (USFWS 2012a) and other measures based on the best available scientific data to reduce risk to birds and bats. These conservation and mitigation practices, which are a part of the Project design, are summarized below.

2.4.2.1 General

- All federal, state, and local environmental laws, orders, and regulations will be complied with.
- Prior to construction, all supervisory construction personnel will be instructed on the protection of wildlife resources including: (1) federal and state laws regarding plants and wildlife, including collection and removal and (2) the importance of these resources and the purpose and necessity of protecting them. This information will be disseminated through the contractor hierarchy to ensure that all appropriate staff members are aware of the correct procedures and responsibility to report wildlife incidences.
- CRWE II will monitor bird and bat fatalities at the site in accordance with the monitoring plan presented in the MAMP (Appendix A) to verify the effectiveness of these avoidance and minimization strategies incorporated into the Project.
- CRWE II has consulted and coordinated with USFWS and IDNR for avoidance and minimization measures related to bats, eagles, other raptors, and other migratory birds. As discussed in Section 4.1 below, the Project has been sited such that potential impacts to these taxa are reduced. Additional measures to avoid and minimize impacts to birds and bats are listed below.

2.4.2.2 Surveys

- As discussed in Section 3.0, the effects of construction, operational, and decommissioning activities were taken into account during the pre-development stage of this Project and were assessed by conducting Tier 1-3 bird and bat resource surveys recommended by USFWS and IDNR.
- All native habitats directly impacted by construction activities during the breeding season will be surveyed for nests by a trained biologist prior to construction.

2.4.2.3 Surface Water, Soils, and Vegetation

- Appropriate storm water management practices that do not create attractions for birds will be implemented. A storm water pollution protection plan will be prepared to ensure that erosion is minimized during storm events and will be kept on-site at all construction sites, as well as in the construction contractors' offices. CRWE II and its contractors will implement the storm water pollution protection plan. To minimize damage to the land surface and property, contractors will limit the movement of crews and equipment to the Project site, including access routes, to that which is necessary for safe and efficient construction. When weather and ground conditions permit, construction-caused deep ruts will be leveled, filled and graded, or otherwise eliminated. Ruts, scars, and compacted soils will be loosened and leveled using a ripper or disc or other landowner-approved method. Damage to ditches, roads, and other features of the land will be repaired. Water bars or small terraces will be constructed along access road ditches on hillsides to minimize water erosion and to facilitate natural revegetation.
- All federal regulations concerning the crossing of waters of the U.S., as listed in Title 33 C.F.R. Part 323, will be complied with.
- Wind turbines and most ancillary facilities will be built on uplands, which avoid the surface water features and designated floodplains.
- Wind turbines will not be placed in areas containing waters of the U.S.
- Refueling and staging will occur at least 300 feet (91 m) from the edge of a channel bank at all stream channels. Sediment control measures will be utilized.
- Prior to construction, field surveys will be conducted to determine the presence of jurisdictional wetlands and streams within the footprint of each turbine location and ancillary facilities. Once the layout for the Project has been finalized, results of the field surveys and a summary of impacts will be submitted to the U.S. Army Corps of Engineers, and the required authorizations/permits will be obtained.
- Roads, portions of roads, crane paths, and staging areas not required for operation and maintenance will be restored to the original contour and made impassable to vehicular traffic. Areas to be reclaimed will be contoured, graded, and seeded as needed to promote successful revegetation, provide for proper drainage, and prevent erosion. Seed mixtures will be developed based on best management practices for the region, requirements or recommendations by the county, or specific requests by the landowner or easement requirements.
- Equipment and vehicles will not cross riparian areas on the ROW during operation or decommissioning activities. Existing bridges or fords will be used to access the ROW on either side of riparian areas.
- During Project construction, riparian areas will be avoided, where feasible. If avoidance is not feasible, activities within riparian areas will be conducted in conformance with storm water pollution protection plan requirements.
- During construction and operation of the Project, industry-standard best management practices will be implemented to protect topsoil and adjacent resources and to minimize soil erosion. Practices may include containing excavated material, protecting exposed soil and stabilizing restored material, and re-vegetating areas as necessary.

- Existing roads and previously disturbed lands will be used where feasible, to reduce vegetation impacts within the Project area. Surface disturbance will be limited to that which is necessary for safe and efficient construction.
- All surface-disturbed areas will be restored to the approximate original contour and reclaimed in accordance with easement agreements.
- Removal or disturbance of vegetation will be minimized through site management (e.g., by utilizing previously disturbed areas, designating limited equipment/materials storage yards and staging areas, scalping) and reclaiming all disturbed areas not required for operations.
- Soil erosion control measures will be monitored, especially after storms, and will be repaired or replaced if needed.
- Construction activities in areas of moderate to steep slopes (≥15-20%) will be avoided, where possible.

2.4.2.4 Site Management

- All carrion discovered on-site during regular maintenance and monitoring activities will be removed to avoid attracting bald eagles and other raptors.
- Hunting, fishing, dogs, or possession of firearms by CRWE II employees and designated contractor(s) in the Project area will be prohibited during construction, operation, and maintenance.
- Project personnel will be advised regarding speed limits on roads (25 mph) to minimize wildlife mortality due to vehicle collisions.
- Potential increases in poaching will be minimized through employee and contractor education regarding wildlife laws. If violations are discovered, the offense will be reported to the IDNR and offending employee or contractor will be disciplined and may be dismissed by CRWE II and/or prosecuted by the IDNR.
- Travel will be restricted to designated roads; no off-road travel will be allowed except in emergencies.

2.4.2.5 Collision Risk

- Turbines will employ unguyed, tubular towers and slow-rotating, upwind rotors.
- Collection and communication lines will be buried.
- The existing overhead transmission line, substation, and operations and maintenance building constructed for Phase I will be used for Phase II.
- Lighting will be minimized to that which is required by the Federal Aviation Administration. The Federal Aviation Administration typically requires every structure taller than 200 feet (61 m) above ground level to be lighted, but in the case of wind power developments, it allows a strategic lighting plan that provides complete conspicuity to aviators but does not require lighting every turbine. CRWE II will develop a lighting plan for the Project to be submitted for Federal Aviation Administration approval. An estimated 40% to 60% of the Project's turbines will be designated for lighting with medium intensity dual red synchronously flashing lights for night-time use and daytime

use, if needed. The turbines will be lighted only as required by Federal Aviation Administration regulations, plus a low voltage, shielded light on a motion sensor at the entrance door to each turbine. To avoid disorienting or attracting birds or bats, lighting on turbines will employ strobed, minimum-intensity lights as recommended by the USFWS (2012).

- During the late summer and fall swarming and migration seasons (August 1-October 7), Project turbines will be curtailed at 15.2 mph (6.9 m/s) beginning at sunset and continuing until sunrise. This curtailment schedule targets the season during which the majority of all bat mortalities have occurred at wind energy facilities (Arnett et al. 2008) and includes the weekly periods during which bat activity was found to be the highest at the Phase I and Phase II Project areas (BHE Environmental, Inc. 2010, Ritzert et al. 2012). The fall migration season is also the season during which all five reported Indiana bat fatalities at wind energy facilities have occurred (Good et al. 2012b, USFWS 2011c, USFWS 2012b, c). Furthermore, this curtailment schedule covers the entire nightly period during which all bat activity at the Phase II Project area was recorded (Gruver 2013).

  Turbine blades will remain fully feathered (i.e., blades will be oriented parallel to the wind) so rotors will move very slowly prior to reaching the turbine cut-in speed. At cut-in wind speeds, the blades will pitch into the wind, rotor speeds will increase, and the generators will eventually close their electrical breaker and begin generating electricity at some slightly higher wind speed, when steady wind power is provided by the rotor to the generator.

  CRWE II will test the effectiveness of these collision risk minimization measures through fatality monitoring during the first three years of operation and every third year thereafter (MAMP, Appendix A).

2.4.2.6 Fencing

- The substation and O&M building will be fenced as required for public safety, but no other fencing is proposed at this time. The public will continue to have access to portions of the Project area via public roads and private roads that are regularly open to the public.

2.4.2.7 Hazardous and Solid Wastes

- All applicable hazardous material laws and regulations existing or hereafter enacted or promulgated regarding these chemicals will be complied with and a Spill Prevention, Control, and Countermeasure Plan will be implemented. The only hazardous chemicals anticipated to be on-site are the chemicals contained in diesel fuel, gasoline, coolant (ethylene glycol), and lubricants in machinery. Hazardous chemicals contained in diesel fuel, gasoline, coolant (ethylene glycol), and lubricants will not be stored in or near any stream, nor will any vehicle refueling or routine maintenance occur in or near streams. When work is conducted in and adjacent to streams, fuels and coolants will be contained in the fuel tanks and radiators of vehicles or other equipment.

- Construction activities will be performed using standard construction best management practices so as to minimize the potential for accidental spills of solid material, contaminants, debris, and other pollutants. Excavated material or other construction materials will not be stockpiled or deposited near or on stream banks.
- No burning or burying of waste materials will occur at the Project site. The contractor will be responsible for the removal of all waste materials from the construction area. All contaminated soil and construction debris will be disposed of in approved landfills in accordance with appropriate environmental regulations.

2.4.2.8 Fire Protection

- A fire protection system will be implemented, using industrial best practices, and in accordance with all applicable fire safety codes. CRWE II will coordinate with fire, safety, and emergency personnel during all stages of the Project to promote efficient and timely emergency preparedness and response.
- A representative will be designated to be in charge of fire control during construction. The fire representative will ensure that each construction crew has appropriate types and amounts of fire-fighting tools and equipment, such as extinguishers, shovels, and axes available at all times.
- At all times during construction and operation, satisfactory spark arresters will be maintained on internal combustion engines.

2.4.2.9 Weeds

- Certified weed-free straw mulches, certified weed-free hay bale barriers, silt fences, and water bars will be used to control soil erosion.
- Mechanical measures will be used to control noxious weeds in all surface-disturbed areas.

2.4.2.10 Noise

- Effective exhaust mufflers will be installed and properly maintained on all construction equipment. CRWE II will require construction contractors to comply with federal limits on truck noise. Construction activities will take place mostly during daylight hours. Construction contractors will be required to ensure that their employee and delivery vehicles are driven responsibly. CRWE II and its contractors will adhere to a Project-wide speed limit of 25 mph or lower depending on the requirements of the specific equipment utilizing the roads. Nighttime construction work will be minimized, and when it does occur, it generally will be limited to relatively quiet activities.

3 AVIAN AND BAT RESOURCES

3.1 Tiers 1 and 2 Preliminary Site Evaluation and Characterization

Tier 1 (Preliminary Site Evaluation), as described in the WEG (USFWS 2012a), is a landscape-scale screening process using existing information sources to identify blocks of native habitat, ecological communities and other areas of broad scale wildlife value. Tier 2 (Site

Characterization) focuses on site-specific natural resource information and existing information specific to the Project area to evaluate potential risks to sensitive or protected natural resource features. A preliminary environmental analysis (Good et al. 2012a) was conducted to evaluate the feasibility of developing Phase II of the California Ridge Wind Energy Project; the results of this analysis are summarized below.

3.1.1 Habitat Description

The Phase II Project area is located within the Vermilion River watershed in Vermilion County, Illinois, in two sections directly to the north and south of the Phase I Project area (see Figure 1.1). The north section is located adjacent to the northern boundary of the Phase I Project area, east of Road 70 E, and west of County Highway 10. The Middle Fork of the Vermilion River is located approximately 0.5 mile (0.8 km) north and east of the north section of the Phase II Project area, with a small portion of the river running through the northeast corner of the Project area. The south section is located adjacent to the southern boundary of the Phase I Project area, east of County Road 0 E, east of Newtown Road, and north of Interstate 74. The Middle Fork of the Vermilion River is found approximately one mile (1.6 km) east of the southern section of the Project area. The town of Danville, Illinois is located approximately four miles (6.4 km) east of the south section and 5.5 miles (8.8 km) southeast of the north section.

The Project area falls within the Central Corn Belt Plains Ecoregion, which encompasses a large portion of central Illinois (Woods et al. 2007). The Central Corn Belt Plains Ecoregion is composed of vast glaciated plains; much of this region was historically dominated by tallgrass prairie, with groves of trees and marshes scattered across the level uplands. Topography within the Project area is flat to rolling, with elevations ranging from approximately 200 to 250 feet (61 to 76 m) above sea level.

3.1.1.1 Land Cover Types

Land cover types and topography in Phase II are relatively consistent with the characteristics of Phase I, with tilled agricultural lands dominating the landscape (see Figure 2.1). Agricultural land is mainly cultivated corn (*Zea* spp.) and soybeans (*Glycine max*), and makes up nearly 95% of the land cover in the Project area. Native habitats (woodlots and pastures) exist near some floodplains, but occupy a small portion of the Project area. Forested riparian areas cover more land in Phase II than in Phase I, though the percent coverage is low relative to the entire Project area. These areas occur mostly as tributaries of the Middle Fork of the Vermilion River. The northeast corner of the northern section of Phase II has the most diverse habitat, with the greatest percent cover of woodlots and forested riparian areas. This area includes into a stretch of the Middle Fork of the Vermilion River and Knights Branch, a tributary of the Middle Fork of the Vermilion River.

3.1.2 Environmental Areas of Concern

3.1.2.1 Illinois Natural Preserve Commission Lands

The Middle Fork of the Vermilion River is designated as an Illinois Natural Areas Inventory site by the IDNR, and is also classified as a State Scenic River, which is included in the National Wild Scenic Rivers System (IDNR 2012). Kinney's Ford Seep Land and Water Reserve is a state listed reserve, located approximately 0.5 mile (0.8 km) east of the northern portion of the Project area. The Horseshoe Bottom Nature Preserve, Windfall Prairie Nature Preserve, Kennekuk Cover County Park, Middle Fork Woods Nature Preserve, Rock Cut Road and Botanical Area, and Kickapoo State Recreation Area all occur within approximately five miles (8 km) of the Project area.

3.1.2.2 Migration Corridors and Stopovers

The Project area contains limited areas of suitable stopover habitat for songbirds in the form of occasional shelterbelts and small woodlots. Waterfowl and shorebirds may utilize open water areas and croplands as stopover habitat during migration. In addition, the American golden-plover (*Pluvialis dominica*; USFWS priority shorebird species [USFWS 2004]) utilizes agricultural fields in Vermilion County in late March and early April for migratory foraging and stopover grounds. The proposed Project area generally lacks topographic features that would funnel birds during migration. Migrating birds are more likely to utilize the Middle Fork of the Vermilion River and the associated forested areas as stopover sites during migration. Areas of the Project area located near the river have some potential to receive higher use by migrating birds.

3.1.2.3 National Wildlife Refuge System

The National Wildlife Refuge System is managed by the USFWS, and is a system of public lands and waters set aside to conserve America's fish, wildlife and plants. There are no known National Wildlife Refuges within or in proximity to the Project area.

3.1.2.4 Maternity Roosts and Hibernacula

Maternity roosts for Indiana bats are known to occur along forested riparian areas associated with the Middle Fork of the Vermillion River, and roosts for other bat species also likely occur in the riparian areas. Some headwaters and smaller forested riparian areas that drain to the Middle Fork of the Vermillion River are present in Project area. The potential exists for Indiana bat and other bat maternity colonies to be present along Stony Creek and Feather Creek in the southern portion of the Project area and along Knights Branch and the Middle Fork of the Vermilion River in the northern portion of the Project area.

3.1.3 Wildlife Resources

3.1.3.1 Bird Species

Generally, the more varied the habitat conditions are in an area, the greater the variety of bird species. The landscape within the Project area is most suitable for breeding landbird species that use the small woodlots and open agricultural lands. Due to the high levels of disturbance and lack of native vegetation, agricultural habitats are of limited quality to bird species. Cultivated agriculture is rarely used as nesting habitat by birds, although certain disturbance-tolerant species may forage in crops. Agricultural fields may attract large flocks of birds, such as blackbirds and Canada geese (*Branta canadensis*), during the fall migration and winter seasons (Erickson et al. 2002).

The Project area contains only limited amounts of forested habitat (woodlot and shelterbelts). Forest fragments such as those found within the Project area are typically not considered high-quality nesting habitat due to their limited size and abundance of edge habitat, which is associated with higher incidence of nest predation and parasitism (USGS 2011). These small patches of forest habitat may receive higher levels of bird use during migration, as forest fragments often provide stopover habitat for migrating passerines and other birds (Packett and Dunning 2009). The diversity in landform, climate and vegetative communities found along the Middle Fork of the Vermilion River in the vicinity of the Project area may support a wider variety of bird species.

3.1.3.2 Bat Species

Based on bat species range maps (Bat Conservation International [BCI] 2012), land cover in the Project area, and other regional pre-construction wildlife studies at other proposed Midwest wind farms, nine bat species may occur as residents and/or migrants in the Project area. These species include big brown bat (*Eptesicus fuscus*), hoary bat (*Lasiurus cinereus*), eastern red bat (*Lasiurus borealis*), northern long-eared myotis (*Myotis septentrionalis*), little brown bat (*Myotis lucifugus*), eastern pipistrelle (*Perimyotis subflavus*), evening bat (*Nycticeius humeralis*), silver-haired bat (*Lasionycteris noctivagans*), and Indiana bat.

Agricultural habitat does not provide roosting habitat for bats but some species, primarily big brown bats and evening bats, may forage over agricultural fields within the Project area. Other bat species in the region may occasionally forage over crops within the Project area, but are more likely to use forested and open water habitat (BCI 2012). Forest fragments within the Project area may also provide limited amounts of foraging or roosting habitat for the nine bat species whose geographic distributions include Vermilion County. Many of these species also forage along stream corridors or over water, and may use the small areas of open water within the Project area (BCI 2012). The Middle Fork of the Vermilion River and associated tributaries found within the Project area and just outside may provide suitable roosting and foraging habitat for many species of bats that have the potential to occur within the Project area. Some species, including little brown bats and big brown bats, will roost and even overwinter in attics or large buildings. The farmsteads located in the Project area, with their farmhouses and outbuildings, likely provide suitable roosting locations for these species. Likewise, buildings in towns also likely provide suitable roosting and possibly overwintering sites for species such as the big brown bat and little brown bat.

