DRAFT HABITAT CONSERVATION PLAN FOR THE INDIANA BAT AND THE NORTHERN LONG-EARED BAT

PIONEER TRAIL WIND FARM

IROQUOIS AND FORD COUNTIES, ILLINOIS

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Appendix

A. Bat Screening Analysis and Pre-Construction Bat Survey, Pioneer Trail Wind Farm, Iroquois and Ford Counties, Illinois

Project Location

See Figure 1, United States Geographical Survey (USGS) Topographic Map for a graphic Project overview.

Iroquois and Ford Counties, Illinois

USGS Quadrangles: Rankin, IL; Paxton, IL; Buckley, IL; Cissna Park, IL

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1. Introduction

1.1 Applicant Information

Pioneer Trail Wind Farm, LLC (PTWF) is a wholly owned subsidiary of E.ON Climate & Renewables, North America (E.ON), itself a division of a publicly traded company, E.ON AG, which has offices and power generation holdings throughout the world. Headquartered in Chicago, Illinois, E.ON's exclusive focus is on the development, construction and operation of wind and solar energy resources throughout the United States and Canada. As a company with an operational focus, E.ON seeks wind development locations that provide an economically viable wind resource that can be harnessed with minimal environmental and community impact. E.ON currently has 2,700 megawatts (MW) of operational wind generation, with an additional 600 MW under construction, and over 9,000 MW under development.

1.2 Background and Purpose

In August 2007, Illinois enacted legislation (Public Act 95-0481) that establishes annual benchmarks for renewable energy generation and energy efficiency.[1] Under this program, electric utilities in Illinois are required to provide at least 25% of their retail electric supply from renewable energy sources, including wind, by 2025. Illinois' renewable portfolio standard (RPS) requires that investor-owned electric utilities (EUs) obtain a minimum of 75% of their renewable energy obligation from wind power, and the remaining amount (25%) from other eligible renewables. For alternative retail electric suppliers (ARES), a minimum of 60% of their renewable energy obligation must come from wind power, and the remaining amounts (40%) from other eligible renewables. For EUs, through 2011, eligible renewable resources must be located in-state. After 2011, equal preference is given to resources within Illinois and adjoining states as long as they are cost-effective. Given the clear legislative objectives of the state of Illinois for increased renewable energy generation, the majority of which must be met by wind energy, E.ON began evaluating potential Illinois wind project sites in 2007 and began developing the Pioneer Trail Wind Farm (Pioneer Trail or the Project) in 2008.

Wind energy has grown significantly across the United States and within Illinois over the past several years. By 2020, 20% of our nation's energy could come from wind energy. In Illinois alone, the target for renewable energy is 25% (75% of that from wind) by 2025. These targets for renewable energy have been established to promote energy independence, environmental stewardship, and economic development. Wind energy generation is emissions free, requires little to no water, changes only a minimal portion of existing land use, and reduces the need for other traditional energy sources and thereby reduces associated harmful emissions. As an example, current installed capacity in Illinois will avoid emission of over 4.7 million metric tons of carbon dioxide annually. In 2012 wind energy became the number one source of new electricity generating capacity in the U.S., providing 42% of all new capacity. Wind is a clean, renewable and free fuel source that helps to keep energy prices low, providing a hedge against volatile fossil fuel price fluctuations. Combined with the increased efficiency through advances in wind turbine technology, wind is now one of the most cost effective sources of new electricity generation. In addition to the environmental and market benefits from wind, significant direct and indirect economic benefits are realized in areas where such projects are developed. A large number of construction jobs are created during construction as well as a significant number of long term operations and maintenance, and environmental monitoring jobs. There

[1] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL04R&re=1&ee=1.

are significant direct payments made to participating landowners and this often increases local spending, which makes its way through the wider community. Another direct benefit to the broader community is the significant increase in tax revenue associated with wind energy projects greatly benefiting schools, fire, water and other municipal services. Beyond the local project areas, wind energy also supports a growing supply chain and manufacturing base. There are now more than 550 wind energy-related manufacturing facilities across the United States. Thirty-six of those facilities are located in Illinois, supporting over 1,000 employees. While job creation and increased economic development activity are welcome by-products of renewable energy projects, the paramount benefit of continued careful development of responsibly sited wind energy projects is meeting our energy needs in a way that minimizes the overall environmental impact of our nation's energy footprint.