3.1.3.3 Threatened and Endangered Species

The USFWS lists only one federally threatened or endangered bird or bat species that may potentially occur within Vermilion County, the Indiana bat (state and federally endangered). The northern long-eared bat is currently under review by the USFWS for listing under the ESA, and a separate request has been submitted for a status review of the little brown bat.

The Indiana bat is known to occur within riparian areas associated with the Middle Fork of the Vermillion River. The results of habitat mapping and modeling potential summer habitat based on USFWS (2011b) guidelines identified potential habitat along Stony Creek and Feather Creek in the southern portion of the Project area and along Knights Branch and the Middle Fork of the Vermilion River in the northern portion of the Project area. The Project area does not appear to contain summer nursery or roosting habitat for Indiana bats, although some individuals roosting along the Middle Fork may forage above fields within the Project area (IDNR correspondence dated 4 December 2009). During consultation, the Service recommended a 1000-foot (305-m) setback from connected foraging habitats to avoid impacts to these foraging individuals, and CRWE II has micro-sited turbines in accordance with this recommendation (see Section 2.4).

There is also potential for Indiana bats to occur within the Project area during migration. Indiana bats using the Middle Fork for summer habitat most likely migrate from hibernation sites in southwestern Indiana and Kentucky, although a banding study in the 1970's indicated that at least some LaSalle County bats move south towards the Middle Fork. Because the actual winter hibernation sites of Middle Fork Indiana bats are unknown, individuals may potentially migrate across or through the Project area. Little is known concerning the routes and habits of Indiana bats during migration; however, the discovery of an Indiana bat in a landscape of large, open corn and soybean fields at the Fowler Ridge Wind Energy Facility in Indiana suggests that at least a portion of the Indiana bat population may fly over large, open areas during the fall migration (Good et al 2012b). The closest known Indiana bat hibernacula are located 90 – 100 miles (145 – 161 km) away in LaSalle County, Illinois and Greene County, Indiana (USFWS 2007).

There are nine species, eight bird species and one bat species, listed as state threatened or endangered by the IDNR that have the potential to occur in Vermillion County (IDNR 2012). These include; Henslow's sparrow (*Ammodramus heslowii;* state threatened), upland sandpiper (*Bartramia longicauda*; state endangered), northern harrier (*Circus cyaneus*; state endangered), barn owl (*Tyto alba*; state endangered), short-eared owl (*Asio flammeus*; state endangered), bald eagle (*Haliaeetus leucocephalus*; state endangered), least bittern (*Ixobrychus exilis*; state threatened), loggerhead shrike (*Lanius ludovicianus*) and the Indiana bat. The potential for Indiana bat activity has been discussed above. Approximately 95% of the Project area is composed of tilled agriculture and developed area, which limits potential for state-threatened and endangered bird species to occur. There is potential for northern harriers to forage over agricultural lands with the Project area during the migration seasons and winter. There is a lower potential for nesting in grasslands within the Project area. The Project area may provide suitable nesting habitat for barn owl, upland sandpiper, and loggerhead shrike (IDNR correspondence dated 4 December 2009). There has been one confirmed breeding pair of upland sandpipers in Vermilion County (Kleen et al. 2004) and this species likely occurs in the County as a migrant (K. Shank, IDNR, pers. comm.). There is the potential for upland sandpipers to occur during spring and fall migration, and the potential exists for upland sandpipers to breed within the Project area during the summer.

3.2 Tier 3 Field Studies

3.2.1 Pre-construction Avian Surveys

Pre-construction avian surveys were conducted at the Project to provide information for making reasonable estimates of potential impacts.

Two types of avian studies were conducted for the Project:

1) Avian use surveys ; and

2) Bald eagle nest surveys.

Methods and results for these surveys are summarized below. In addition to the pre-construction surveys that have already been completed, bald eagle nest surveys for Phase II are underway (Section 3.2.1.2) and American golden-plover surveys for Phase II will be conducted in spring 2013.

3.2.1.1 Avian Use Surveys

Avian use surveys were not conducted within the Phase II Project area; however, because of the proximity to the Phase I Project area, and similarities in habitat between the two areas (over 90% agricultural), the results of the Phase I avian use surveys (Good et al. 2010) are considered descriptive of the Phase II Project area. The Phase I surveys were conducted to characterize and document spatial and temporal patterns of species richness and bird use of the Project area.

Avian use surveys were conducted in the Phase I Project area using fixed-point bird use surveys from March 12, 2009 through February 15, 2010 (Good et al. 2010). Surveys were conducted weekly during the spring and fall migration seasons and monthly during the winter to estimate the seasonal, spatial, and temporal use of the Project area by birds, particularly raptors. No surveys were conducted during the summer. Twenty-four total survey events were conducted. Fifteen survey points, distributed throughout the Project area, were sampled for a period of 20 minutes during each survey event. Three hundred and sixty 20-minute fixed-point surveys were conducted; 180 in spring, 120 in fall, and 60 in winter.

Forty-eight species were observed during all fixed-point surveys (Table 3.1), with an average species richness of 0.67 large bird species/2,625-ft [800-m] plot/20-min survey and 1.66 small bird species/328-ft [100-m] plot/20-min survey (Table 3.2). The total number of species was greater in the spring (45 species) and fall (30) than in the winter (12). Three passerine species, European starling (*Sturnus vulagris*), brown-headed cowbird (*Molothrus ater*), and red-winged blackbird (*Agelaius phoeniceus*) composed 44% of all bird observations.

A total of 5,325 individual bird observations comprised of 1,469 separate groups were recorded during the surveys. Overall, use by large bird species was higher during the spring and fall (3.40 and 2.43 birds/2,625-ft [800-m] plot /20-min survey, respectively) than during the winter (1.05 birds/2,625-ft [800-m] plot /20-min survey). Small bird use followed a similar pattern, with higher use in the spring and fall (9.10 and 10.53 birds/328-ft [100-m] plot /20-min survey, respectively) than in the winter (4.58 birds/328-ft [100-m] plot /20-min survey).

Waterbirds

Great blue heron (*Ardea herodias*) was the only waterbird species observed; use by this species was 0.04 birds/2,625-ft [800-m] plot /20-min survey in spring. Waterbirds were not recorded in the fall or winter. Of the seven great blue herons observed flying, 85.7% were below and 14.3% were within the rotor-swept area.

Waterfowl

Waterfowl had the highest use in the winter (0.15 birds/2,625-ft [800-m] plot /20-min survey), compared to other seasons (spring: 0.05; fall: <0.01). Canada goose was the only waterfowl species observed in the fall or winter, and comprised approximately 80% of waterfowl use in spring. Mallards (*Anas platyrhynchos*) accounted for the remaining spring waterfowl use. Of the 11 waterfowl observed flying, 90.9% were below and 9.1% were within the rotor-swept area.

Shorebirds

Shorebirds had higher use in the spring (2.37 birds/2,625-ft [800-m] plot /20-min survey) than in the fall (1.62), and were not observed during winter surveys. About 66% of spring shorebird use was due to use by American golden-plover, but this species was observed during less than

3.3% of spring surveys, indicating that a few large groups were observed. Of the 509 shorebirds observed flying, 100% were below the rotor-swept area.

Raptors

Sixty-five individual raptors (excluding vultures) comprised of six species were recorded. Raptor use was fairly uniform among seasons, with 0.20 birds/2,625-ft [800-m] plot /20-min survey in the fall, 0.18 in the spring, and 0.15 in the winter. Red-tailed hawk (*Buteo jamaicensis*) was the most commonly observed raptor species in the spring and winter (0.09 and 0.12 birds/2,625-ft [800-m] plot /20-min survey, respectively), while American kestrel (*Falco sparverius*) had slightly higher use in the fall (0.08 birds/2,625-ft [800-m] plot /20-min survey for American kestrels compared to 0.07 for red-tailed hawks). Of the 57 raptors observed flying, 71.9% were below, 21.1% were within, and 7.0% were above the rotor-swept area.

Data collected during fixed-point count surveys did not indicate the presence of important eagle use areas (i.e. nests and breeding territories, communal roosts and foraging concentrations, migration corridors and stopovers) within the Project area (Good et al. 2010). Additional surveys were conducted in May 2011, December 2012, and March 2013 to evaluate habitat along the Vermilion River for important eagle use areas and search for bald eagle nests (see Section 3.2.1.2).

Passerines

Passerines made up the greatest number of observations, comprising approximately 75% of all observations. As mentioned above, passerine (small bird) use was much higher in the fall and spring than in the winter. European starling had the highest use by any one species in the fall (5.47 birds/328-ft [100-m] plot /20-min survey) and winter (3.30). In the spring, three species had markedly higher use: common grackle (*Quiscalus quiscula*; 1.78 birds/328-ft [100-m] plot /20-min survey), brown-headed cowbird (1.69), and red-winged blackbird (1.62). A total of 2,712 passerines were observed flying in 684 groups within the 328-ft (100-m) plot; all small bird species were observed below the rotor-swept area.

Spatial Use of the Project Area

Flight paths for waterbirds, waterfowl, shorebirds, raptors, and vultures were digitized and mapped. No obvious flyways or concentration areas were observed. Large bird use was higher at point 11 (14.1 birds/2,625-ft [800-m] plot /20-min survey) compared to use at the remaining points, where use ranged from 0.58 to 3.96 birds/2,625-ft [800-m] plot /20-min survey. Passerine use, focused within 328 feet (100 m) of the point, was highest at points five and 11 (17.6 and 21.1 birds/328-ft [100-m] plot /20-min survey, respectively), where the majority of passerine use was comprised of European starling, red-winged blackbird, brown-headed cowbird, and common grackle. Passerine use ranged from 3.08 to 13.6 birds/328-ft [100-m] plot /20-min survey at the remaining points.

Sensitive Species

Four sensitive species were recorded during fixed-point bird use surveys. Three upland sandpipers, a state-endangered species (IDNR 2011) and a federal species of concern (USFWS 2008), were observed within the Project area. Ten northern harriers and one osprey (*Pandion haliaetus*), also both Illinois state-endangered species (IDNR 2011), were recorded during fixed-point surveys. In addition, 283 American golden-plovers were observed in eight groups. While this species is not federally listed, it is a species of concern on the federal priority species lists (USFWS 2004). The number of state endangered species observations may represent repeated observations of the same individual in some cases.

Table 3.1 Total Number of Individuals and Groups, by Season and Overall, for each Bird Type, Raptor Subtype, and Species Observed during Fixed-Point Bird Use Surveys at the California Ridge Project Area, March 12, 2009-February 15, 2010

		Spring		Fall		Winter		Total	
Species/Type	Scientific Name	No. Grp	No. Ind	No. Grp	No. Ind	No. Grp	No. Ind	No. Grp	No. Ind
Waterbirds		**6**	**7**	**0**	**0**	**0**	**0**	**6**	**7**
Great blue heron	*Ardea herodias*	6	7	0	0	0	0	6	7
Waterfowl		**3**	**9**	**1**	**1**	**5**	**359**	**9**	**369**
Canada goose	*Branta canadensis*	2	7	1	1	5	359	8	367
Mallard	*Anas platyrhynchos*	1	2	0	0	0	0	1	2
Shorebirds		**110**	**426**	**22**	**195**	**0**	**0**	**132**	**621**
American golden-plover	*Pluvialis dominica*	8	283	0	0	0	0	8	283
Killdeer	*Charadrius vociferus*	97	138	22	195	0	0	119	333
Upland sandpiper	*Bartramia longicauda*	3	3	0	0	0	0	3	3
Wilson's snipe	*Gallinago delicata*	2	2	0	0	0	0	2	2
Raptors		**28**	**32**	**19**	**24**	**7**	**9**	**54**	**65**
Accipiters		**0**	**0**	**2**	**2**	**1**	**1**	**3**	**3**
Sharp-shinned hawk	*Accipiter striatus*	0	0	2	2	1	1	3	3
Buteos		**15**	**18**	**7**	**8**	**5**	**7**	**27**	**33**
Red-tailed hawk	*Buteo jamaicensis*	14	17	7	8	5	7	26	32
Rough-legged hawk	*Buteo lagopus*	1	1	0	0	0	0	1	1
Northern harrier	*Circus cyaneus*	5	5	4	4	1	1	10	10
Falcons		**7**	**8**	**6**	**10**	**0**	**0**	**13**	**18**
American kestrel	*Falco sparverius*	7	8	6	10	0	0	13	18
Other Raptors		**1**	**1**	**0**	**0**	**0**	**0**	**1**	**1**
Osprey	*Pandion haliaetus*	1	1	0	0	0	0	1	1
Vultures		**16**	**23**	**17**	**19**	**0**	**0**	**33**	**42**
Turkey vulture	*Cathartes aura*	16	23	17	19	0	0	33	42

Species/Type	Scientific Name	Spring No. Grp	Spring No. Ind	Fall No. Grp	Fall No. Ind	Winter No. Grp	Winter No. Ind	Total No. Grp	Total No. Ind
Upland Gamebirds		**16**	**17**	**0**	**0**	**0**	**0**	**16**	**17**
Northern bobwhite	*Colinus virginianus*	1	1	0	0	0	0	1	1
Ring-necked pheasant	*Phasianus colchicus*	15	16	0	0	0	0	15	16
Doves/Pigeons		**53**	**86**	**22**	**48**	**4**	**43**	**79**	**177**
Mourning dove	*Zenaida macroura*	52	84	22	48	3	31	77	163
Rock pigeon	*Columba livia*	1	2	0	0	1	12	2	14
Large Corvids		**7**	**12**	**1**	**5**	**2**	**2**	**10**	**19**
American crow	*Corvus brachyrhynchos*	7	12	1	5	2	2	10	19
Passerines		**906**	**2,184**	**182**	**1,513**	**37**	**305**	**1,125**	**4,002**
American goldfinch	*Carduelis tristis*	18	26	20	38	0	0	38	64
American robin	*Turdus migratorius*	94	182	30	68	0	0	124	250
Barn swallow	*Hirundo rustica*	40	71	7	37	0	0	47	108
Blue jay	*Cyanocitta cristata*	1	2	3	7	0	0	4	9
Brown-headed cowbird	*Molothrus ater*	119	411	9	200	0	0	128	611
Brown thrasher	*Toxostoma rufum*	3	3	1	1	0	0	4	4
Cedar waxwing	*Bombycilla cedrorum*	1	2	0	0	0	0	1	2
Chipping sparrow	*Spizella passerina*	14	15	1	1	0	0	15	16
Cliff swallow	*Petrochelidon pyrrhonota*	0	0	3	14	0	0	3	14
Common grackle	*Quiscalus quiscula*	120	387	7	30	0	0	127	417
Common yellowthroat	*Geothlypis trichas*	7	9	0	0	0	0	7	9
Dickcissel	*Spiza americana*	10	17	1	2	0	0	11	19
Eastern kingbird	*Tyrannus tyrannus*	6	8	0	0	0	0	6	8
Eastern meadowlark	*Sturnella magna*	[illegible]05	131	10	13	0	0	115	144
European starling	*Sturnus vulgaris*	48	168	34	780	10	228	92	1,176

Species/Type	Scientific Name	Spring		Fall		Winter		Total	
		No. Grp	No. Ind	No. Grp	No. Ind	No. Grp	No. Ind	No. Grp	No. Ind
Gray catbird	*Dumetella carolinensis*	2	2	0	0	0	0	2	2
Horned lark	*Eremophila alpestris*	87	123	18	44	20	46	125	213
House finch	*Carpodacus mexicanus*	2	3	0	0	0	0	2	3
House sparrow	*Passer domesticus*	17	47	4	11	1	1	22	59
Indigo bunting	*Passerina cyanea*	5	5	0	0	0	0	5	5
Lapland longspur	*Calcarius lapponicus*	16	105	0	0	5	20	21	125
Northern cardinal	*Cardinalis cardinalis*	8	9	1	1	0	0	9	10
Purple martin	*Progne subis*	0	0	1	30	0	0	1	30
Red-winged blackbird	*Agelaius phoeniceus*	140	402	11	143	1	10	152	555
Song sparrow	*Melospiza melodia*	16	21	0	0	0	0	16	21
Tree swallow	*Tachycineta bicolor*	7	12	13	84	0	0	20	96
Unidentified sparrow		0	0	1	2	0	0	1	2
Unidentified warbler		0	0	1	1	0	0	1	1
Vesper sparrow	*Pooecetes gramineus*	20	23	6	6	0	0	26	29
Other Birds		**4**	**4**	**1**	**2**	**0**	**0**	**5**	**6**
Chimney swift	*Chaetura pelagica*	2	2	0	0	0	0	2	2
Northern flicker	*Colaptes auratus*	2	2	1	2	0	0	3	4
Overall		**1,149**	**2,800**	**265**	**1,807**	**55**	**718**	**1,469**	**5,325**

Table 3.2 Mean Bird Use[1], Percent of Total Composition (%), and Frequency of Occurrence (%) by Season for each Bird Type, Raptor Subtype, and Species Observed during Fixed-Point Surveys at the California Ridge Project Area, March 12, 2009-February 15, 2010