1.3 Habitat Conservation Plan Contents

This Habitat Conservation Plan (HCP) has been prepared in accordance with the requirements set forth under Section 10(a)(1)(B) of the Endangered Species Act (ESA), as amended, and applicable U.S. Fish and Wildlife Service (USFWS or the Service) guidance documents. The HCP has been prepared in order to manage risk associated with protected species, particularly during the operation of Pioneer Trail. The Project's location is within the range of the Indiana bat (*Myotis sodalis*), a species listed as endangered under the ESA and the Illinois Endangered Species Protection Act-520 Illinois Compiled Statutes (ILCS) 10/1; regulatory authority under the state law lies with the Illinois Department of Natural Resources (IDNR). Estimates of the size of hibernating populations of the Indiana bat vary across the state of Illinois. Maternity colonies have been recorded in 20 counties (USFWS 2007). The Project's location is also within the range of the northern long-eared bat (*Myotis septentrionalis*), a species which is currently proposed for listing under the ESA. There are 36 known hibernacula in Illinois (USFWS 2013a).

In order to provide PTWF or its assignees with long-term assurances that no unauthorized take of either the Indiana bat or the northern long-eared bat will occur that could give rise to liability for PTWF or individuals associated with the operation of the Project, PTWF is requesting the issuance of a Section 10(a)(1)(B) Incidental Take Permit (ITP). 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. PTWF is applying for an ITP to authorize any incidental take of the Indiana bat or northern long-eared bat that may occur as a result of the activities that are proposed for coverage under the ITP.

Two additional federally threatened, endangered or candidate species have the potential to be found in the Pioneer Trail Plan Area based on historic geographic distribution. These species were considered but excluded from the HCP. A discussion of these species and the reasons for exclusion are found in Section 2.5.3.

Before the Service issues an ITP to PTWF, it must confirm that PTWF has taken measures to avoid, minimize, and mitigate for potential take of the Indiana bat or the northern long-eared bat to the maximum extent practicable. PTWF has prepared this HCP to support the issuance of an ITP for Indiana and northern long-eared bats during the operation and decommissioning of the Project pursuant to Section 10(a)(1)(b) of the ESA. Specifically, this HCP provides the following:

- An overview of the regulatory framework of wind projects as it relates to species protection, including a summary of agency coordination;
- A discussion of the general environmental setting and biological resources within the Plan

Area;

- A description of the Project, including its purpose and a definition of activities to be covered under the HCP; alternatives considered; construction schedule; and public participation;
- A discussion of the life history and presence of the Indiana bat;
- A discussion of the life history and presence of the northern long-eared bat;
- Potential effects of the proposed action, including alternatives for minimizing risk to Indiana and northern long-eared bats;
- Estimates of the Project's take, and context defining the significance of the potential take relative to each species' overall population viability;
- A Conservation Plan, outlining measures to avoid, minimize and mitigate potential take; conduct post-construction monitoring for effectiveness; and implement adaptive management measures as appropriate; and
- An implementation plan and Implementation Agreement (IA).

An ITP must be issued to PTWF if the Service makes the following determination with respect to PTWF's ITP application (USFWS and National Ocean and Atmospheric Administration [NOAA] 1996):

- The take will be incidental.

- PTWF will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.

- PTWF will ensure that adequate funding for the plan will be provided.

- The taking will not appreciably reduce the likelihood of the survival and recovery of the overall species in the wild.

- Other measures required by the Service in the plan will be met, and there are assurances that the plan will be implemented.

Incidental take authorized within the scope of a Section 10(a)(1)(B) permit issued to PTWF could primarily include – under specific circumstances and limits – direct and indirect mortality, and harassment and disturbance of individuals during the implementation of mitigation measures.

As part of the requirements for the issuance of an ITP, PTWF has prepared this HCP to identify those actions that will minimize and mitigate for the effects on the Indiana and northern long-eared bat and their habitats that may occur as a result of construction and operation of Pioneer Trail.

2. Background

2.1 Overview

Pioneer Trail is a state-of-the-art wind energy facility located in Iroquois and Ford counties, Illinois; just east of the towns of Paxton and Loda, Illinois (Figure 1). The Project is designed to generate approximately 150 MW with 94 1.6-MW wind turbine generators (WTGs) and associated operations and maintenance building, access roads, collector line system, and substation. Approximately 3.0 miles (4.8 kilometers [km]) of overhead transmission line extends from the existing Paxton West substation to a newly constructed substation on the Project site. A pad-mounted transformer is installed at the base of each WTG to collect electricity generated by each turbine through cables routed down the inside of the tower. PTWF has signed a Power Purchase Agreement pursuant to which third parties have committed to purchase the output from the Pioneer Trail Project at a fixed cost.

PTWF has installed a power collection system between the pad mounted transformers and a collector substation. The power collection system was installed underground, with cables ranging from approximately 2 to 5 inches (5 to 13 centimeters [cm]) in outside diameter. In addition to the WTGs and power collection system, the PTWF includes unpaved service roads allowing access to the turbines, and an operations and maintenance building. The temporary crane paths, approximately 50 feet (ft) (15 meters [m]) wide, which were used as the crane was moved between turbine locations during construction, have been restored to agricultural use.

2.2 Permit Duration

PTWF is seeking a 43-year ITP for the Indiana and northern long-eared bat. This is based on the duration of Project site leases, which incorporate 25-year terms with two 10-year extensions at PTWF's option. PTWF may elect to not exercise one or both of its options, or otherwise decide to decommission the Pioneer Trail facility prior to expiration of the 43-year term of the HCP and ITP. This HCP identifies the measures intended to assure that the effects of the incidental take will be minimized and mitigated to the maximum extent practicable. At the close of the 43-year term, the ITP may be renewed or extended with the approval of the Service.

2.3 Regulatory and Legal Framework

2.3.1 Endangered Species Act

The purpose of the ESA is to provide a means whereby the ecosystems upon which threatened and endangered (T&E) species depend may be conserved, and to provide a program for the conservation of such T&E species.

Section 7(a)(2) of the ESA requires all federal agencies, in consultation with the Service, to ensure that any action "authorized, funded, or carried out" by any such agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification" of critical habitat. Actions of federal agencies that are not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of their designated critical habitat, but that could adversely affect the species, or result in a take, must be addressed under Section 7 of the ESA.

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed under the ESA as endangered. Under federal regulation, take of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation. Take, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect a listed species, or attempt to engage in any such conduct" [ESA §3(19)].

Section 9 of the ESA also prohibits the removal and reduction to possession of any listed plant species "under federal jurisdiction," as well as the removal, damage, or destruction of such plants on any other areas in knowing violation of any state law or regulation or in violation of state trespass law.

The Service's implementing regulations further define the term "harm" to mean "significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering." They also define harass as "an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering."

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]. Under this provision, the Secretary of the Interior and Secretary of Commerce 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.

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 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.

The submission of an ESA Section 10(a)(1)(B) permit application requires the development of an HCP (16 United States Code [USC] §1539(a)(1)(B) and 1539(a)(2)(A)) designed to ensure the continued existence and aid in the recovery of the listed species while allowing for any limited, incidental take of the species that might occur during the construction and operation of a project. The HCP must demonstrate that the impacts of incidental take have been minimized and mitigated to the maximum extent practicable. Incidental take may be permitted through the issuance of an ITP if the following six criteria of Section 10(a)(2)(B) and 50 CFR 17.22(b)(2) and 50 CFR 17.32 (b)(2) are met:

- The take will be incidental to otherwise lawful activities.
- The Applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking.
- The Applicant will ensure that adequate funding for the HCP and procedures to deal with unforeseen circumstances will be provided.

- The taking will not appreciably reduce the likelihood of the survival and recovery of the listed species in the wild.

- The Applicant will ensure that other measures that the Service may require as being necessary or appropriate will be provided.