	Mean Use			% Composition			% Frequency		
Species/Type	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter
Waterbirds	**0.04**	**0**	**0**	**1.1**	**0**	**0**	**3.3**	**0**	**0**
Great blue heron	0.04	0	0	1.1	0	0	3.3	0	0
Waterfowl	**0.05**	**<0.01**	**0.15**	**1.5**	**0.3**	**14.3**	**1.7**	**0.8**	**5.0**
Canada goose	0.04	<0.01	0.15	1.1	0.3	14.3	1.1	0.8	5.0
Mallard	0.01	0	0	0.3	0	0	0.6	0	0
Shorebirds	**2.37**	**1.62**	**0**	**69.6**	**66.8**	**0**	**51.7**	**18.3**	**0**
American golden-plover	1.57	0	0	46.2	0	0	3.3	0	0
Killdeer	0.77	1.62	0	22.5	66.8	0	48.3	18.3	0
Upland sandpiper	0.02	0	0	0.5	0	0	1.7	0	0
Wilson's snipe	0.01	0	0	0.3	0	0	1.1	0	0
Raptors	**0.18**	**0.20**	**0.15**	**5.2**	**8.2**	**14.3**	**13.9**	**15.0**	**11.7**
Accipiters	**0**	**0.02**	**0.02**	**0**	**0.7**	**1.6**	**0**	**1.7**	**1.7**
Sharp-shinned hawk	0	0.02	0.02	0	0.7	1.6	0	1.7	1.7
Buteos	**0.10**	**0.07**	**0.12**	**2.9**	**2.7**	**11.1**	**7.8**	**5.8**	**8.3**
Red-tailed hawk	0.09	0.07	0.12	2.8	2.7	11.1	7.2	5.8	8.3
Rough-legged hawk	<0.01	0	0	0.2	0	0	0.6	0	0
Northern harrier	0.03	0.03	0.02	0.8	1.4	1.6	2.8	3.3	1.7
Falcons	**0.04**	**0.08**	**0**	**1.3**	**3.4**	**0**	**3.9**	**5.0**	**0**
American kestrel	0.04	0.08	0	1.3	3.4	0	3.9	5.0	0
Other Raptors	**<0.01**	**0**	**0**	**0.2**	**0**	**0**	**0.6**	**0**	**0**
Osprey	<0.01	0	0	0.2	0	0	0.6	0	0
Vultures	**0.13**	**0.16**	**0**	**3.8**	**6.5**	**0**	**8.9**	**14.2**	**0**
Turkey vulture	0.13	0.16	0	3.8	6.5	0	8.9	14.2	0
Upland Gamebirds	**0.09**	**0**	**0**	**2.8**	**0**	**0**	**8.9**	**0**	**0**
Northern bobwhite	<0.01	0	0	0.2	0	0	0.6	0	0
Ring-necked pheasant	0.09	0	0	2.6	0	0	8.3	0	0
Doves/Pigeons	**0.48**	**0.40**	**0.72**	**14.1**	**16.4**	**68.3**	**23.3**	**18.3**	**6.7**
Mourning dove	0.47	0.40	0.52	13.7	16.4	49.2	23.3	18.3	5.0

Species/Type	Mean Use			% Composition			% Frequency		
	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter
Rock pigeon	0.01	0	0.20	0.3	0	19.0	0.6	0	1.7
Large Corvids	**0.07**	**0.04**	**0.03**	**2.0**	**1.7**	**3.2**	**3.9**	**0.8**	**3.3**
American crow	0.07	0.04	0.03	2.0	1.7	3.2	3.9	0.8	3.3
Overall (Large Birds)	**3.40**	**2.43**	**1.05**	**100**	**100**	**100**			
Passerines	**9.08**	**10.52**	**4.58**	**99.8**	**99.8**	**100**	**94.4**	**78.3**	**45.0**
American goldfinch	0.11	0.32	0	1.2	3.0	0	6.7	16.7	0
American robin	0.78	0.52	0	8.5	4.9	0	33.9	22.5	0
Barn swallow	0.34	0.22	0	3.8	2.1	0	19.4	5.0	0
Blue jay	0	<0.01	0	0	<0.1	0	0	0.8	0
Brown-headed cowbird	1.69	1.67	0	18.6	15.8	0	47.2	7.5	0
Brown thrasher	0	<0.01	0	0	<0.1	0	0	0.8	0
Cedar waxwing	0.01	0	0	0.1	0	0	0.6	0	0
Chipping sparrow	0.04	<0.01	0	0.4	<0.1	0	3.3	0.8	0
Cliff swallow	0	0.12	0	0	1.1	0	0	2.5	0
Common grackle	1.78	0.22	0	19.5	2.1	0	41.7	5.0	0
Common yellowthroat	0.03	0	0	0.3	0	0	2.2	0	0
Dickcissel	0.06	0.02	0	0.6	0.2	0	2.8	0.8	0
Eastern kingbird	0.04	0	0	0.5	0	0	3.3	0	0
Eastern meadowlark	0.31	0.05	0	3.4	0.5	0	24.4	4.2	0
European starling	0.68	5.47	3.30	7.4	52.0	72.0	20.0	22.5	11.7
Gray catbird	0.01	0	0	0.1	0	0	1.1	0	0
Horned lark	0.51	0.37	0.77	5.6	3.5	16.7	32.2	15.0	31.7
House finch	0.02	0	0	0.2	0	0	1.1	0	0
House sparrow	0.26	0.09	0.02	2.9	0.9	0.4	8.9	3.3	1.7
Indigo bunting	0.03	0	0	0.3	0	0	2.8	0	0
Lapland longspur	0.49	0	0.33	5.4	0	7.3	7.2	0	8.3
Northern cardinal	0.05	<0.01	0	0.5	<0.1	0	4.4	0.8	0
Purple martin	0	0.25	0	0	2.4	0	0	0.8	0
Red-winged blackbird	1.62	0.43	0.17	17.8	4.1	3.6	48.9	6.7	1.7
Song sparrow	0.09	0	0	1.0	0	0	6.1	0	0
Tree swallow	0.04	0.66	0	0.5	6.2	0	3.3	10.0	0
Unidentified sparrow	0	0.02	0	0	0.2	0	0	0.8	0
Unidentified warbler	0	<0.01	0	0	<0.1	0	0	0.8	0

Species/Type	Mean Use			% Composition			% Frequency		
	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter
Vesper sparrow	0.10	0.05	0	1.1	0.5	0	8.3	5.0	0
Other Birds	**0.02**	**0.02**	**0**	**0.2**	**0.2**	**0**	**1.7**	**0.8**	**0**
Chimney swift	<0.01	0	0	<0.1	0	0	0.6	0	0
Northern flicker	0.01	0.02	0	0.1	0.2	0	1.1	0.8	0
Overall (Small Birds)	**9.10**	**10.53**	**4.58**	**100**	**100**	**100**			

[1]Number of large birds/2,625-ft [800-m] plot /20-min survey; Number of small birds/328-ft [100-m] plot/20-min survey

3.2.1.2 Bald Eagle Nest Surveys

A records request sent to the USFWS Rock Island Ecological Services Field Office USFWS on September 13, 2012, revealed at least two documented bald eagle nests in the vicinity (within five to 10 miles [eight to 16 km]) of Phase II, with the understanding that this does not represent a comprehensive data set and occurrences could be higher than currently reported (D. Baker, USFWS, pers. comm.). It is thought likely that new nests may be established along the North Fork, Middle Fork, and Salt Fork Rivers during the Project's life, given the increasing bald eagle population in Illinois.

Two rounds of bald eagle nest surveys were conducted to further assess bald eagle nesting in the vicinity of the Project: the first round was conducted for the Phase I Project in May 2011, and, the second round was conducted for the Phase II Project in December 2012 and March 2013. The Phase I survey evaluated areas within 2.0 miles (3.2 km) of Phase I turbine locations for use by nesting bald eagles, with a focus on potential nesting habitat along the Vermilion River (Ritzert et al. 2011). The Phase II surveys evaluated areas within 10 miles (16.09 km) of Phase II turbine locations for use by nesting bald eagles.

2011 Bald Eagle Nest Survey

All suitable eagle nesting habitats within the 2.0-mile (3.2-km) buffer that were not previously surveyed during the avian surveys in 2009 (Good et al. 2010) were surveyed from public roads in 2011. Biologists used binoculars and spotting scopes to search for bald eagle nests and conducted 20-minute fixed-point count surveys similar to Reynolds et al. (1980) at 17 point count stations to record bald eagle use. Fixed-point count surveys were used because leaf-out had already occurred and searchers' ability to detect nest structures was limited. Point count locations were focused near areas of potential nesting and foraging habitat near the Middle Fork; however, public roads were not present along some portions of the river. Additional areas within the 2.0-mile (3.2-km) buffer that were not surveyed for nesting raptors in 2009 were surveyed by driving public roads to confirm lack of suitable bald eagle nesting habitat and document any new raptor nest structures.

Habitat within the Project area was dominated by tilled agriculture and generally lacked potential nesting habitat for bald eagles. Potential nesting and foraging habitat was present outside the Project area along the Middle Fork of the Vermillion River. However, no bald eagles or bald eagle nest structures were observed during the 2011 survey. In addition, no new raptor nests were identified within the 2.0-mile (3.2-km) turbine buffer. Detection ability during the survey was reduced by leaf-out and the lack of public roads near some portions of the Vermillion River limited where point count surveys could be conducted (Ritzert et al. 2011).

2012-2013 Bald Eagle Nest Surveys

An initial survey was flown in December 2012 to ground-truth the eagle nest location data provided by the USFWS in September 2012 and to document any other eagle nest structures within 10 miles (16 km) of the Phase II Project area. Three nest structures were documented during the December survey: two located in close proximity to one another along the Middle Fork of the Vermilion River to north of the Project area, and one on Lake Vermilion to the east of the Project area. The nest documented on Lake Vermilion confirmed one of the nest locations provided by the USFWS. A bald eagle was observed perched near the two nests located along the Vermilion River. No nests were observed within the Phase II Project area; all of the documented nests were at least 5.0 miles (8.0 km) from the Phase II Project area (M. Ritzert, Western EcoSystems Technology, Inc. [WEST], pers. comm.).

A follow-up survey was flown in March 2013 to determine the occupancy status of the three nests observed during the December 2012 survey. Four active nests were observed. Two additional nest locations were observed during the March survey, one along the Middle Fork of the Vermillion River and a second along the North Fork of the Vermillion River. The closest nest was located approximately 5.7 miles (9.1 km) north of Phase II along the Middle Fork of the Vermillion River. The other three active nests were located 6.8 miles (10.9 km), 10.2 miles (16.3 km), and 10.8 miles (17.3 km) from the boundary of Phase II (located along the Middle Fork of the Vermillion River).

3.2.2 Pre-construction Bat Surveys

3.2.2.1 Bat Acoustic Surveys

Acoustic surveys were conducted at the Phase I Project area by BHE Environmental, Inc., from August 5 to November 4, 2009 (BHE Environmental, Inc. 2010). Because of the proximity to the Phase I Project area, and similarities in habitat between the two areas (over 90% agricultural), the results of the Phase I bat acoustic surveys are considered descriptive of the Phase II Project area. However, acoustic surveys of bat activity were also conducted within the Phase II Project area by WEST from August 9 to October 15, 2012 (Ritzert et al. 2012). The results of both surveys are summarized below.

2009 Bat Acoustic Surveys (Phase I Project area)

Surveys designed to detect ultrasonic bat calls within the Project area were implemented in accordance with methods, goals, and objectives established in coordination with the IDNR. Ultrasonic detectors (Anabat II™ with CF ZCAIM) were mounted on three meteorological (MET) towers within the Project area to assess bat activity during the fall migration period. Habitat surrounding each MET tower differed slightly. MET Tower 1 was situated in a corn field adjacent to a bean field. MET Tower 2 was in an old field adjacent to a pond and corn and bean fields. MET Tower 3 was in a bean field adjacent to a road. Anabat detectors were mounted at 7 feet (2 m) and 190 feet (58 m) above ground level on MET Towers 1 and 3; MET tower 2 had only one detector, mounted at 7 feet (2 m). Each Anabat unit was programmed to collect data every night for 91 consecutive nights, from approximately 30 minutes prior to civil sunset to 30 minutes after civil sunrise. Due to background noise, memory card space, and Anabat malfunctions, recording did not occur on all nights at each tower. However, the Anabats recorded on 219 of the 274 total nights (80%). Results of these surveys are summarized in Table 3.3, below.

Passes were tallied as either high (≥35 kHz) or low (<35 kHz) frequency based on characteristic frequency and, when possible, identified to one of five species groups. Hoary bats, big brown bats, silver-haired bats, and occasionally red bats and evening bats produce calls with characteristic frequencies below 35 kHz. Little brown bats, northern long-eared, Indiana bats, tri-colored bats and often red bats and evening bats produce calls with a characteristic frequency at or above 35 kHz. Some species produce unique call sequences and can be identified to species (hoary bats and tri-colored bats), while others produce sequences too similar to be distinguished from other species. Because of the difficulty in distinguishing some species with similar call sequences (big brown bats from silver-haired bats, red bats from evening bats, and those species in the genus *Myotis* [little brown bats, northern long-eared bats, and Indiana bats]), these species were grouped. The five species groups potentially in the Project area include 1) hoary bats, 2) big brown/silver-haired bats, 3) red/evening bats, 4) little brown/northern long-eared/Indiana bats, and 5) tri-colored bats.

The Anabat at MET Tower 2 recorded 239 bat passes during 77 nights, averaging 3.10 ± 6.07 bat passes per night. The Anabat at MET Tower 3 recorded 537 bat passes during 83 nights, averaging 6.47 ± 7.67 bat passes per night. The Anabat at MET Tower 1 filled with background noise on all nights except two; consequently, data from this Anabat were excluded from further analysis. Table 3.3 presents the species composition and seasonality of the bat passes. It is important to note that each bat pass does not necessarily represent each bat present within the survey area; a single bat may be recorded several times, or pass the Anabat without being detected. These results are instead representative of relative levels of bat activity.

Table 3.3 Summary of Bat Passes Recorded at MET Towers 2 and 3 Monthly between August and October, 2009

MET Tower	Month	Hoary bat	Big brown/ Silver-haired bat	Red/Evening bat	*Myotis* spp.	Tri-colored bat	Unknown bats	Total Passes
2	August	1	44	15	24	3	2	88
	September	0	119	0	3	4	11	137
	October	0	4	2	1	0	6	13
3	August	44	78	91	1	8	5	227
	September	18	189	49	1	8	27	292
	October	0	14	2	0	0	2	18
Total MET 2		1	167	17	28	7	19	239
Total MET 3		62	281	142	2	16	34	537
Total		**63**	**448**	**159**	**30**	**23**	**54**	**776**

While bat passes were recorded throughout all hours of the night, the majority of bat passes were recorded during the first half of the night, with 59% and 63% of all passes being recorded at MET Towers 2 and 3, respectively, within six hours of civil sunset. The number of bat passes peaked a second time around the ninth hour after sunset at MET Tower 3.

Throughout the three-month sampling period, the number of bat passes recorded varied substantially from night to night. The total number of bat passes recorded each night ranged from zero (numerous nights in October at both towers) to 35 (September 30) at MET Tower 2 and 27 (September 10) at MET Tower 3. The number of bat passes recorded per night was the least variable in October, when the number of passes varied between zero and four in a night at MET Tower 2 and zero and six at MET Tower 3. The greatest variation occurred in September at both MET towers.

Though microphones were placed at both 7 feet (2 m) and 190 feet (58 m), one each at the three towers, sample size and other variables such as habitat differences (i.e., corn [MET Tower 1] and bean fields [MET Tower 3] compared to fallow field with a pond [MET Tower 2]) made quantitative comparisons between activity detected at the different heights impossible. Bat passes were examined for species group composition, activity throughout the night, and activity changes each week throughout the fall season. The majority (73% at MET Tower 2 and 83% at MET Tower 3) of echolocation calls recorded were generated by the low frequency group (<35 kHz), which includes hoary bats, big brown bats, silver-haired bats, and occasionally red bats and evening bats. All but evening bats are relatively large-bodied, less maneuverable bats that tend to forage in open habitats where there are fewer obstacles (Brooks and Ford 2005). Insects are less abundant in open areas, and bats adapted to forage in open areas tend to have lower frequency calls, which travel farther than higher frequencies, thus increasing the search range of the bat (Altringham 1996). In addition, because low frequency vocalizations travel farther than those at high frequencies, the detectors likely record low-frequency bats at a greater distance from the microphone than high-frequency bats.

Arnett et al. (2006) and Redell et al. (2006) reported greater high frequency group activity at low elevations, and greater low frequency group activity at high elevations. Based upon the relative number of ultrasound calls recorded, results from these studies suggest that during the fall migration bats with high frequency calls (smaller bats) are less active at rotor-swept height than bats with low frequency calls (larger bats). This is consistent with results of studies that suggest different species of bats partition their use of habitats vertically (Kalcounis et al. 1999; Hayes and Gruver 2000). The Phase I survey results may indicate patterns similar to these studies; however, microphone height is only one possible explanation for the different proportions of bats found at each tower.

2012 Bat Acoustic Surveys (Phase II Project area)

The bat acoustic survey conducted for the Phase II Project area followed the recommendations of the USFWS 2012 Guidelines and methods outlined in the scientific literature. Four AnaBat™ SD1 detectors were placed at two MET towers, one ground detector at 5 feet (1.5 m) and one raised detector at 164 feet (50 m) above ground level at both towers. Two additional detectors were placed 5 feet (1.5 m) above ground level on the edges of agricultural fields to represent potential turbine locations. Units were programmed to collect data from approximately 30 minutes before sunset to approximately 30 minutes after sunrise. The units operated correctly on 401 of 408 detector-nights (one detector operating for one night), or 98.3% of the sampling period. Similar to the Phase I survey, recorded passes were tallied as either high (>30 kHz) or low (<30 kHz) frequency and identified to one of five species groups, when possible. Results of these surveys are summarized in Table 3.4 and Figure 3.1, below. These results are again representative of relative levels of bat activity, not bat abundance.

Table 3.4 Summary of Bat Passes Recorded at MET Tower Detectors and Field Detectors, August-October 2012, in the Phase II Project Area

Detector	Hoary bat	Big brown/ Silver-haired bat	Total LF[a,b]	Red/ Evening bat	*Myotis* spp.	Tri-colored bat	Total HF[a,b]	Total Passes/ Night[c,d]
MET A ground	17	170	194	108	0	6	207	5.90 ±0.84
MET A raised	24	66	112	70	0	1	89	2.96±0.34
MET B ground	10	112	124	88	4	17	186	4.56±0.59
MET B raised	6	71	78	31	0	0	37	1.89±0.36
Field A ground	10	297	310	377	13	38	675	14.49±1.55
Field B ground	8	322	334	226	4	14	307	9.43±1.83
Total ground	45	901	962	799	21	75	1,375	8.59±1.00
Total raised	30	137	190	101	0	1	126	2.42±0.29
Total	**75**	**1,038**	**1,152**	**900**	**21**	**76**	**1,501**	**6.53±0.68**

[a]LF= low frequency, HF= high frequency
[b]Species groups do not sum to frequency group totals because not all passes were of sufficient quality to be identified.
[c]All detectors recorded for 68 nights, except MET B raised, which recorded for 61 nights.
[d]± bootstrapped standard error

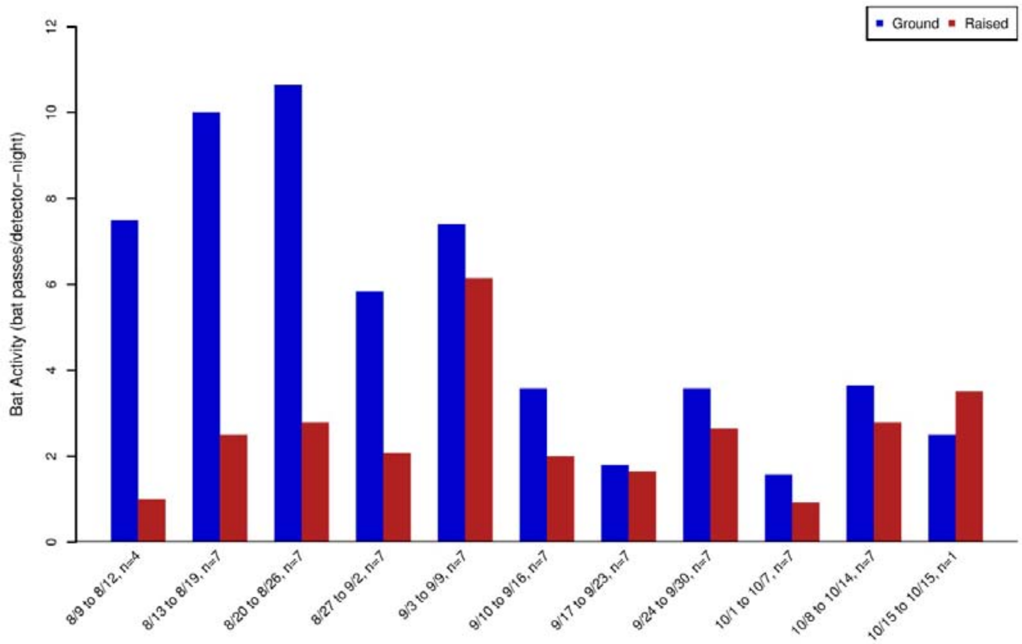

Figure 3.1 Weekly Patterns of Bat Activity from August 9 to October 15, 2012, at Ground and Raised MET Tower Detectors in the Phase II Project Area

In total, the detectors recorded 2,653 bat passes for a mean of 6.5 $\pm$ 0.7 bat passes per detector-night. Activity was relatively higher at the two detectors located at the edges of agricultural fields than at the detectors at the MET towers. At both MET towers, activity was approximately twice as high at the ground-level detectors as at the raised detectors. Activity at the two MET towers was roughly similar. No calls were recorded before sunset or after sunrise. The mean time of recording was 168.8 minutes after sunset or before sunrise, with a standard deviation of 89.9 minutes. The median time of recording was 149 minutes after sunset or before sunrise (Gruver 2013).

Overall, high frequency species comprised the majority (57%) of the activity (low frequency species comprised 43%); however, species composition varied by detector height and location. Total bat activity was highest in August and declined in September and October. The August peak was dominated by activity at the ground detectors and likely corresponded to high foraging rates among resident females and newly volant juveniles. Activity at the raised detectors peaked in early September, perhaps due to migratory activity which primarily occurs at higher elevations than foraging activity (Cryan and Veilleux 2007 as cited in Ritzert et al. 2012), but then was relatively consistent throughout the sampling period. High frequency activity followed this trend, peaking from August 18 to 24 and then maintaining low levels through September and October. Low frequency activity peaked from September 1 to 7 and then declined less abruptly. Approximately 40% of the calls identifiable to species group were categorized in the big brown bat/silver-haired bat group. The eastern red bat group comprised another 34% of the identifiable calls. Very few (0.8%) of the identifiable calls were categorized in the *Myotis* group. The hoary bat and big brown bat/silver-haired bat groups represented the majority of calls at the raised detectors; the *Myotis* group was recorded only at ground detectors.

Acoustic data, such as these described for the Project, are useful in characterizing bat communities and populations at a study site. However, these data are not reliable for definitively determining species presence at a site because of the similarity in echolocation frequencies between species, and patterns shared among species. As such, these data are most often used to determine bat activity at the genus level or, indirectly, by call frequency groupings, as discussed above. Furthermore, acoustic data cannot be used to estimate local population sizes of bat species in a specific geographic area because there is no way to determine how many bats made the calls that were recorded (e.g., a single bat can fly by a detector multiple times), nor can the sex or age of a bat be determined from acoustic data (Kunz et al. 2007).

4 POTENTIAL IMPACTS TO BIRDS AND BATS

This section analyzes existing habitat information for the Project area and research results from other wind energy facilities in order to evaluate and compare potential impacts from the Project to other similar operating wind energy facilities (i.e., Tier 2 of the USFWS 2012 Guidelines). In addition, site-specific bird and bat survey data were analyzed in the context of the proposed Project layout (i.e., Tier 3 of the USFWS 2012 Guidelines).

4.1 Birds

Wind energy facility impacts on birds can include varying degrees of displacement from the turbines and surrounding habitat, as well as mortalities resulting from collisions with turbines, transmission lines, and other facility structures (Winegrad 2004). To reduce the risk of these potential impacts, the Project has been sited within previously altered habitat that is dominated by tilled agriculture (95%; corn, soybeans, wheat, sorghum) and developed areas. The area also receives regular vehicular traffic and human activity, especially during the growing season. Within the Project area, CRWE II has committed to placing all turbines within tilled and untilled agricultural areas and avoiding native habitat. Additionally, CRWE II has committed to a 1,000-foot (305-m) setback from forested habitat within and adjacent to the Project area, including the riparian habitat along the Middle Fork of the Vermilion River.

4.1.1 Habitat Fragmentation, Displacement, and Mortality due to Project Construction and Decommissioning

The construction of turbines may displace birds from an area due to the creation of edge habitat, the introduction of vertical structures and/or disturbances directly associated with turbine operation (e.g., sound or shadows). Disturbance impacts are often complex, involving shifts in abundance, species composition, and behavioral patterns. The magnitudes of these impacts vary across species, habitats, and regions. Based on studies by Pearce-Higgins et al. (2012), Strickland (2004), and others, some degree of displacement of breeding birds in the vicinity of the Project turbines is anticipated. For species that are displaced, it is unclear if displacement impacts would persist for the life of the Project; certain species may adapt to the presence of the turbines (The Ornithological Council 2007).

The Project has been sited to minimize the impacts of potential displacement on bird populations and the overall composition of the avian community in the area. The Project area is located in a landscape already disturbed by human activity. Avian habitat within the Project area is predominately disturbed and fragmented; forest stands are small with a high ratio of edge to interior habitat, and little undisturbed (non-pasture) grassland habitat is available. The majority of the Project area is in active agricultural production. Within the Project area, CRWE II has committed to placing all turbines within tilled and untilled agricultural areas and avoiding native habitat. Additionally, CRWE II has committed to a 1,000-foot (305-m) setback from forested habitat.

Pre-construction surveys have demonstrated that the Project area is not an area of high avian use or diversity or an area that supports many species of concern. The large majority of birds detected during pre-construction surveys within and near the Project area were common species and species adapted to human disturbance, with the exception of the American golden-plover (see Section 3.2.1). Therefore, it is unlikely that displacement impacts from the turbines would greatly alter the composition of the area's avian community. The American golden-plover is sensitive to human disturbance and may be displaced from agricultural fields that were historically used as stopover areas. However, American golden-plovers utilize no-till soybean fields as stopover habitat, which is abundant in eastern Illinois. Additional pre-construction surveys will be conducted in spring 2013 (Section 3.2.1) to further characterize American golden-plover use of the Phase II Project area and provide a baseline for comparison to the results of post-construction American golden-plover surveys (MAMP, Appendix A).

Incidental injury or mortality of juvenile birds may occur if vegetation clearing for construction takes place in non-tilled areas during the breeding season. However, habitat for ground- and shrub-nesting birds is limited within the Project area due to the predominance of active agriculture. Additionally, CRWE II will implement a host of measures designed to avoid and reduce impacts to birds and other wildlife from Project construction and decommissioning, discussed in Section 2.4.

4.1.2 Collision-Related Mortality due to Project Operation

The Project has been sited and designed to be a low-risk site for birds. The Project area does not contain distinct topography or unique habitats or resources that could concentrate birds. No indicators of high avian risk in the Project area (e.g., presence of ESA-listed species, impacts to high quality avian habitat, high volume use as migration stopover habitat, etc.) were uncovered during either the site characterization (correspondent with Tiers 1 and 2 of the USFWS 2012 Guidelines) or the pre-construction avian surveys, which were conducted in accordance with Tier 3 of the USFWS 2012 Guidelines.

As mentioned above, pre-construction surveys have demonstrated that the Project area is not an area of high avian use or diversity or an area that supports many species of concern (see Section 3.2.1). A comparison of the California Ridge pre-construction avian survey results to other available pre-construction survey reports indicates that surveys within the Project area detected many fewer birds and fewer species than have generally been detected at other Midwest wind energy sites (e.g., Cutright 2009, Kerlinger et al. 2007, Derby et al. 2010, Guarnaccia and Kerlinger 2008, Gruver et al. 2009). The pre-construction surveys also demonstrated a lack of major raptor migration routes through the Project area, limited prey communities, and raptor passage rates similar to those recorded at other Midwest sites (e.g., Johnson et al. 2000, Ecology and Environment 2009 as cited in Good et al. 2010, Derby et al. 2009 as cited in Good et al. 2010, Stantec 2009). No federally-listed species were observed during the pre-construction surveys. All of the state-listed species observed within the Project area are considered to be at low collision risk due the results of other post-construction mortality studies and the species' low observed use of the rotor-swept area.

Results of the avian studies in the Project area indicated that only four species regularly flew within the rotor-swept area (Table 4.1). Overall use by these species was low, and thus the calculated exposure index was also low.

Table 4.1 Relative Exposure Index for Species Observed Flying within Rotor-Swept Area during Fixed-Point Bird Use Surveys, March 12, 2009-February 15, 2010

Species	No. of Groups Flying	Overall Mean Use	% Flying	% Flying within Rotor-Swept Area at Initial Obs.	Exposure Index	% Flying within Rotor-Swept Area at Any Time
Red-tailed hawk	21	0.1	84.4	44.4	0.04	48.1
Turkey vulture	33	0.08	100	38.1	0.03	47.6
Canada goose	4	0.08	52.9	11.1	<0.01	11.1
Great blue heron	6	0.01	100	14.3	<0.01	14.3

Turbines have been setback from the few areas of concern near the Project that were identified during the pre-construction site characterization and survey efforts (Tiers 1-3). CRWE II has committed to placing all turbines within tilled and untilled agricultural areas and avoiding native habitat. Additionally, CRWE II has committed to a 1,000-foot (305-m) setback from forested habitat within and adjacent to the Project area, including the riparian habitat along the Middle Fork of the Vermilion River. CRWE II has also committed to downshielding the Project's substation lights and minimizing security and maintenance lighting at the Project to prevent mass avian mortality events of night-migrating passerines as have been observed at other substations (e.g., Stantec 2011).

Based on the results of the site characterization and the pre-construction surveys and considering the conservation measures built into the Project, it is expected that avian mortality at the Project will be similar to or lower than the publicly-available estimates of bird mortality at wind energy facilities in the Midwest, which range from 0.00 to 11.83 birds/turbine/year (Barclay et al. 2007 and Poulton 2010). Raptor mortality rates at other Midwest sites have been very low; generally limited to one or two carcasses found per study (Poulton 2010). Although passerines are expected to comprise the majority of all bird fatality at the Project and result in spring and fall peaks in bird mortality as has been observed nation-wide (approximately 75% of all fatalities, Erickson et al. 2001 and Johnson et al. 2002), no particular species is expected to incur significantly greater numbers of fatalities based on pre-construction survey results and the monitoring results from other wind energy facilities. Mortality of federally listed bird species is not expected to occur as a result of Project operation. Post-construction monitoring conducted within an adaptive management framework for the Project will provide an accurate means of determining ongoing potential impacts to birds and a plan for implementation of mortality minimization measures if impacts are determined to be significant (MAMP, Appendix A).

4.2 Bats

4.2.1 Habitat Fragmentation, Displacement, and Mortality due to Project Construction and Decommissioning

Resident bats in Illinois are generally associated with trees or wooded areas and wetlands (BCI 2012); the Project has been sited to avoid impacts to native roosting and foraging habitat for these bat species, as well as to avoid impacts to maternity habitat, fall swarming habitat, and hibernacula for bats. The lack of forested habitat and open water within the Project area may reduce risk to bats, as most bat species in Illinois prefer forests and bodies of open water for foraging and migration stopover roosting habitat (BCI 2012). CRWE II has committed to a 1,000-foot (305-m) setback from forested habitat within and adjacent to the Project area, including the riparian habitat along the Middle Fork of the Vermilion River. These siting measures will avoid fragmentation of bat habitat by the Project. Although certain bats, including big brown bats, may forage over grasslands and agricultural fields, nighttime Project construction activities in these areas will be minimal and there are no data to suggest bats will avoid foraging in these habitats once the turbines have been constructed. Based on the number and frequency of documented deaths of bat species observed at wind energy facilities throughout North America, there appears to be no active avoidance of wind facilities by bat species (USFWS 2011b). Construction of the Project will not require the removal of potentially suitable roosting habitat in the form of trees or man-made structures; this will avoid the potential for construction activities to cause mortality or displacement of bats.

4.2.2 Barotrauma and Collision-Related Mortality due to Project Operation

The Project has been sited and designed to avoid likely risk factors for bats. The Project area does not contain large tracts of forested habitat, hibernacula, or other features that could concentrate bats. Bats migrating through the vicinity of the Project area may prefer the Middle Fork and Salt Fork Vermilion Rivers and associated forests compared to the open landscape that covers most of the Project area. No indicators of high bat risk in the Project area (e.g., impacts to high quality bat habitat, high volume bat activity, etc.) were uncovered during either the site characterization (correspondent with Tiers 1 and 2 of the USFWS 2012 Guidelines) or the pre-construction acoustic survey, which was conducted in accordance with Tier 3 of the USFWS 2012 Guidelines. Turbines have been setback from the few areas of concern near the Project that were identified during the pre-construction site characterization and survey efforts (Tiers 1-3). CRWE II has committed to a 1,000-foot (305-m) setback from forested habitat within and adjacent to the Project area, including the riparian habitat along the Middle Fork of the Vermilion River.

Although the Project is within the range of one ESA-listed bat species, the Indiana bat, CRWE II has sited the Project to avoid potentially suitable habitat for this species. CRWE II has committed to a 1,000-foot (305-m) setback from potential commuting habitat for Indiana bats as defined by the Service within and adjacent to the Project area. The closest known Indiana bat hibernacula are located 90 – 100 miles (145 – 161 km) away in LaSalle County, Illinois and Greene County, Indiana (USFWS 2007) and there is no suitable Indiana bat maternity habitat within the Project area.

As mentioned above, pre-construction surveys have demonstrated that the Project area is not an area of high bat use or an area that includes habitat for bat species of concern (see Section 3.2.2). Pre-construction acoustic bat surveys indicated a moderate level of bat activity within the Project area compared to surveys at other Midwest wind energy sites (Ritzert et al. 2012, e.g., BHE Environmental, Inc. 2007 as cited in BHE Environmental, Inc. 2010, BHE Environmental, Inc. 2009 as cited in BHE Environmental, Inc. 2010, Stantec 2009).

Seasonally, bat activity in the Phase I Project area peaked during early to mid-September (BHE Environmental, Inc. 2010); bat activity in the Phase II Project area peaked in mid- to late August (Ritzert et al. 2012). This seasonal activity pattern, combined with the species composition of the identifiable calls recorded during the pre-construction surveys, indicates that impacts from the Project may primarily affect tree-roosting bats migrating through the Project area during the fall migration season (August-September for central Illinois, Cryan 2003) as has been observed at wind energy facilities nation-wide (Johnson et al. 2004; reviewed by Kunz et al. 2007). Based on the lack of hibernacula and summer maternity habitat within the Project area, as well as the seasonality of the majority of the overall bat fatality and the five Indiana bat fatalities recorded to-date (Good et al. 2012b, USFWS 2011c, USFWS 2012b, c), it is expected that the potential for impacts to Indiana bats from the Project will be limited to the fall migration season. CRWE II has committed to implementing a turbine operational protocol during the fall bat migration season that is designed to reduce mortality of bats in general and avoid mortality of Indiana bats from the Project (see Section 2.4.2). Many studies have documented a strong negative relationship between bat mortality and wind speed and curtailment studies have demonstrated that raising the cut-in speed of wind turbines can significantly reduce bat mortality (Kerns et al. 2005; Good et al. 2011 and 2012b, Arnett et al. 2008, 2009, 2010, Baerwald et al. 2009).

Based on the results of the site characterization and the pre-construction surveys and considering the conservation measures built into the Project, it is expected that bat mortality at the Project will be considerably lower than most of the publically-available estimates of bat mortality at wind energy facilities in the Midwest, which range from 0.1 to 40.5 bats/turbine/year (Poulton 2010). Mortality of the federally endangered Indiana bat is not expected to occur as a result of Project operation. Post-construction monitoring conducted within an adaptive management framework for the Project will provide an accurate means of determining potential impacts to bats and assessing the effectiveness of the Project's impact minimization strategies, as well as a plan for implementation of additional measures if impacts are determined to be significant (MAMP, Appendix A).

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Appendix A

Monitoring and Adaptive Management Plan

TABLE OF CONTENTS

1 BACKGROUND AND GOALS

California Ridge Wind Energy II LLC (CRWE II) has voluntarily prepared a Bird and Bat Conservation Strategy (BBCS) for the California Ridge Wind Energy II Project (Project) to avoid and reduce impacts to bird and bat species from the Project. Specific goals of the BBCS are to:

1) Develop measures that, when implemented at the Project, will avoid and reduce potential impacts to birds and bats during construction, operation, maintenance, and decommissioning of the Project;

2) Ensure the potential impacts to Endangered Species Act (ESA)-listed bat species are reduced to the point where take is unlikely;

3) Describe effective post-construction monitoring and adaptive management procedures to guide management actions for the life of the Project;

4) Develop a protocol for consistent, ongoing communication and reporting to U.S. Fish and Wildlife Service (USFWS or the Service) and Illinois Department of Natural Resources (IDNR); and

5) Outline CRWE II's efforts to implement recommendations and best practices contained with the USFWS Land-Based Wind Energy Guidelines (WEG, USFWS 2012) and the Draft Eagle Conservation Plan Guidance (USFWS 2011).