- The Service has received such other assurances as may be required that the HCP will be implemented.

An ITP can only be issued if the HCP addresses all of these requirements. To demonstrate that all six requirements have been adequately addressed, the HCP must document and describe:

- Impacts likely to result from the proposed taking of the species for which permit coverage is requested;

- Measures the project will undertake to monitor, minimize, and mitigate such impacts;

- Funding that will be made available to undertake such measures;

- Procedures to deal with unforeseen circumstances;

- Alternatives that were considered that would not result in incidental take, and the reasons why such alternatives are not being utilized; and

- Other necessary and appropriate measures the Service may require as necessary or appropriate for purposes of the plan.

In order to issue an ITP, the Service is required under Section 7 of the ESA to prepare a Biological Opinion (BO) that evaluates the impacts of the Proposed Action (i.e., issuance of an ITP) and establishes an overall effect determination. The BO analyzes the HCP and other relevant information for the effects on the listed species and analyzes whether the Proposed Action would be likely to jeopardize the continued existence of the species or destroy or adversely modify designated critical habitat. If the BO reaches a jeopardy or adverse modification conclusion, the opinion must suggest "reasonable and prudent measures" that would avoid that result. If the BO concludes that a project as proposed would involve the "take" of a listed species, but not to an extent that would jeopardize the species' continued existence, the BO must include an incidental take statement and specify reasonable and prudent measures to minimize the impact of the take.

The incidental take statement specifies an amount of take that the Service believes may occur as a result of the action. The Service may also make conservation recommendations, which are non-binding suggestions, such as identifying additional discretionary measures to reduce take, identifying additional needed studies, monitoring or research, and recommending how the action agency may assist species conservation in furtherance of ESA Section 7(a)(1). If a proposed action is carried out in compliance with the BO and the incidental take statement, it may be implemented without violation of the ESA, and the take is thereby exempted. The resulting BO will encompass the issuance of the ITP and implementation of the HCP.

In addition to these necessary HCP elements, the Five-Point Policy (Federal Register [FR] 65 35241-35257; USFWS and NOAA 2000), an addendum to the *Handbook for Habitat Conservation Planning and Incidental*

Take Permitting Process (USFWS and NOAA 1996), describes five clarifying components that should be included in an HCP:

1. Biological Goals and Objectives – Biological goals are the broad guiding principles for the operating conservation program of the HCP and provide the rationale behind the minimization and mitigation strategies. Objectives describe the desired outcome of the plan and are described in terms of measurable targets for achieving the biological goals.

2. Adaptive Management – Adaptive management is an integrated method of addressing uncertainty over time. Adaptive management provides flexibility in the conservation program to examine alternative strategies for achieving the goals and objectives.

3. Monitoring – Monitoring is a mandatory element of an HCP under the Five-Point Policy. The monitoring plan must identify how compliance with the HCP will be evaluated, identify how biological goals and objectives will be met and provide information that will inform the adaptive management strategy.

4. Permit Duration – HCPs should clearly define the desired duration the permit will be in effect and discuss the factors considered in determining the length of the permit.

5. Public Participation – The Five-Point Policy expanded the public comment period for most HCPs from 30 days to 60 days, with the exception of large scale, regional or exceptionally complex HCPs, where the comment period was extended to 90 days.

2.3.2 National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969, as amended, requires federal agencies to evaluate and disclose the effects of their proposed actions on the natural and human environment. The NEPA process is intended to help federal agencies make decisions that are based on an understanding of potential environmental consequences, and take actions that protect, restore, and enhance the environment. NEPA regulations provide the direction to achieve that purpose. The issuance of an ITP by the Service constitutes a federal action subject to NEPA compliance and review (42 USC §§4321-4347, as amended).

NEPA and the Council for Environmental Quality (CEQ) *Regulations for Implementing NEPA* (40 CFR 1501) contain "action-forcing" provisions to ensure that all federal agencies act according to the letter and spirit of NEPA. NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken. Accurate scientific analysis, expert agency comments, and public scrutiny are essential to implementing NEPA. NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail.