This Monitoring and Adaptive Management Plan (MAMP) has been developed in conjunction with the BBCS to provide a means of assessing the effectiveness of the BBCS in meeting the above-stated goals. Included in the MAMP for this Project are: a post-construction mortality monitoring plan (monitoring), an American golden plover (*Pluvialis dominica*) monitoring plan (monitoring), and an adaptive management plan (adaptive management).

2 TIER 4 POST-CONSTRUCTION MORTALITY MONITORING

To enable CRWE II to monitor mortality rates of birds and bats at the Project, post-construction avian and bat mortality monitoring will be conducted in accordance with standardized monitoring protocol. Monitoring will also help determine the effectiveness of avoidance and minimization measures at the facility. The monitoring protocol presented below was developed, in part, using the WEG (USFWS 2012).

2.1 Monitoring Goals

The goals of the post-construction monitoring are to determine the overall bird and bat fatality rates from the Project and to evaluate the circumstances under which fatalities occur. Post-construction monitoring results will also provide triggers for adaptive management, as described in Section 4 below.

2.2 Species to be Monitored

The post-construction monitoring will address all bird and bat fatalities observed within the Project area. The monitoring plan is designed to enable comparison with other operating wind energy projects. Within the overall bat and bird fatality estimates, estimates by species will be made, if possible, based on the number of carcasses detected. Based on the analysis provided in Section 4.2.1 of the BBCS and the turbine operational protocols that will be implemented (Section 2.4.2 of the BBCS), Indiana bat mortalities are unlikely to occur at the Project, and thus the monitoring plan is designed to detect carcasses and calculate all bat fatality estimates with enough precision to determine if the operational protocols are effective in reducing all bat fatalities at the Project and compared to other operating projects. Monitoring designed to detect Indiana bat carcasses is not proposed because 1) Indiana bat fatalities are unlikely, 2) such a study would require extensive ground surveys and considerable expense for the purposes of detecting an unlikely event, 3) the proposed study could detect Indiana bat fatalities, and 4) more extensive monitoring could be implemented, as described in the adaptive management plan (Section 4 below), should one of the adaptive management triggers be met.

2.3 Permits and Wildlife Handling Procedures

2.3.1 Permits

State and federal collecting/salvaging permits will be acquired from the IDNR and the USFWS by CRWE II's consultants and CRWE II prior to commencement of the study to enable searchers to collect and handle carcasses in compliance with laws pertaining to the collection and possession of wildlife and migratory birds.

2.3.2 Wildlife Handling Procedures

All carcasses found will be labeled with a unique number, individually bagged, and retained in a freezer at the Project Operations and Maintenance (O & M) building. A copy of the original data sheet for each carcass will be placed in the bag with each frozen carcass. Non-listed carcasses may be used in searcher efficiency and carcass removal trials. In the event that an eagle carcass or a carcass of an ESA- or state-listed species is found, CRWE II will notify the agencies within one business day and arrange to submit the carcass to the appropriate authorities. If an injured bird or bat is found, the animal will be handled by a biologist and transferred to a local certified and licensed wildlife rehabilitator, whenever possible and necessary.

2.4 Monitoring

2.4.1 Study Design

The results of post-construction monitoring efforts intended to provide an estimate of overall fatality at a facility can be influenced by several sources of bias during field-sampling. To provide corrected estimates of overall fatality rates, the methodology of mortality monitoring efforts must account for important sources of field-sampling bias including 1) fatalities that occur on a highly periodic basis, 2) carcass removal by scavengers, 3) searcher efficiency, 4) failure to account for the influence of site conditions (e.g., vegetation) in relation to carcass removal and searcher efficiency rates, and 5) fatalities or injured birds or bats that may land or move to areas not included in the search plots (Kunz et al. 2007a). CRWE II's post-construction mortality monitoring methodology is designed to account for these sources of bias and adapt to preliminary results such that effectiveness, efficiency, and accuracy of the study is maximized.

Post-construction mortality monitoring at the Project will involve baseline standardized carcass searches, follow-up standardized carcass searches, searcher efficiency trials, and carcass removal trials. Standardized carcass searches will allow statistical analysis of the search results, calculation of overall fatality estimates, and assessment of correlations between fatality rates and potentially-influential variables (e.g., season, location). Intensive carcass searches will be conducted in spring (April 15-May 15) and fall (August 1-October 7) during the first three years of Project operation by a consultant and by specifically-trained CRWE II personnel to establish baseline fatality estimates of bird and bat fatality. After the first three years of monitoring, CRWE II will have baseline data from which to measure changes in overall bird and bat fatalities. Follow-up carcass searches will be conducted by trained CRWE II personnel during the fall season (August 1-October 7) once every three years to confirm that no significant increase in overall bird or bat mortality has occurred relative to the baseline mortality estimates. Searcher efficiency and carcass removal trials are critical for developing appropriately corrected and unbiased fatality estimates. Searcher and carcass removal rates are two sources of field bias in mortality studies that have been proven to be highly variable and site- and researcher-specific; mortality estimators are highly sensitive to these parameters (Huso 2010). Kunz et al. (2007b) and the WEG (USFWS 2012) both strongly recommend that all mortality studies should conduct searcher efficiency and carcass removal trials that follow accepted methods and address the effects of differing vegetation types.

2.4.1.1 Sample Size

Standardized carcass searches will be conducted at 15 of the 31 turbines. During follow-up studies (discussed in Section 2.4.2.2) conducted every three years by trained CRWE II personnel, a sample size of 15 turbines will also be studied. This sample size is adequate for standardized carcass searches and follow-up studies, as 1) this represents roughly half the turbines in the Phase II project which exceeds the 30% rule of thumb for number of turbines searched, 2) mortality data will be available from California Ridge I to compare to results from the Project, and 3) the purpose of the follow-up studies is to provide fatality estimates which can be compared against the baseline estimate established during the first year of monitoring to confirm that no significant increase in overall bird or bat mortality has occurred. A significant increase is defined as a measurable, statistically significant ($p \leq 0.10$) increase in estimated fatality relative to the baseline fatality estimate. A sample size of 15 turbines during follow-up studies will meet the goal of detecting significant increases, as differences small enough that their detection requires a sample size of all 31 turbines instead of 15 are unlikely to be biologically-justifiable as significant.

The 15 turbines to be sampled will be determined using a stratified random sampling approach. These 15 sample turbines will include turbines located in the northeastern part of the Project area, per USFWS recommendation. The same 15 turbines will be sampled during follow-up studies to reduce the introduced variables (i.e. location) and provide a more accurate comparison of fatality rates between study years.

2.4.1.2 Search Interval

Search intervals will be once weekly for each of the 15 sample turbines during the spring and fall periods of intensive monitoring and during the follow-up studies. The turbine search schedule and order will be randomized so that each turbine's search plot will be sampled at differing periods during the day. If more or less intensive monitoring is deemed necessary following initial data collection (carcass searches and carcass removal trials) at the site, the search intervals will be modified accordingly. The WEG recommend that "carcass search intervals should be adequate to answer applicable Tier 4 questions at an appropriate level of precision to make general conclusions about the project" (USFWS 2012). A weekly search interval for fatality monitoring was deemed adequate by Kunz et al. (2007a) and studies have demonstrated that a weekly search interval provides effective mortality monitoring and adequately estimates impacts from wind energy facilities (Gruver et al. 2009; Young et al. 2009), such that the added effort associated with more frequent intervals is not warranted.

2.4.2 Field Methods

2.4.2.1 Plot Size, Vegetation Mowing, Visibility Classes

At all search turbines, 256 feet x 256 feet (78 m x 78 m) square plots will searched using a full-coverage transect methodology. Several studies that have indicated that the majority of bird and bat carcasses typically fall within 100 feet (30 m) of the turbine or within 50% of the maximum height of the turbine (Kerns and Kerlinger 2004; Arnett et al. 2005; Young et al. 2009; Jain et al. 2007; Piorkowski and O'Connell 2010). The plot size will exceed one-half the maximum turbine rotor height of the Project turbines (492 feet [150 m]). This should minimize the number of fatalities or injured birds or bats that land or move outside of the search plots and thereby reduce the number of bird or bat carcasses that would be undetected, causing underestimation of overall fatality.

Each search plot will be centered on a turbine location. Thirteen transects will be established in each plot for complete survey coverage. Vegetation will be mowed in each plot prior to the beginning of each study period to improve searcher efficiency. Although the majority of vegetation within each search plot is expected to consist of row crops or fallow fields, visibility classes will be established if vegetation type and density vary sufficiently. If necessary, visibility classes will be mapped within each plot, and searches will be designed to preferentially include areas of higher visibility to maximize searcher efficiency. Searcher efficiency and carcass removal rates will be determined for each visibility class.

2.4.2.2 Timing and Duration

Baseline standardized carcass searches will be conducted at the Project for a total of four weeks in the spring (April 15 through May 15) and nine weeks during the fall (August 1 through October 7) during the first year of Project operation. Baseline carcass searches will be conducted by both a consultant and specifically-trained CRWE II personnel. Trained CRWE II personnel will then conduct follow-up carcass searches for nine weeks during the fall (August 1 through October 7) every three years to confirm that no significant increase in overall bird or bat mortality has occurred relative to the baseline study.

2.4.2.3 Standardized Carcass Searches

All carcass searches will be conducted by a biologist or appropriately-trained CRWE II personnel, experienced in conducting fatality search methods, including proper handling and reporting of carcasses. Searchers will be familiar with and able to accurately identify bird and bat species likely to be found at the Project area. Any unknown birds and bats or suspected Indiana bats discovered during fatality searches will be sent to a qualified, USFWS-approved bird or bat expert for positive identification. During searches, searchers will walk at a rate of approximately 2 mph (45 to 60 m per minute) while searching 10 feet (3 m) on either side of each transect.

For all carcasses found, data recorded will include:

- Date and time;
- Initial species identification;
- Sex, age, and reproductive condition (when possible);

- GPS location;
- Distance and bearing to turbine;
- Substrate/ground cover conditions;
- Condition (intact, scavenged);
- Any notes on presumed cause of death; and
- Wind speeds and direction and general weather conditions for nights preceding search.

A digital picture of each detected carcass will be taken before the carcass is handled and removed. As previously mentioned, all carcasses will be labeled with a unique number, bagged, and stored frozen (with a copy of the original data sheet) at the Project O&M building.

Bird and bat carcasses found in non-search areas (e.g. near a turbine not included in the study) will be coded as "incidental finds" and documented as much as possible in a similar fashion to those found during standard searches. Maintenance personnel will be informed of the timing of standardized searches and, in the event that maintenance personnel find a carcass or injured animal, these personnel will be trained on the collision event reporting protocol. Any carcasses found by maintenance personnel will also be considered incidental finds. Incidental finds will be included in survey summary totals, but will not be included in the mortality estimates.

2.4.2.4 Searcher Efficiency and Carcass Removal Trials

Searcher efficiency trials will be used to estimate the percentage of all bird and bat fatalities that are detected during the carcass searches. Similarly, carcass removal trials will be used to estimate the percentage of bird and bat fatalities that are removed by scavengers prior to being located by searchers. When considered together, the results of these trials will represent the likelihood that a bird or bat fatality that falls within the searched area will be recorded and considered in the final fatality estimates.

Trials will be conducted during each study period by placing "trial" carcasses in the search areas. One round of trials will be conducted during the spring and two trials will be conducted during the fall monitoring seasons to account for changes in personnel, searcher experience, weather, and scavenger densities. A total of 20 searcher efficiency trial carcasses, 10 birds of variable sizes and 10 bats, will be placed in search areas according to randomly selected distances and azimuths from each turbine prior to the carcass search on the same day. Per the WEG (USFWS 2012), a maximum two trial carcasses will be placed per search turbine and some variation will be established in the number of trial carcasses placed per search turbine. Searcher efficiency and carcass removal trials will be limited to one spring trial and two fall trials to avoid attracting scavengers to the site with carcasses and potentially artificially inflating the carcass removal rate.

Each trial carcass will be discretely marked and labeled with a unique number so that it can be identified as a trial carcass. Prior to placement, the date of placement, species, turbine number, distance and direction from turbine, and visibility class (if applicable) will be recorded. If an insufficient number of bird carcasses has been collected during searches, species such as house sparrows (*Passer domesticus*) and European starlings (*Sturnus vulgaris*) may be used to represent small-sized birds; rock doves (*Columba livia*) and commercially raised hen mallards (*Anas platyrhynchos*) or hen pheasants (*Phasianus colchicus*) may be used to represent medium-sized to large birds. Brown mice (*Mus* or *Peromyscus* spp.) may be used to represent bats if bat carcasses are not available. If vegetation classes are established, trial carcasses will be placed in a variety of vegetation classes so that searcher efficiency rates can be determined for each class.

Searcher efficiency trials will be conducted blindly; the searchers will not know when trials are occurring, at which search turbines trial carcasses are placed, or where trial carcasses are located within the subplots. The number and location of trial carcasses found by searchers will be recorded and compared to the total number placed. Searchers will be instructed prior to the initial search effort to leave carcasses, once discovered to be trial carcasses, in place. The number of trial carcasses available for detection (non-scavenged) will be determined immediately after the conclusion of the trial.

Searcher efficiency of the consultant searchers and CRWE II searchers will be combined to generate the estimate of searcher bias for calculation of baseline fatality estimates. Searcher efficiency rates will be spot-checked each year of follow-up monitoring to ensure that initial estimates continue to be valid. Spot-check trials will also use 20 carcasses (10 bird and 10 bat) and all other methods will remain the same. The follow-up searcher efficiency rates will be compared to the baseline searcher efficiency rates using a t-test (significant $p \leq 0.10$) to determine if searcher efficiency has changed appreciably such that adjustments to the follow-up monitoring studies should be made.

Carcass removal trials will be conducted immediately following the baseline searcher efficiency trials using the same trial carcasses. Trial carcasses will be left in place by searchers, and monitored for a period of up to 30 days. Carcasses will be checked on days 1, 2, 3, 4, 5, 10, 14, 20, and 30. The status of each trial carcass will be recorded throughout the trial. Carcass removal rates will also be spot-checked each year of follow-up monitoring to ensure that initial estimates continue to be valid. The follow-up carcass removal rates will be compared to the baseline carcass removal rates using a t-test (significant $p \leq 0.10$) to determine if carcass removal has changed appreciably such that adjustments to the follow-up monitoring studies should be made.

2.4.2.5 CRWE II Personnel Training

CRWE II searchers will be full-time CRWE II employees who will be trained by qualified biologists in conducting: (1) standardized carcass searches and search protocols; (2) bird and bat identification and procedures to confirm identifications of rare species; and (3) wildlife handling procedures for all dead or injured wildlife discovered at the Project.

Standardized Carcass Searches: CRWE II searchers will be trained by a qualified biologist of CRWE II's choice, most likely the consulting biologist conducting the baseline mortality monitoring. Training will include:

- Location, size, and configuration of each search plot and how to record carcass location;
- Knowledge of the visibility classes within each plot;
- Start and stop points and width of search transects;
- Search/walking speed;
- Practice searches with planted carcasses;
- Familiarity with data sheets;
- Recording data and observations that assist with data interpretation;
- Photographing carcasses; and
- Procedures for handling, storing, and transmitting bat carcasses for positive identification.

Statistical tests (t-test, significant $p \leq 0.10$) will be conducted to (1) compare baseline fatality estimates determined using data collected by trained CRWE II personnel to estimates determined using data collected by the consultant and (2) compare searcher efficiency rates of the trained CRWE II personnel to searcher efficiency rates of the consultant. These tests will confirm that CRWE II personnel are adequately trained and qualified to accurately conduct follow-up carcass searches.

Bird and Bat Identification: CRWE II searchers will be permitted to handle bird and bat carcasses as described in Section 2.3. Any unknown carcass or those requiring additional study for identification (e.g., feather spot, bat wing, *Myotis* bats) will be labeled with a unique identification number, bagged, and retained for future reference. All unknown birds and bats or any suspected Indiana bats will be collected and provided to a qualified, USFWS-approved bird or bat expert for inspection and identification verification.

Wildlife Handling Procedures: Prior to April 15 of each year, CRWE II will conduct training sessions for Project personnel to ensure that wildlife handling procedures described in Section 2.3 are properly implemented.

2.5 Statistical Methods for Estimating Fatality Rates

The methodology for estimating overall bird and bat fatality rates will make use of contemporary, peer-reviewed equations, such as the estimator proposed by Erickson et al. (2003) as modified by Young et al. (2009), the empirical estimator presented in Good et al. (2011), or the estimator proposed by Huso (2010). The use of a contemporary fatality estimator will be necessary for developing fatality estimates that can be compared to other sites and used to accurately determine if any of the adaptive management triggers have been met.

Regardless of the specific equation used, the estimate of the total number of wind turbine-related casualties will be generally based on four components: (1) observed number of casualties, (2) searcher efficiency, (3) scavenger removal rates, and (4) estimated percent of casualties that likely fall in non-searched areas, based on percent of area searched around each turbine. Variance and 90% confidence intervals will be calculated using bootstrapping methods (Erickson et al. 2003 and Manly 1997 as presented in Young et al. 2009). Calculations and analyses will be conducted separately for birds and bats to provide results specific to each group.

2.6 Data Analysis and Reporting

2.6.1 Data Analysis

Analysis of data collected during the post-construction mortality study will include spring and fall season fatality estimates for all birds and bats to the taxonomic level where fatality estimates can be calculated (i.e., it is difficult to calculate representative fatality rates from very small numbers of carcasses so species- and genus-level fatality calculations may not be possible for some species/genera). *Myotis* fatality estimates will be calculated when supported by sufficient observed mortality. Data analysis will be performed to assess fatality estimates by turbine location. Data may also be analyzed to determine the influence of factors such as date and location on bird and bat fatality rates. These relationships may influence turbine operation, as described in Section 4 below.

A variety of statistical tests may be applied to the data to analyze the patterns of fatality rates in relationship to species/genera/taxa, season, and location. Statistical tests applied to the data may include: ANOVA, tabular summary, graphical representation (least squares, regression, interaction plot, etc), t-test, univariate association analyses (Pearson's and Spearman's rank correlations, linear regression), multivariate regression, chi-square goodness-of-fit and test of independence, and F test. Tests will be selected based on the parameter(s) under analysis, the ability of the data to meet test assumptions, and the suitability of tests for different forms of data. Comparisons between baseline overall bird and bat fatality estimates and those of follow-up studies will be evaluated using t-tests. In general, p values equal to or less than 0.10 will be considered significant.

While statistical tests will not be used to correlate fatalities with weather variables, CRWE II will qualitatively evaluate fatality events with regards to notable weather events.

2.6.2 Reporting

CRWE II will provide an annual monitoring report to the Service following the completion of each year of post-construction monitoring. The report will include mortality monitoring fatality estimates and data summaries. Fatalities will be expressed both in terms of fatalities/turbine/season and in terms of fatalities/MW/season, as recommended by the WEG (USFWS 2012) to facilitate comparison with other studies. The reports will include all data analyses, including correlation analyses and overall fatality estimates, and a discussion of monitoring results and their implications. In addition to the annual monitoring reports, CRWE II will report the discovery of any ESA-listed species or eagles to Service and the discovery of any state-listed species to IDNR within one business day of their discovery. CRWE II will also fulfill the reporting requirements of all salvage/collection permits held throughout the post-construction monitoring effort.

3 TIER 4 AMERICAN GOLDEN-PLOVER MONITORING

3.1 Migration Monitoring

3.1.1 Monitoring Goals

The goals of American golden-plover migration monitoring are to determine the timing of the species' use of the Project area during the spring migration and to assess the general behavior and movement patterns of the species within the Project area.

3.1.2 Study Design

American golden-plover migration monitoring will be conducted between April 1 and May 20 of the first two years of Project operation. This survey period coincides with the peak spring migration stopover period for American golden-plovers in the upper Midwest. Four survey transects will be established bisecting the Project area; two transects will follow north-south roads and the other two will follow east-west roads. Transect locations will be determined using aerial photography and knowledge of the Project area. Surveys will be conducted four days per week; two transects will be surveyed each day so that each transect is surveyed two times per week.

Observers will drive transects at approximately 15-20 mph (6.7-8.9 m/s) while looking for birds on both sides of the road. Observation points will be established approximately each mile along the transects. Observers will stop at each observation point and scan the surrounding area with binoculars to determine if American golden-plovers are present. Stops will last for no more than three minutes unless plovers are observed. No unplanned stops will be made unless plovers are spotted. Data collected for all individuals and flocks detected during surveys will include: date, time, location, habitat, weather conditions, number of individuals observed, behavior (e.g. resting, feeding, etc.), flight height, and direction of flight. If American golden-plovers are observed during a transect survey, observers will spend approximately 30 minutes collecting additional data on plover behavior and flight height/direction at up to two observation locations per day. Surveys will begin at 0800 am and end when the transects have been completed.

Weather conditions (e.g. temperature, wind speed, cloud cover) will be recorded at the beginning and end of each transect survey.

3.1.3 Data Analysis and Reporting

American golden-plover observations will be used to determine the dates during which plovers are present in the Project area. The locations and number of birds for each observation will be mapped to determine areas of plover use within the Project area. Habitat characteristics recorded at each observation and at the observation points will be analyzed to assess plover selection of different habitats within the Project area. Behavioral observation data will be analyzed to determine flight paths between areas of use, average flight heights within the Project area, and time spent flying in the rotor-swept area by plovers. Monitoring data and results will be included in the annual monitoring report provided to the USFWS, as described in Section 2.6, above.

3.2 Mortality Monitoring

3.2.1 Monitoring Goals

The goals of American golden-plover mortality monitoring are to detect fatalities of spring-migrating American golden-plovers from the Project and, if applicable, develop an estimate of overall plover mortality from the Project.

3.2.2 Study Design

American golden-plover mortality monitoring will be conducted during the four-week spring monitoring period (April 15 through May 15, a portion of the American golden-plover stopover period when plovers are likely to be moving through) during the first two years of Project operation if plovers are observed within the Project area during the transect surveys. If initiated, plover mortality monitoring will be conducted largely according to the study design described in Section 2, above. The same 15 study turbines will be searched during plover mortality monitoring, although the search interval at each turbine will be increased from once a week to twice a week.

Any other carcasses found incidentally during plover mortality monitoring will be recorded as well.

3.2.3 Data Analysis and Reporting

Analysis of the plover mortality monitoring data will be conducted as described for the overall mortality monitoring in Section 2.6, above. The results of the searcher efficiency and carcass removal trials conducted during the spring mortality monitoring will be applied to the results of the plover mortality monitoring to develop a plover fatality estimate, if necessary. Fatality estimates will not be developed for other species found as incidental fatalities. Results of the plover mortality monitoring will be included in the annual monitoring report provided to the USFWS, as described in Section 2.6, above.

4 ADAPTIVE MANAGEMENT

The BBCS represents a process through which CRWE II plans to reduce impacts to birds and bats at the Project while maintaining optimal Project operation and generating electricity from renewable, emissions-free wind. CRWE II has sited the Project and incorporated measures to avoid and minimize impacts to birds and bats, including sensitive and listed species (based on

Tier 1-3 studies). The effectiveness of these measures will be informed by post-construction monitoring (Tier 4 studies) of fatality rates. Adaptive management is a process that will allow CRWE II to adjust the minimization measures outlined in this BBCS to reflect new information or changing conditions in order to reach a goal – in this case, minimization of impacts to all bird and bat species and avoidance of impacts to Indiana bats (*Myotis sodalis*), while minimizing effects on the operation of the Project. Changes to the Project's avoidance and minimization plan may be triggered by certain events but no changes to the agreed upon turbine operational protocols will occur without USFWS concurrence (except temporary cessation of turbine operations for maintenance). The adaptive management plan will apply throughout the life of the Project; on-going evaluation and adaptation of the Project will provide effective measures for avoiding and reducing impacts to birds and bats.

Adaptive management will allow CRWE II to minimize the uncertainty associated with gaps in scientific information or biological requirements. Information used in the adaptive management process will come from the post-construction monitoring activities described in Sections 2 and 3 and from other industry research as it becomes available. Monitoring data will be analyzed to determine if the objectives of the BBCS are being met (see Section 1.1 in the BBCS). If the minimization measures are not producing the desired results, adjustments will be made as necessary to achieve the biological objectives of the BBCS.

Adaptive management measures for the Project will be triggered by the following events, which are further defined below:

- Take of any Indiana bats or other ESA-listed species;
- Take of any bald or golden eagles;
- Greater than expected bird or bat mortality; or
- Identification of one or more variable(s) with a consistent and strong negative relationship to bat mortality.

Take of any Indiana bats or other ESA-listed species

If take of any Indiana bats or other ESA-listed species occurs at the Project, the following actions will be taken:

1) CRWE II will, working with a trained wildlife biologist, promptly identify and store the carcass after its discovery.
2) USFWS will be notified within one business day of the discovery.
3) CRWE II and the USFWS will meet and confer to determine, based on the available data, the circumstances under which the fatality occurred.
4) If a particular cause for the mortality can be identified, CRWE II will develop specific mitigation measures in consultation with USFWS to address the occurrence, including, but not limited to, raising cut-in speeds on a specific turbine or group of turbines during specified wind conditions or periods of the year.
5) CRWE II will conduct follow-up post-construction monitoring as described in Section 2 during fall (August 1-October 7) in the subsequent year to assess whether cut-in speed adjustments or other mitigation measures are sufficient to reduce impacts to ESA-listed species.

6) CRWE II and USFWS will determine the need to pursue additional ESA permits or authorizations in view of new information.

Take of any bald or golden eagles

If a bald or golden eagle take occurs at the Project, the following actions will be taken:

1) CRWE II will, working with a trained wildlife biologist, promptly identify and store the carcass after its discovery.
2) USFWS will be notified within one business day of the discovery.
3) CRWE II and the UWFWS will meet and confer to determine, based on the available data, the circumstances under which the fatality occurred.
4) If a particular cause can be identified, CRWE II will develop specific mitigation measures in consultation with USFWS.
5) CRWE II will conduct follow-up post-construction monitoring as described in Section 2 during fall (August 1-October 7) in the subsequent year to assess whether mitigation measures are sufficient to reduce impacts to bald and golden eagles.
6) CRWE II and USFWS will determine the need to obtain additional Bald and Golden Eagle Protection Act (BGEPA) permits or authorizations in view of new information.

<u>Greater than expected bird or bat mortality</u>

If fatalities are greater than predicted and are likely to be significant, CRWE II will meet and confer with the USFWS and the applicable actions presented below will be carried out. If a particular cause can be identified, CRWE II will develop specific mitigation measures in consultation with the USFWS address the occurrence. Actions to be taken may include the following:

1) Removing/modifying the source of bird attraction;
2) Implementing turbine operational protocols designed to reduce bird or bat fatalities and targeted to the particular issue identified during fatality monitoring:
    a. raising cut-in speeds (define cut-in speed, time of day, days of the year, turbines affected),
    b. curtailment (define time of day, days of the year, weather triggers [e.g., storm front], biological triggers [e.g., fall migration for large flocks of a particular species] and turbines affected, and
    c. raising cut-in speeds or curtailing specific turbines that data show are the cause of greater mortality;
3) Implementing technological solutions. If bird and/or bat fatalities exceed the above-defined adaptive management triggers and new techniques or technology become available that are cost effective and feasible to implement, CRWE II will evaluate whether to replace or augment the measures detailed in the BBCS with these new approaches; and

4) Conducting additional specific, targeted monitoring to determine if adaptive management measures are effective.

Identification of one or more variable(s) with a consistent and strong negative relationship to bat mortality

If, through post-construction monitoring, one or more variable(s), including but not limited to a specific period of the night, seasonal period, temperature, wind speed[s], pressure, etc., that has a consistent and strong negative relationship to bat mortality is identified, the curtailment protocol will be lifted and turbines will be fully operational when the identified variable(s) is present in site conditions.

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APPENDIX B – Supplemental Tables

Table B-1. Global and North America population statuses of avian species with documented mortality at CRWE found during carcass searches.

Species	Spring Mortality Reports[1]			Fall Mortality Reports[2]			Total by Species (#)	Species Composition (%)	Population (Global)[3]	Population (North America)[3]
	2013	2014	2015	2013	2014	2015				
American goldfinch	0	0	0	0	1	0	1	0.84	44,000,000	44,000,000
American redstart	0	0	0	0	3	1	4	3.36	42,000,000	42,000,000
American robin	0	0	0	0	1	0	1	0.84	370,000,000	370,000,000
Barn swallow	0	0	0	0	1	0	1	0.84	190,000,000	47,000,000
Bay-breasted warbler	0	0	0	0	1	0	1	0.84	9,900,000	9,900,000
Black-billed cuckoo	0	0	0	1	0	1	2	1.68	880,000	880,000
Blackpoll warbler	0	0	0	0	1	0	1	0.84	60,000,000	60,000,000
Brown-headed cowbird	0	0	0	0	0	1	1	0.84	130,000,000	130,000,000
Cape may warbler	0	0	0	0	0	1	1	0.84	7,000,000	7,000,000
Chestnut-sided warbler	0	0	0	0	3	0	3	2.52	18,000,000	18,000,000
Cliff swallow	0	0	0	0	2	1	3	2.52	83,000,000	78,000,000
Downy woodpecker	0	0	0	0	1	0	1	0.84	13,000,000	13,000,000
Eastern wood-pewee	0	0	0	1	0	1	2	1.68	6,500,000	6,500,000
Horned lark	0	0	0	1	8	2	11	9.24	140,000,000	100,000,000
House sparrow	0	0	0	2	2	0	4	3.36	740,000,000	93,000,000
Kill deer	0	1	0	0	8	3	12	10.08	2,300,000	1,800,000
Least flycatcher	0	0	0	0	0	1	1	0.84	27,000,000	27,000,000
Magnolia warbler	0	0	0	1	3	0	4	3.36	39,000,000	39,000,000
Mourning dove	0	0	0	3	0	1	4	3.36	150,000,000	130,000,000
Mourning warbler	0	0	0	1	0	0	1	0.84	14,000,000	14,000,000
Ovenbird	0	0	0	0	0	1	1	0.84	26,000,000	26,000,000
Purple martin	0	0	0	0	3	4	7	5.88	9,300,000	8,700,000
Red-eyed vireo	0	0	1	0	6	5	12	10.08	130,000,000	130,000,000
Red-tailed hawk	1	0	0	1	0	0	2	1.68	3,100,000	2,800,000
Red-winged blackbird	0	0	0	0	0	1	1	0.84	180,000,000	170,000,000
Rock pigeon	0	0	0	0	1	0	1	0.84	140,000,000	16,000,000
Sora	0	0	1	0	0	0	1	0.84	4,400,000	4,400,000
Swainson's thrush	0	0	0	1	1	0	2	1.68	120,000,000	120,000,000
Tennessee warbler	0	0	0	0	8	0	8	6.72	110,000,000	110,000,000
Unidentified *empidonax*	0	0	0	1	0	0	1	0.84	---	---

Species	Spring Mortality Reports[1]			Fall Mortality Reports[2]			Total by Species (#)	Species Composition (%)	Population (Global)[3]	Population (North America)[3]
	2013	2014	2015	2013	2014	2015				
Unidentified passerine	0	0	0	3	0	0	3	2.52	---	---
Unidentified warbler	0	0	1	1	0	4	6	5.04	---	---
Unknown sp.	0	0	1	0	5	0	6	5.04	---	---
Vesper sparrow	0	0	0	1	0	0	1	0.84	35,000,000	35,000,000
Yellow bellied sapsucker	1	0	0	0	0	0	1	0.84	14,000,000	14,000,000
Yellow-billed cuckoo	0	0	0	1	2	3	6	5.04	9,600,000	8,400,000
Yellow-throated vireo	0	0	0	0	0	1	1	0.84	4,700,000	4,700,000
Total	**2**	**1**	**4**	**19**	**61**	**32**	**119**	**100.00**		

[1] Sources: Ritzert et al. 2014a, b; Shoener 2015b
[2] Sources: Gruver 2014a; Shoener 2015a, c
[3] Source: Partners in Flight. 2020. Global Avian Conservation Assessment Database. http://pif.birdconservancy.org

APPENDIX C – State Population Estimates for Little Brown and Tricolored Bats in Illinois

Little Brown Bat Population Estimate for Illinois

The little brown bat population in Illinois has not been calculated by any studies currently available in the published literature. To provide a coarse estimate of the statewide little brown bat population size, we conducted a desktop assessment using Frick et al.'s (2010) range-wide population estimate of 6.5 million little brown pats, applied in several approaches that seemed theoretically reasonable to estimate the proportion of those bats that may occur in Illinois (replicated from the MidAmerican HCP). Without evidence to support calculation of a variation in little brown bat density, it was assumed that the density of was approximately even across the species' range or across suitable habitat within the species' range. The approaches all followed the same general two-step methodology: (Step 1) a bat/acre density was calculated by dividing the 6.5 million-bat population estimate over a given area, and (Step 2) the Illinois population was calculated by multiplying the bat/acre density over a given area within Illinois. The approaches differed in how the area in each step was defined.

Four approaches were considered:

- Step 1: divide 6.5 million LBBAs across the entire area of the five Northeastern U.S. states comprising the core LBBA range. Step 2: multiply the bat/acre density calculated in Step 1 by the entire area within the state of Illinois. Result: 2,963,414 little brown bats in Illinois.
- Step 1: divide 6.5 million LBBAs across the entire area of the continental U.S. Step 2: multiply the bat/acre density calculated in Step 1 by the entire area acreage within the state of Illinois. Result: 121,954 little brown bats in Illinois.
- Step 1: divide 6.5 million LBBAs across the USGS Gap Analysis Program (GAP)-defined species distribution acreage of the five Northeastern U.S. states composing the core LBBA range. Step 2: multiply the bat/acre density calculated in Step 1 by the USGS GAP-defined species distribution acreage within the State (http://gapanalysis.usgs.gov/species/data/). Result: 484,444 little brown bats in Illinois.
- Step 1: divide 6.5 million LBBAs across the USGS GAP-defined species distribution acreage of the continental U.S. Step 2: multiply the bat/acre density calculated in Step 1 by the USGS GAP-defined species distribution acreage within the State. Result: 64,909 little brown bats in Illinois.

The USGS GAP defines species distributions as the spatial arrangement of environments suitable for occupation by a species. In other words, a species distribution is created using a deductive model to predict areas suitable for occupation within a species' range. These species' distributions are then made available for use by the general public.

The highest and lowest estimates were deemed unlikely to be reasonable estimates of the little brown bat population size in Illinois, but there is insufficient information to further assess whether the population may be nearer to 121,954 or 484,444 little brown bats in Illinois. For the purposes of this EA, the straight average of these two estimates, 303,199 little brown bats, was taken then we applied a 57% reduction to represent the estimated effects from white-nose syndrome (WNS) in Midwestern states over the last decade (USFWS unpublished data). Thus, the little brown bat Illinois population assumed in this EA is 172,824 little brown bats.

Tricolored Bat Population Estimate

1. Range-wide Population Estimate

There are no estimates of the range-wide population of tricolored bats, but in the eastern U.S., data suggest that its population size is an order or two less than the population of little brown bats. In a survey of hibernacula in New York, Pennsylvania, West Virginia, and Tennessee spanning 1999 - 2011, 68,148 tricolored bats were counted in comparison with 982,974 little brown bats (Ingersoll et al. 2013). It is worth noting that, prior to the onset of WNS, tricolored bat numbers appeared to be on the decline (Ingersoll et al. 2013). Another survey (Turner et al. 2011) compared pre- and post-WNS counts at 43 hibernacula in New York, Pennsylvania, Vermont, Virginia, and West Virginia. It found a 75% decrease in the number of tricolored bats, from 3,107 to 783. For little brown bats, the decrease was 91%, from 348,277 to 30,260. In these comparisons, tricolored bat numbers were 6.9%, 0.9%, and 2.6% of the number of little brown bats, respectively, yielding an average of 3.5% of the number of little brown bats captured during the studies.

2. Illinois Population Estimate

The analysis detailed above for estimating the little brown bat population considered 303,199 little brown bats to be a reasonable coarse estimate of that species' population in Illinois (pre-WNS) based on the best scientific information. That value was the straight average of two reasonable estimates (121,954 and 484,444 individuals) that used different ways to calculate the bat/acre density of the continental population of little brown bats (6.5 million; Frick et al. 2010) and multiply them over given areas within Illinois. Using the average proportion of 0.035 tricolored bats to one little brown bat in the studies cited above (Turner et al. 2011, Ingersoll et al. 2013), a corresponding reasonable coarse estimate of the Illinois population is 10,612. The Service estimates that tricolored bats have experienced a 50% decline in Midwestern states over the last decade from WNS; thus, under this approach, the population could be as low as 5,306 tricolored bats in Illinois.