To evaluate the environmental effects of a proposed Action, the Service typically prepares and provides for public review an Environmental Assessment (EA). If the Service finds that significant impacts to the natural and human environment are not expected as a result of the proposed action, then a Finding of No Significant Impact (FONSI) is issued. If significant impacts are anticipated, then a comprehensive Environmental Impact Statement (EIS) is prepared and distributed for public review. After the Service completes its review of an EIS, it issues a Record of Decision of its findings. The Service can issue an ITP only after the NEPA review process has been completed.

2.3.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA, 16 USC §§703-712) prohibits the taking, killing, injuring, or capture of listed migratory birds. Neither the MBTA nor its implementing regulations found in 50 CFR Part 21 provide for the permitting of "incidental take" of migratory birds that may be killed or injured by wind turbines.

2.3.4 Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (50 CFR 22.26), and its implementing regulations, provide additional protection to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) such that it is unlawful to take an eagle. In this statute the definition of "take" is to "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, 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."

The Service published a final rule (Eagle Permit Rule) on September 11, 2009 under the BGEPA authorizing limited issuance of permits to take bald eagles and golden eagles ''for the protection of…other interests in any particular locality'' where the take is compatible with the preservation of the bald eagle and the golden eagle, is associated with and not the purpose of an otherwise lawful activity, and cannot practicably be avoided (FR 46836-46879).

On May 2nd, 2013, the Service announced the availability of the Eagle Conservation Plan Guidance: Module 1 – Land-based Wind Energy, Version 2 (FR 10387)[2] (the "Guidance"). The Guidance provides a means of compliance with the BGEPA by providing recommendations and in-depth guidance for:

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

The Guidance interprets and clarifies the permit requirements in the regulations at 50 CFR 22.26 and 22.27, and does not impose any binding requirements beyond those specified in the regulations.

2.3.5 Illinois Endangered Species Protection Act

The Illinois Endangered Species Protection Act-520 ILCS 10/1 is maintained by the IDNR. Any species or subspecies of animal or plant designated as endangered or threatened by the Secretary of the Interior of the United States pursuant to the ESA of 1973, as amended, shall be automatically listed as an endangered or

[2] http://www.fws.gov/windenergy/eagle_guidance.html.

threatened species under this Act and thereby placed on the Illinois List by the Illinois Endangered Species Protection Board without notice or public hearing. According to 17 Illinois Administrative Code, Chapter 1, Section 1080, "Incidental taking of endangered and threatened species shall be authorized by the Department of Natural Resources (Department) only if the applicant submits to the Department a conservation plan that satisfies all criteria established in this Part. The Department shall provide written notice to the applicant of the approval or denial of authorization for incidental taking. The written notice shall constitute the authorization for incidental taking or the denial of the authorization for incidental taking is effective as of the date of execution by the Director of the Department's Office of Resource Conservation."

2.3.6 Local Regulations

Wind energy conversion facilities, such as the PTWF, are regulated primarily at the county level. The two counties within the Plan Area have adopted ordinances governing the siting and development of wind projects. Pioneer Trail received local zoning and construction approval from both Ford and Iroquois counties prior to construction. Ford and Iroquois counties do not have specific requirements that would relate to this HCP, although Indiana bats are known to occur in Ford County and northern long-eared bats occur in both Ford and Iroquois County..

2.4 Plan Area

The Plan Area for this Project is shown in Figure 1 and is considered to be the outermost boundary of the approximately 12,500 acres (5,060 hectares [ha]) of participating landowner property (Project boundary). It includes all areas that would be affected directly and indirectly by activities associated with operation of Pioneer Trail. The requested ITP would cover the entire Plan Area.

2.5 Covered Species

2.5.1 Indiana Bat

The range of the federally endangered Indiana bat includes the eastern and mid-western United States, from Iowa, Oklahoma, and Wisconsin, northeast to Vermont, and south to northwestern Florida and northern Arkansas (USFWS 2007). The majority of the wintering population occurs in the limestone cave regions of Indiana, Kentucky, and Missouri.