Acoustic survey data collected between 2017 and 2019 for 20 sites across the state of Illinois by the Illinois Bat Conservation Program suggest that 55% to 60% of sites surveyed likely had tricolored bats present in a given year. Approximately 4.9 million acres of forested habitat occurs in the state of Illinois (USDA 2016); thus, between approximately 2.695 to 2.94 million acres could be occupied by tricolored bats at 55-60% occupancy.

There is very little information regarding home range size of tricolored bats, maternity colony size for tricolored bats, and overlap of home ranges, but under the assumption that a typical home range size for tricolored is similar to other myotis species, then an assumption can be made that a single maternity colony may occupy approximately 610 acres (McPeek 2015). This would suggest that there could be between 4,419 to 4,820 discrete home ranges that could be occupied by a summer colony of tricolored bats without overlap. Assuming a typical tricolored bat maternity colony has 10 individuals, this would equate to between 44,180 to 48,197 female tricolored bats, or between 88,361 and 96,394 total tricolored bats assuming a 1:1 sex ratio.

The same dataset suggested that between 70 to 75% of the sites surveyed had little brown bats likely present (Illinois Bat Conservation Program: https://www.illinoisbats.org/?page_id=702). This would suggest that tricolored bats are similarly distributed across the surveyed areas as little brown bats at an approximate 0.8:1 occupancy ratio. Thus, assuming there are 172,824 little brown bats in Illinois (post-WNS), we would expect at least 138,259 tricolored bats in the state.

These three methods provide a tricolored bat population estimate ranging from 5,306 to 138,259 bats in Illinois. While each method has limitations and assumptions, there is little direct information related to tricolored bat abundance. The Illinois Bat Conservation Program acoustic data currently represents the best available information. The median between the lowest and highest estimates based on the acoustic data is approximately 113,310 tricolored bats, which is a reasonable estimate for further analyses.

APPENDIX D – Bat Impact Assessment

Bat Impact Assessment Introduction

To analyze the effects of the alternatives considered in this EA, we calculated take estimates for all-bat fatality, non-covered bat fatality, and covered bat fatality for each alternative. Our estimates are founded on the baseline fatality rates calculated for, and reported in the HCP, as summarized herein. Post-construction mortality data is available for the Project; however, the full dataset has restricted use as operation of the Project differed over time due to the bat deterrent study that was conducted at the Project. Therefore, baseline fatality rates were estimated using site-specific data collected during Fall 2013 and Fall 2014 when turbines operated at 3.0 m/s (Gruver et al. 2014, Skalski and Shoener 2015). This data was inputted into the Evidence of Absence model to get a conservative estimate of the annual bat fatalities at 3.0 m/s operation. See section 6.2 of the HCP for more detail. The Fall 2013 and 2014 data occurred around the time when WNS was initially discovered in Illinois, so bats occurring in the Project area may not have been affected by WNS-associated declines. Based on recently available winter census data, we estimate that the Covered Species may have experienced the following declines in the Midwestern states since the advent of WNS during the last decade: 8% for Indiana bats, 50-90% for northern long-eared bats, 57% for little brown bats, and 50% for tricolored bats. To account for these estimated declines, the HCP and the EA apply these reductions to the carcasses found in 2013-2014 to better reflect current conditions of the Covered Species' populations in the region (Table 1). We also note here that by reducing the take estimates congruently with the WNS population reductions, we assume that populations have experienced relatively uniform declines across the analysis area. It is also possible that WNS may affect some populations disproportionately but we do not currently have data to suggest one way or the other. Thus, we are assuming the former.

Table 1. Adjusted fatality rate per covered species since introduction of WNS in the Midwest, tabulated from information in section 6.2 of the HCP.

Species	No. of Carcasses Found in Fall 2013 & 2014[1]	Percent Reduction Since WNS Introduction in the Midwest[2]	Adjusted Carcass Data[3]	Adjusted Annual Fatality Rate per Species[4]
Indiana Bat	0*	8%	0	7.7
Northern Long-eared Bat	1	50-90%	1	23.1
Little Brown Bat	2	57%	1	31.8**
Tricolored Bat	0	50%	0	10.6

[1] Gruver et al. 2014; Skalski and Shoener 2015
[2] USFWS *pers. communication*
[3] Rounded to the nearest whole bat.
[4] Based on outputs from the "multi-year" module in EofA.
* While an Indiana bat has been found at the Project, it was not found during standardized searching and is thus not included in this method for model purposes.
** Reduced from 53 little brown bats to 31.8 little brown bats based on the adjustment.

Two methods were considered in the approach for calculating the all-bat and non-covered bat fatality estimates at the Project. Method 1 retains the bat fatality rate in spring and fall observed at the project and calculates the annual fatalities through an assumed seasonal fatality composition. Method 2 averages the bat fatality rate across seasons by calculating the annual bat fatalities at 3.0 m/s and dividing it by 214.4 (MW of the Project) then converting that average bat fatality rate to the uncurtailed rate (divide by 0.64). Both methods are provided for comparison for each estimate below.

The seasonal fatality composition from the Midwest Wind Energy Multi-Species HCP (MSHCP) was used for the estimates. It assumes that 6.5% of fatalities occur in the spring, 25.5% occur during the summer, and 68.0% occur during the fall (USFWS 2016). According to data collected from 2015 through 2017 across Iowa by MidAmerican Energy Company (MEC), 3.57% of bat fatalities occur in the spring, 31.37% in the summer, 64.44% in the fall, and 0.66% in the late fall (October 15 – November 15) (MEC 2019). This dataset provides more recent information about bat fatality rates in the Midwest than the MSHCP but covers a smaller geographic area. We have chosen to use the MSHCP distribution data in the main text of the EA to be consistent with the methodology presented in the HCP. However, because the MEC data is also valid, we evaluated the potential impacts to bat resources using the MEC distribution information in Section 2 below.

1.0 Take Estimation Using MSCHCP Data

1.1 All-bat Fatality Estimate

1.1.1 Method 1

The bat fatality rate for the Project while operating at 3.0 m/s was estimated to be 0.16 to 0.19 bats/MW/spring and 9.99 bats/MW/fall. Assuming an average bat fatality rate of 0.175 bats/MW in the spring and 9.99 bats/MW in the fall, the estimated bat fatalities in spring and fall is 2,179.4 bats. We then calculated the annual fatality rate based on the seasonal fatality composition from the Midwest Wind Energy Multi-Species HCP where 6.5% of bat fatalities occur in the spring, 25.5% occur during the summer, and 68.0% occur during the fall (USFWS 2016). Therefore, 2,179.4 bats would represent 74.5% of all fatalities (6.5% in the spring and 68% in the fall, combined), and the annual fatality rate at 3.0 m/s is expected to be 2,925.3 bats (2,179.4 divided by 0.745) for the 214.4-MW Project.

Operating at 3.0 m/s is expected to reduce all bat fatalities by 36%; thus the expected bat fatalities with no operational adjustment (uncurtailed) would be 4,570.8 bats per year, with 58.6 bat fatalities in the spring, 1,165.6 bat fatalities in the summer, and 3,346.7 bat fatalities in the fall. The No Operational Adjustment Scenario is not an alternative considered in this EA but was used to calculate the expected take under each alternative by applying expected fatality reductions under each operational cut-in speed scenario. The following equations were utilized to calculate the all-bat fatality estimate for each alternative:

$$S = spring\ bat\ fatalities = average\ spring\ fatality\ rate * MW = \frac{0.16 + 0.19}{2}(214.4)$$

$$F = fall\ bat\ fatalities = fall\ fatality\ rate * MW = 9.99(214.4)$$

$$A = annual\ bat\ fatalities\ at\ 3.0\ m/s = \frac{S + F}{0.745}$$

$$B = fatalities\ uncurtailed = \frac{A}{0.64}$$

$$fatalities\ expected\ under\ the\ No\ Action\ Alternative = S + A(0.255) + \frac{F}{0.64}(0.19)$$

$$fatalities\ expected\ under\ the\ Proposed\ Action\ Alternative = S + A(0.255) + \frac{F}{0.64}(0.38)$$

$$fatalities\ expected\ under\ the\ More\ Restricted\ Alternative = \frac{S}{0.64}(0.34) + B(0.255)(0.34) + \frac{F}{0.64}(0.34)$$

Thus, the all-bat fatality estimate under each alternative are as follows (rounded up to the nearest whole bat) under Method 1 and adjusted by estimated reductions in Covered Species from WNS (see Table 1):

- 1,409 bats under the No Action Alternative
- 2,040 bats under the Proposed Action (HCP) Alternative
- 1,543 bats under the More Restrictive Alternative

1.1.2 Method 2

Similar to Method 1, the bat fatalities estimated during the spring and fall while operating at 3.0 m/s at the Project is 2,180 bats. Assuming that this represents 74.5% of all fatalities, the all-bat fatality estimate while operating at 3.0 m/s is 2,925 bats/year. To calculate the average bat fatality rate, 2,925 was divided by 214.4 (MW of the Project) to get 13.64 bats/MW/year at 3.0 m/s. The uncurtailed rate is then calculated by dividing by 0.64 to get 21.33 bats/MW/year; thus, the expected bat fatalities (under this method) with no operational adjustment (uncurtailed) would be 4,572.75 bats/year. The No Operational Adjustment Scenario is not an alternative considered in this EA but was used to calculate the expected take under each alternative by applying expected fatality reductions under each operational cut-in speed scenario.

The following equations were utilized to calculate the all-bat fatality for each alternative (under this method):

$$S = spring\ bat\ fatalities = 4{,}572.75 * 0.065$$

$$Su = summer\ bat\ fatalities = 4{,}572.75 * 0.255$$

$$F = fall\ bat\ fatalities = 4{,}572.75 * 0.68$$

$$fatalities\ expected\ under\ the\ No\ Action\ Alternative = S(0.64) + Su(0.64) + F(0.19)$$

$$fatalities\ expected\ under\ the\ Proposed\ Action\ Alternative = S(0.64) + Su(0.64) + F(0.38)$$

$$fatalities\ expected\ under\ the\ More\ Restricted\ Alternative = (S + Su + F)(0.34)$$

Thus, the all-bat fatality estimate under each alternative are as follows (rounded up to the nearest whole bat) under Method 2 and adjusted by estimated reductions in Covered Species from WNS (see Table 1):

- 1,517 bats under the No Action Alternative
- 2,103 bats under the Proposed Action (HCP) Alternative
- 1,543 bats under the More Restrictive Alternative

1.1.3 Summary of All-bat Fatality Estimates

Table 2 summarizes the results of the two methods used to estimate the all-bat fatality estimate per alternative.

Table 2. Estimated all-bat fatalities at the Project per alternative under each method considered. Results are bats/year rounded up to the nearest whole bat.

Alternative	Method 1 (bats/year)	Method 2 (bats/year)
No Action Alternative	1,409	1,517
Proposed Action (HCP) Alternative	2,040	2,103
More Restricted Alternative	1,543	1,543

1.2 Non-covered Bat Fatality Estimate

For calculating the anticipated impacts of the operation of the Project under each alternative on non-listed, non-covered bats, we assumed that these species would make the up the same percent species composition of non-covered bat fatalities, regardless of alternative:

- Eastern red bat: 54.22%
- Silver-haired bat: 21.45%
- Hoary bat: 20.6%
- Big brown bat: 3.55%
- Evening bat: 0.18%

Fatalities for each species were calculated by subtracting the estimated take of the covered species per season (see Table 6) from the all-bat fatality estimate per alternative per season, multiplied by the percent species composition above. This same approach was applied both to Method 1 and Method 2 all-bat fatality estimates. The results are presented in Tables 3 and 4 and compared in Table 5. Method 2 was presented in the EA since it resulted in a higher, more conservative estimate than Method 1, but the differences between the methods did not differ substantially for most species under each alternative.

Table 3. Non-covered bat fatality estimate using Method 1.

Non-covered Bat Species	No Action				Proposed Action (HCP)				More Restrictive			
	Spring (6.5%)	Summer (25.5%)	Fall (68%)	***Total***	Spring (6.5%)	Summer (25.5%)	Fall (68%)	***Total***	Spring (6.5%)	Summer (25.5%)	Fall (68%)	***Total***
All-bat Fatality per Season	37.52	745.96	635.86	***1419.34***	37.52	745.96	1271.73	***2055.21***	19.93	396.29	1137.86	***1554.09***
Non-covered Bat Fatality per Season[1]	32.47	728.19	621.79	***1382.45***	32.47	728.19	1225.61	***1986.26***	17.25	386.85	1096.60	***1500.69***
Eastern Red Bat	17.60	394.81	337.13	***749.54***	17.60	394.81	664.51	***1076.92***	9.35	209.74	594.56	***813.65***
Silver-haired Bat	6.96	156.18	133.36	***296.50***	6.96	156.18	262.86	***426.01***	3.70	82.97	235.19	***321.86***
Hoary Bat	6.69	150.03	128.11	***284.84***	6.69	150.03	252.52	***409.25***	3.55	79.71	225.94	***309.20***
Big Brown Bat	1.15	25.87	22.09	***49.11***	1.15	25.87	43.57	***70.56***	0.61	13.74	38.96	***53.31***
Evening Bat	0.06	1.29	1.10	***2.46***	0.06	1.29	2.18	***3.53***	0.03	0.69	1.95	***2.67***

[1] Calculated by subtracting the covered bat take estimate per season (see Table 6) from the all-bat fatality per season, without changes from WNS.

Table 4. Non-covered bat fatality estimate using Method 2.

Non-covered Bat Species	No Action				Proposed Action (HCP)				More Restrictive			
	Spring (6.5%)	Summer (25.5%)	Fall (68%)	***Total***	Spring (6.5%)	Summer (25.5%)	Fall (68%)	***Total***	Spring (6.5%)	Summer (25.5%)	Fall (68%)	***Total***
All-bat Fatality per Season	99.27	389.46	1038.56	***1527.30***	137.68	540.11	1440.31	***2118.10***	101.06	396.46	1057.22	***1554.74***
Non-covered Bat Fatality per Season	94.22	371.69	1024.49	***1490.40***	132.62	522.34	1394.19	***2049.15***	98.37	387.02	1015.96	***1501.34***
Eastern Red Bat	51.08	201.52	555.46	***808.07***	71.91	283.21	755.91	***1111.02***	53.34	209.83	550.84	***814.01***
Silver-haired Bat	20.21	79.72	219.73	***319.66***	28.44	112.03	299.02	***439.49***	21.10	83.01	217.90	***322.00***
Hoary Bat	19.41	76.58	211.09	***307.08***	27.33	107.62	287.26	***422.21***	20.27	79.74	209.33	***309.34***
Big Brown Bat	3.35	13.20	36.39	***52.94***	4.71	18.56	49.53	***72.79***	3.49	13.75	36.09	***53.33***
Evening Bat	0.17	0.66	1.82	***2.65***	0.24	0.93	2.48	***3.64***	0.17	0.69	1.80	***2.67***

[1] Calculated by subtracting the covered bat take estimate per season (see Table 6) from the all-bat fatality per season, without changes from WNS.

Table 5. Summary of non-covered bat fatalities under Method 1 and Method 2.

Non-covered Bat Species	Method 1			Method 2		
	No Action	Proposed Action (HCP)	More Restrictive	No Action	Proposed Action (HCP)	More Restrictive
Eastern Red Bat	749.54	1076.92	813.65	808.07	1111.02	814.01
Silver-haired Bat	296.5	426.01	321.86	319.66	439.49	322.00
Hoary Bat	284.84	409.25	309.2	307.08	422.21	309.34
Big Brown Bat	49.11	70.56	53.31	52.94	72.79	53.33
Evening Bat	2.46	3.53	2.67	2.65	3.64	2.67

1.3 Covered Bat Fatality Estimate

1.3.1 Method 1

We utilized the most conservative take estimates at 3.0 m/s presented in Section 6.2.4 of the HCP to calculate take of the covered species under each alternative using the seasonal fatality composition. The Midwest Energy Multi-species HCP seasonal fatality composition was used for bats that could be at the Project throughout the bat active season (little brown and tricolored bats). For migratory bats (northern long-eared and Indiana bats), a seasonal fatality composition of 98.3% of fatalities occurring in the fall and the remainder in the spring was used because take of migratory bats during the summer is not expected at the Project (all turbines are sited over 1,000 feet away from suitable summer habitat). The fall 98.3% estimate was calculated by taking the fall percentage of total average fatality rates observed at the Project[1]:

$$migratory\ bat\ fall\ fatality\ composition = \frac{9.99}{0.175 + 9.99} * 100$$

This was used to calculate take under the No Operational Adjustment Scenario (uncurtailed), which could then be used to calculate take under each alternative. Given that the alternatives differ by season at times, take was calculated per season under each alternative. We assumed that summer take at the Project would not occur for Indiana bats and northern long-eared bats as there are no turbines sites within 1,000 feet of suitable summer habitat; therefore, take for these two species is based solely on spring and fall mortality estimates. Spring take of Indiana and northern long-eared bats has not occurred in Illinois to date; therefore, we reassessed the take numbers in Table 6 to assume zero take in the spring for these two species. The final take estimates, as presented in Table 3-7 of the EA, are included here as Table 7 with numbers of 0.09 and above rounded up to the nearest whole bat.

[1] The spring fatality rate ranged from 0.16 bats/MW to 0.19 bats/MW. An average 0.175 bats/MW was utilized. The fall fatality rate was 9.99 bats/MW.

Table 6. Covered bat fatality estimate utilizing estimated take at 3.0 m/s as presented in the HCP.