Indiana bat maternity colonies are historically known from Ford County (USFWS 2007). Recent records include a July 2010 survey that identified an Indiana bat maternity colony on the Middle Fork of the Vermilion River in Ford and Champaign counties (IDNR 2010). Maternity colonies are also known from Vermillion County, located adjacent to Ford County to the southeast (USFWS 2007). No records of Indiana bats are known from Iroquois County (USFWS 2007). The closest known hibernaculum is Blackball Mine located in LaSalle County, Illinois approximately 120 miles (190 km) to the northwest of the Plan Area (USFWS 2007).

Acoustic monitoring surveys conducted in 2010 indicated that overall bat activity levels within the Plan Area are moderate relative to the results of acoustic bat surveys at other wind energy projects in the Midwest. The results of the acoustic bat survey, with only nine confirmed *Myotis* calls (none of which were identified as an Indiana bat), do not suggest high levels of Indiana bat migratory activity within the Pioneer Trail Plan Area (see Section 3.10). Nevertheless, little is known about the migration patterns of bats, specifically how they disperse across the landscape during migration. Therefore, it is not possible to accurately predict an individual bat's route during migration. However, Indiana bats have been known to occur in Ford County and the Plan Area is located within their migratory range. Therefore, the Indiana bat does have the potential to, at times, occur in the Plan Area and is consequently considered a covered species in this HCP.

As a result of effective avoidance and minimization efforts by PTWF during siting and construction, as well as similarly effective avoidance and minimization efforts during future decommissioning, operation of the Project is the only activity covered by this HCP that is expected to result in take of Indiana bats. The primary method to minimize impacts to Indiana bats, beyond the careful siting that has already occurred, will be increasing turbine cut-in speed (i.e., the wind speed at which turbines begin rotating and producing power) at fully operational turbines.

2.5.2 Northern Long-eared Bat

The northern long-eared bat was proposed for listing under the ESA by the USFWS on 2 October, 2013. A final decision will be made within one year, though PTWF is assuming that the species will be listed for the purposes of this HCP. The northern long-eared bat's range covers much of the eastern and north central United States, from Maine to North Carolina westward to eastern Oklahoma, Wyoming and Montana, as well as all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. They have historically been found in greater abundance in the northeast and portions of the Midwest and Southeast (USFWS 2014a). Though widespread, their distribution may be patchy or irregular (Amelon and Burhans 2006). In Illinois, northern long-eared bats hibernate from 1 November through 31 March, with a breeding season that lasts from 1 April through 30 September (USFWS 2014a).

Northern long-eared bats hibernate in limestone caves and mines. During the spring and summer, females live in maternity colonies in hollow trees and under loose bark. They forage along forested hillsides, rivers and streams, feeding on true bugs, leafhoppers, wasps and flies.

Of the nine confirmed *Myotis* calls from acoustic surveys conducted at the site, one was identified as a northern long-eared bat (see Section 3.10). Thus, these results do not suggest high levels of northern long-eared bat migratory activity within the Pioneer Trail Plan Area. Nevertheless, little is known about the migration patterns of bats, specifically how they disperse across the landscape during migration. Therefore, it is not possible to accurately predict an individual bat's route during migration. However, the Plan Area is located within their summer and winter range. Therefore, the northern long-eared bat does have the potential to, at times, occur in the Plan Area, and is consequently a covered species in this HCP.

As a result of effective avoidance and minimization efforts by PTWF during siting and construction, as well as similarly effective avoidance and minimization efforts during future decommissioning, operation of the Project is the only activity covered by this HCP that is expected to result in take of northern long-eared bats. The primary method to minimize impacts to northern long-eared bats, beyond the careful siting that has already occurred, will be increasing turbine cut-in speed (i.e., the wind speed at which turbines begin rotating and producing power) at fully operational turbines.

2.5.3 Species Considered But Excluded from the Habitat Conservation Plan

The following species were considered for inclusion in this HCP, but ultimately excluded from the HCP based upon consultation with the Service and information regarding planned Project activities.