Covered Species	3.0 m/s*				No Operational Adjustment Scenario*				No Action @ 6.9 m/s in Fall[3]				HCP @ 5.0 m/s in Fall[4]				More Restricted @ 5.5 m/s[5]			
	Annual take @ 3.0 m/s[1]	Spring†	Summer†	Fall†	Annual take Uncurtailed[2]	Spring†	Summer†	Fall†	Spring†	Summer†	Fall†	*Total*	Spring†	Summer†	Fall†	*Total*	Spring†	Summer†	Fall†	*Total*
IBAT	7.7	0.13	0**	7.57	12.03	0.20	0**	11.83	0.13	0**	0.00	***0.13***	0.13	0**	4.49	***4.63***	0.07	0**	4.02	***4.09***
NLEB	23.1	0.39	0**	22.71	36.09	0.61	0**	35.48	0.39	0**	0.00	***0.39***	0.39	0**	13.48	***13.88***	0.21	0**	12.06	***12.27***
LBB	31.8	2.07	8.11	21.62	49.69	3.23	12.6721.12	33.79	2.06	8.11	6.42	***16.60***	2.07	8.11	12.84	***23.02***	1.10	4.31	11.49	***16.89***
TRI	16.7	1.09	4.26	11.36	26.09	1.70	6.65	17.74	1.09	4.26	3.37	***8.72***	1.09	4.26	6.74	***12.09***	0.58	2.26	6.03	***8.87***
Total [6]	---	***3.68***	***12.37***	***63.26***	***123.91***	***5.74***	***19.32***	***98.84***	***3.68***	***12.37***	***9.79***	***25.84***	***3.68***	***12.37***	***37.56***	***53.60***	***1.95***	***6.57***	***33.61***	***42.13***

[1] Values obtained from Section 6.2.4 of the HCP for unminimized take estimated for the Project while operating at 3.0 m/s.
[2] Calculated by dividing the annual take @ 3.0 m/s by 0.64, assuming that operating at 3.0 m/s is a 36% reduction from the No Operational Adjustment Scenario.
[3] Alternative involves operating at 3.0 m/s in spring and summer and at 6.9 m/s in the fall. Values were calculated by using the same values at 3.0 m/s for spring and summer, and multiplying the uncurtailed fall estimate by 0.19. When operating at 6.9 m/s, take would be avoided for northern long-eared bats and Indiana bats.
[4] Alternative involves operating at 3.0 m/s in spring and summer and at 5.0 m/s in the fall. Values were calculated by using the same values at 3.0 m/s for spring and summer, and multiplying the uncurtailed fall estimate by 0.38.
[5] Alternative involves operating at 5.5 m/s during the entire bat active season (spring – fall). Values were calculated by multiplying the uncurtailed estimates for each season by 0.34.
[6] Seasonal values used for calculating the non-covered bat fatalities. See Section 1.2.
* Not an alternative under consideration in the EA but presented for calculation purposes.
** No take is expected during the summer as no turbines are located within 1,000 feet of suitable summer habitat.
† Seasonal fatality composition used for northern long-eared and Indiana bats was 1.7% in spring, 0% in summer, and 98.3% in the fall. For little brown and tricolored bats, the composition used was 6.5% in spring, 25.5% in summer, and 68% in fall from the Midwest Energy Multi-species HCP.

Table 7. Summary of estimated fatalities for Covered Species by alternative annually and for the 20-year permit duration.

Species	No Operational Adjustment Scenario[1]		Alternative 1: No Action Alternative		Alternative 2: Proposed Action Alternative		Alternative 3: More Restrictive Alternative	
	Annual	**20 Years**	**Annual**	**20 Years**	**Annual**	**20 Years**	**Annual**	**20 Years**
Indiana Bat Fatality Estimate[2]	12	240	0	0	5	100	4	80
Northern Long-eared Bat Fatality Estimate[2]	36	720	0	0	14	280	13	260
Little Brown Bat Fatality Estimate[3]	50	1,000	17	332	23	460	17	340
Tri-colored Bat Fatality Estimate[3]	26	520	9	180	12	240	9	180
Total Bats for Covered Species	**124**	**2,480**	**26**	**512**	**54**	**1,080**	**43**	**860**
Percent Reduction from No Operational Adjustment Scenario			79.03%		56.45%		65.32%	

[1] This is not an alternative under consideration but is included in the analysis for comparison.
[2] Summer take at the Project is not expected for Indiana bats and northern long-eared bats as there are no turbines sited within 1,000 feet of suitable summer habitat, therefore take for these two species is based solely off of the spring and fall mortality estimates. Spring take has not occurred in Illinois to date, therefore we assume no take would occur in the spring.
[3] Take for little brown bat and tricolored bat is based on the entire bat active season, including summer.

2.0 Take Estimation Using MEC Data

Calculation methods under Section 1 were also applied in this section. Numbers differs by the assumed seasonal fatality composition of 3.57% of bat fatalities in the spring, 31.37% in the summer, 64.44% in the fall, and 0.66% in the late fall (October 15 – November 15). For the all-bat and non-covered bat fatalities, only Method 2 numbers are presented (Table 8). The covered bat take estimate is calculated in Table 9 and compared to the MSHCP data in Table 10. Ultimately, there is not a significant difference between the two calculations for the bat fatality estimates.

The all-bat fatality using the MEC data for each alternative were:

- 1,592 bats under the No Action Alternative
- 2,148 bats under the Proposed Action (HCP) Alternative
- 1,554 bats under the More Restrictive Alternative

Table 8. Non-covered bat fatality estimates using MEC data.

Non-covered Bat Species	No Action					Proposed Action (HCP)					More Restrictive				
	Spring (3.57%)	Summer (31.37%)	Fall (64.44%)	Late Fall (0.66%)	***Total***	Spring (3.57%)	Summer (31.37%)	Fall (64.44%)	Late Fall (0.66%)	***Total***	Spring (3.57%)	Summer (31.37%)	Fall (64.44%)	Late Fall (0.66%)	***Total***
All-bat Fatality per Season	57.18	502.46	1032.15	10.57	***1602.37***	77.17	678.09	1392.93	14.27	***2162.46***	55.85	490.76	1008.11	10.33	***1565.04***
Non-covered Bat Fatality per Season[1]	55.82	490.49	1007.57	10.32	***1564.20***	74.68	656.24	1348.05	13.81	***2078.98***	53.93	473.91	973.50	9.97	***1511.31***
Eastern Red Bat	30.26	265.94	546.29	5.60	***848.09***	40.49	355.81	730.89	7.49	***1134.68***	29.24	256.95	527.82	5.41	***819.41***
Silver-haired Bat	11.97	105.20	216.10	2.21	***335.48***	16.02	140.75	289.12	2.96	***448.85***	11.57	101.64	208.79	2.14	***324.14***
Hoary Bat	11.50	101.06	207.60	2.13	***322.29***	15.39	135.21	277.75	2.84	***431.20***	11.11	97.64	200.58	2.05	***311.39***
Big Brown Bat	1.98	17.42	35.79	0.37	***55.57***	2.65	23.31	47.89	0.49	***74.34***	1.92	16.84	34.58	0.35	***53.69***
Evening Bat	0.10	0.87	1.79	0.02	***2.78***	0.13	1.17	2.39	0.02	***3.72***	0.10	0.84	1.73	0.02	***2.68***

[1] Calculated by subtracting the covered bat take estimate per season (see Table 9) from the all-bat fatality per season, without changes from WNS.

Table 9. Covered bat fatality estimates using MEC data.

Covered Species	No Action @ 6.9 m/s in Fall[3]					HCP @ 5.0 m/s in Fall[4]					More Restricted @ 5.5 m/s[5]				
	Spring†	Summer†	Fall†	Late Fall†	***Total***	Spring†	Summer†	Fall†	Late Fall†	***Total***	Spring†	Summer†	Fall†	Late Fall†	***Total***
IBAT	0.27	0.00**	0.00	0.05	***0.33***	0.27	0.00**	4.38	0.05	***4.70***	0.15	0.00**	3.92	0.05	***4.11***
NLEB	0.82	0.00**	0.00	0.15	***0.98***	0.82	0.00**	13.14	0.15	***14.11***	0.44	0.00**	11.75	0.15	***12.34***
LBB	1.14	9.98	6.08	0.21	***17.40***	1.14	9.98	12.17	0.21	***23.49***	0.60	5.30	10.89	0.21	***17.00***
TRI	0.60	5.24	3.19	0.11	***9.14***	0.60	5.24	6.39	0.11	***12.33***	0.32	2.78	5.72	0.11	***8.93***
Total[6]	***2.83***	***15.21***	***9.28***	***0.52***	***27.85***	***2.83***	***15.21***	***36.07***	***0.52***	***54.64***	***1.50***	***8.08***	***32.27***	***0.52***	***42.38***

** No take is expected during the summer as no turbines are located within 1,000 feet of suitable summer habitat.

† Seasonal fatality composition used for northern long-eared and Indiana bats was 3.57% in spring, 0% in summer, 95.77% in the fall, and 0.66% in the late fall. For little brown and tricolored bats, the composition used was 3.57% in spring, 31.37% in summer, 64.44% in fall, and 0.66% in the late fall from the MEC data.

Table 10. Comparison of take estimates for the covered species using MSHCP and MEC data per alternative.

Species	Alternative 1: No Action Alternative		Alternative 2: Proposed Action Alternative		Alternative 3: More Restrictive Alternative	
	MSHCP	**MEC**	**MSHCP**	**MEC**	**MSHCP**	**MEC**
Indiana Bat Fatality Estimate	0.13	0.33	4.63	4.7	4.09	4.11
Northern Long-eared Bat Fatality Estimate	0.39	0.98	13.88	14.11	12.27	12.34
Little Brown Bat Fatality Estimate	16.60	17.40	23.02	23.49	16.89	17.00
Tri-colored Bat Fatality Estimate	8.72	9.14	12.09	12.33	8.87	8.93
Total	**25.84**	**27.85**	**53.60**	**54.64**	**42.13**	**42.38**

APPENDIX E – Comments Received on the HCP and Draft EA and Responses to Public Comments

Responses to Public Comments on the Draft EA and Draft HCP

On June 3, 2021, the Service published the Draft EA and Draft HCP in the Federal Register (86 FR 29803). Public comments were accepted during a 30-day period following publications of the Federal Register Notice of Availability. Electronic copies of the documents were available for review under Docket No. FWS-R3-ES-2021-0042. The Service received 3 comments through regulations.gov during the 30-day public comment period for the Draft EA and Draft HCP. The public comment period was open No other comments were received through other avenues. A summary of comments received and our responses are provided below and in **Table 1**.

Comment #1: A commenter expressed concern about the impact of killing bats and birds and provided comment against the issuance of the incidental take permit.

Comment #2: A commenter expressed concern over the 20-year duration of the permit and the estimated take level of little brown bats.

Comment #3: The U.S. Environmental Protection Agency (EPA) provided comments supporting the inclusion of a reversion trigger, adaptive management, and intensive monitoring to ensure take rates are not exceeded under the Proposed Action. Overall, the EPA had no substantive comments related to the Draft EA but did advise on further consideration of cumulative effects to bats, including non-listed bats, for future-installed capacity of wind projects in concert with other challenges faced by bats.

Table 1. Public comments received during the 30-day comment period.

Comment #	Date	Author	Comment	Response
1	6/2/2021	Jean Publieee	This permit needs to be denied. it has no realit to it. massive deaths of bats have happened all over the usa so that billions of bats are deaad. that means the ones left alive are very precious and must be protected at the highest level. this killing permit makes no sense. it is a permit to kill an endangered species. it needs to be denied promptly and totally., bats cant learn to stay out of the way of a wind tunnel. they are dragged n and killed. such wind tunnels are massive killers of birds too which too are in complete and total decline in all popularions for mankinds profiteers. this profiteering is killing all species on earth. we need to be more prudent and stop these assalts no wildlife. deny deny deny.	Thank you for your comment.
2	7/5/2021	Anonymous	Please do not go ahead with this, because 20 years is a long time and these bats do not need to face more threats to their existence along with white-nose syndrome. And the estimated level of take for the little brown bats is really huge and what happens if sometime in the coming 20 years this bat species gets listed as endangered or threatened? This plan would make things worse for these bats. Please protect the northern long-eared bats, the tricolored bats, little brown bats, and Indiana bats. Thanks.	Thank you for your comment. Following the publication of the Draft EA, new information came forward regarding estimated impacts from white-nose syndrome over the last decade in Midwestern states. Since the initial take estimate was based on post-construction mortality data pre-WNS onset, the applicant has incorporated adjustments which has decreased the permitted level of take over the 20-year permit term for little brown bats. The adaptive management triggers and reversion triggers are in place to prevent take exceeded during operation of the Project over the permit term.

Comment #	Date	Author	Comment	Response
3	7/6/2021	Kenneth Westlake, U.S. Environmental Protection Agency	Action Alternative 2 was identified as the Applicant's Proposed Action. However, a USFWS-Preferred Alternative was not identified in the Draft EA. EPA has no substantive comments to offer relating to the Draft EA or NEPA Decision document. We concur with the Applicant's proposal for a reversion trigger clause, given the proposal for adaptive management and intensive monitoring and assurance that statistical confidence levels ensure that take rates are not being exceeded. Based on take estimates provided in Table 3-8, the annual percent impact for each Covered Species relative to the species' recovery unit or state population estimates are presented in Table 3-9 of the Draft EA. Based on these small percentages, USFWS states that it does not expect naturally occurring populations of the covered bat species to be reduced in numbers below levels for maintaining viability at local or regional level (page 48). However, "Direct mortality of 23.1 million unlisted bats over the next 30 years associated with wind energy facilities, in concert with other challenges faced by these species, could have a substantial cumulative effect on these species, including potentially substantial declines in populations." (Frick et al. 2017). The mortality associated with wind energy facilities, in concert with other challenges faced by these species, could have a substantial cumulative effect on these species, including potentially substantial declines in populations. It is unknown whether tree bat populations can be sustained under wind energy development that may cause the loss of millions of	Thank you for your comment. The Final EA reflects that Action Alternative 2: the Proposed Action is identified as the Service's Preferred Alternative.

Comment #	Date	Author	Comment	Response
			bats over the next 30+ years. Cumulative effects to bats, including non-listed species, is an important consideration to acknowledge when reviewing the alternatives analyzed not only for this Project, but also for the possible future-installed capacity of wind projects in USFWS Region 3 states.	

APPENDIX F – Summary of Changes Made to Final EA

Summary of Changes Made to Final EA

Revisions made to the Draft EA, which are reflected in this Final EA, are summarized below:

- Formatting and text changes
  - Formatting changes may include changes to appearances of tables or figures, page numbers, and section numbers.
  - Changed title from "Draft" to "Final" Environmental Assessment.
  - Revised date of document.
  - Updated preparation costs on cover.
- Abbreviations
  - Added U.S. Environmental Protection Agency (EPA).
- Section 2.2.2: Alternative 2: The Proposed Action
  - Updated anticipated mitigation for little brown bats based on revised take estimate for little brown bats under the Proposed Action (the Applicant's HCP).
- Section 3.6.1.2: Status and Environmental Trends of Covered Bat Species, Including Threatened and Endangered Bats
  - Table 3-4
    - Added data regarding number of USFWS-reported Indiana bat fatalities at wind facilities as of July 2021 (USFWS 2021).
    - Added information to northern long-eared bat, little brown bat, and tricolored bat regarding new information about estimated impacts from WNS in Midwestern states over the last decade.
    - Revised estimate of Illinois populations of little brown bat and tricolored bat used for this EA, explained in detail in Appendix C.
  - Table 3-5
    - Added detail regarding operation of wind turbines at the Project during post-construction mortality monitoring.
- Section 3.6.2.2: Effects to Bat Resources
  - Text reorganization under "Turbine Related Fatality"
  - Added text regarding what data was used in the take estimate.
  - Modified take estimate based on new information about estimated impacts on the covered species' populations from WNS in Midwestern states over the last decade.
  - Table 3-8
    - Revised take estimates for little brown bat under the No Operational Adjustment Scenario, Alternative 1 (No Action), Alternative 2 (Proposed Action), and Alternative 3 (More Restrictive Alternative).
    - Updated total take estimate for all covered bats under each alternative based on revisions to the little brown bat take estimates.
    - Updated "Percent Reduction from No Operational Adjustment Scenario" numbers based on take estimate revisions for each alternative.
  - No Action Alternative: updated take estimate for little brown bats.
  - HCP Alternative: updated take estimate for little brown bats.
  - More Restrictive Alternative: updated take estimate for little brown bats.
  - Table 3-9

        - Revised impact of annual take at the Project under each alternative relative to the Illinois populations of little brown bats and tricolored bats based on new take estimate for little brown bats and revised state population estimates of little brown bats and tricolored bats.
    - Effects of mitigation: revised number of artificial roosts needed for mitigation for little brown bat take at the Project under the Proposed Action Alternative and More Restrictive Alternative based on revised take estimates for little brown bats.
    - White-nose syndrome
        - Added information regarding when WNS was first detected in Illinois and the affected bat species.
        - Added data regarding new information about estimated impacts from WNS in Midwestern states over the last decade.
- Section 4.0: Identification of the Preferred Alternative
    - Added this section to the Final EA identifying the Service's preferred alternative.
- Section 6.0: References
    - Additions:
        - ILDNR. 2013. White-nose syndrome confirmed in Illinois bats. Press Release. Springfield, IL. Available: https://www2.illinois.gov/dnr/news/Pages/White-NoseSyndromeConfirmedinIllinoisBats.aspx. Accessed July 2021.
    - Changes:
        - Updates USFWS 2020a to USFWS 2021 to reflect updated information on Indiana bat fatalities at wind energy facilities
        - Changed USFWS 2020b to USFWS 2020a.
        - Changed USFWS 2020c to USFWS 2020b.
- Appendices
    - Additions:
        - Added "Appendix E: Comments Received on the HCP and Draft EA and Responses to Public Comments."
        - Added "Appendix F: Summary of Changes Made to Final EA."
    - Changes:
        - Appendix C: State Population Estimates for Little Brown Bats and Tricolored Bats in Illinois
            - Revised Illinois population estimates for little brown bat and tricolored bat to account for impacts from WNS over the last decade.
            - Little brown bat population reduced by 57%.
            - Revised estimates for tricolored bat population based on changes to the little brown bat population estimate.
        - Appendix D: Bat Impact Assessment
            - Clarified what data was used to estimate take.
            - Modified data inputs used in the EofA modeling to reflect estimated impacts from WNS to the covered bat species over the last decade since the original data was pre-WNS introduction. Overall, these modifications only changed the take estimate for little brown bats.
            - Added a new Table 1. Updated other table numbers throughout.
            - Revised all-bat fatality estimates of each alternative in Section 1.1.

- Tables 6, 7, 9, and 10: Revised little brown bat take estimates under each alternative and total covered bat take estimates.