2.5.3.1 Eastern Prairie Fringed Orchid

The Eastern prairie fringed orchid (*Platanthera leucophaea*) was listed as threatened by the Service on September 28, 1989 (54 FR 39857-39863). A USFWS Eastern Prairie Fringed Orchid Recovery Plan was developed and signed on September 29, 1999 (USFWS 1999a). The Eastern prairie fringed orchid is also currently listed as endangered by the state of Illinois. State-listed species are protected under the Illinois Endangered Species Protection Act and regulatory authority under state law lies with IDNR.

Extant populations are known from Ford and Iroquois counties. No extensive surveys for this species were conducted as part of this Project. Eastern prairie fringed orchids are typically found in moist to wet tallgrass prairie, sedge meadows, fens and old fields. Land use throughout much of the Plan Area is dominated by agriculture (i.e., row crops and pasture) with only a small portion consisting of natural waterways and forested areas. Remnant railroad prairie within the Plan Area was avoided during siting of turbines and other ancillary features (e.g., electrical interconnections, access roads) associated with Pioneer Trail. In addition, wetlands within the Plan Area were avoided during siting of turbines and access roads and temporary wetland impact resulting from underground electrical interconnections was minimized to the greatest extent possible. Where underground electrical interconnections were required to traverse wetland area, directional drilling techniques were utilized to avoid surface impact to potential ecological communities. Due to characteristics of the Project, location, and on-site habitat, this species is not expected within the Plan Area, and no impacts to this species are expected. This precludes the need for further action on this Project with regard to this species as required by the ESA, as amended.

2.5.3.2 Mead's Milkweed

Mead's milkweed (*Asclepias meadii*) was listed as threatened by the Service on September 1, 1988 (53 FR 33992-33996). A USFWS Mead's Milkweed Recovery Plan was developed and signed on September 16, 2003 (USFWS 2003). Mead's milkweed is also currently listed as threatened by the state of Illinois. State-listed species are protected under the Illinois Endangered Species Protection Act and regulatory authority under state law lies with the IDNR.

Mead's milkweed has not been documented in Iroquois County and the historic population recorded for Ford County has been extirpated. No extensive surveys for this species were conducted as part of this Project. Mead's Milkweed is found in tallgrass prairie habitat. Land use throughout much of the Plan Area is dominated by agriculture (i.e., rowcrops and pasture). Remnant railroad prairie within the Plan Area was avoided during siting of turbines and other ancillary features (e.g., electrical interconnections, access roads) associated with Pioneer Trail. Due to characteristics of the Project, location and onsite habitat, this species is not expected within the Plan Area, and no impacts to this species are expected. This precludes the need for further action on this Project with regard to this species as required by the ESA, as amended.

2.5.3.3 Little Brown Bat

Little brown bats (*Myotis lucifugus*) are medium-sized, glossy yellowish to dark brown bats with a forearm length of 1.3 to 1.6 inches (3.4 to 4.1 cm) and a total length of 3.0 to 3.7 inches (7.6 to 9.5 cm). The tragus (a fleshy projection arising from the base of the inner ear that directs sound into the ear) is short and blunt and measures about one-half the height of the ear and is not obviously curved. The tail is approximately as long as the outstretched leg. Little brown bats may be distinguished from the similar Indiana bat by the lack of a keeled calcar or only a slightly keeled calcar, and long toe hairs on the hind feet that extend beyond the claws.

Little brown bats hibernate in limestone caves and mines. During the spring and summer, females live in maternity colonies in man-made structures (e.g., buildings, bridges, culverts, etc.), in hollow trees, under loose bark, and in small cliff crevices. They forage over water, along forest edges or in clearings, feeding on moths, leafhoppers, beetles, wasps, mosquitoes and midges.

The little brown bat is not currently listed as endangered or threatened, although the Service is collecting information for a status review of the species to determine if threats to the species may warrant listing. Although not conclusive, results of preconstruction acoustic monitoring at the Plan Area suggested the potential presence of little brown bats. However, given the lack of adequate scientific understanding of the species and its current unlisted status, PTWF decided not to include it within this HCP for purposes of obtaining incidental take authorization. The little brown bat is likely to be a covered species under the Midwest Wind Energy Multi-Species Habitat Conservation Plan (MSHCP) that is currently under development within USFWS Region 3 (Fed. Reg. Vol. 77, No. 169, p. 52754, August 30, 2012). In the event that take coverage for this species becomes necessary during the term of the MSHCP, PTWF may seek to obtain the necessary coverage by opting in to the MSHCP if and to the extent allowed thereunder.

3. Environmental Setting and Biological Resources

The Plan Area is located in east-central Illinois. The Plan Area is within the Till Plains section of the Central Lowland physiographic province (Illinois State Geological Survey 2011). This region is characterized by flat to gently rolling topography produced by glacial processes. Iroquois and Ford counties include many small towns with residential, commercial and industrial activity, connected by a comprehensive network of local and state roads, an interstate highway, active railways, and major and minor transmission lines. The counties are largely comprised of agricultural lands interspersed with creeks, drainages, and small clusters of residential and agricultural development. Forested areas are limited to fragmented, linear tracts and small forested bands associated with larger streams in these counties.

3.1 Land Use

Land use within the Plan Area and surrounding counties is dominated by agriculture. Pasture and row crops, mostly of corn and soybeans, comprise the majority of land in Iroquois and Ford counties. Other land uses include: residential; urban; manufacturing; commercial; transport; recreational; and utilities. Larger urban areas include: Gilman and Watseka in Iroquois County and Gibson City and Paxton in Ford County. Major transportation routes include: US Highway 57; US 45; State Route 54; and US 24.

3.2 Topography

Ford and Iroquois counties are located in parts of both the Kankakee Plain and Bloomington Ridge Plain regions of Illinois. The plains formed when the bedrock and topographic features of the region were covered by glacial till deposits during the Wisconsin glaciations 70,000 years ago (Illinois State Geological Survey 2011). The plains are crossed by several low, poorly developed, end moraines which provide the only topographic relief (Luman et al. 2011). Elevation within Ford and Iroquois counties ranges from 620 to 820 ft (190 to 250 m) above mean sea level (msl); there is even less topographic relief in the immediate area of the Project.

3.3 Geology

The geology of the northern half of Illinois is the product of the Wisconsin glaciations. Surficial geology is dominated by glacial deposits of sedimentary rocks which range in thickness from 25 to 50 ft (8 to 15 m) in northern Iroquois County, to 400 to 500 ft (122 to 152 m) in southeastern Ford County (Illinois State Geological Survey 2011). Bedrock within Ford and Iroquois counties is diverse and includes formations of the Silurian, Devonian, Mississippian, and Pennsylvanian periods (Kolata 2005). Most Silurian rocks formed approximately 440 to 410 million years ago and consist of limestones and dolostones with varying amounts of fossils and argillaceous material (Mikulic et al. 2011). Devonian bedrock is approximately 410 to 360 million years old and consists of carbonates and shale formations. The limestone rocks of the Mississippian period formed approximately 360 to 295 million years ago (Devera et al. 2011). Pennsylvanian rocks consist of limestone, clay, and shale and contain the bituminous coal resources of Illinois; these rocks formed approximately 320 to 286 million years ago (Nelson and Jacobsen 2011).

3.4 Soils

Iroquois County is comprised primarily of Milford silty clay loam (16%), Selma loam (8%), Ashkum silty clay loam (13%) and small acreages of many other soil types. Most of the soils in Iroquois County are hydric. Ford County is comprised primarily of Elliott silt loam (9%), Drummer silty clay loam (10%), Ashkum silty clay loam (15%), Bryce silty clay (15%) and small acreages of many other soil types. Elliott silt loam and a few of the smaller acreage soil types in Ford County are not hydric soils. The Milford, Ashkum, Selma, Drummer, and Bryce series are prime farmland if drained. The Elliott series is prime farmland. Most of the smaller acreage soils in Iroquois and Ford counties are prime farmland, farmland of statewide importance, or prime farmland if drained (United States Department of Agriculture [USDA]-Natural Resource Conservation Service [NRCS] 2011a).

The Milford series consists of very deep, poorly drained and very poorly drained soils formed in lacustrine sediments. The Selma series consists of very deep, poorly drained soils formed in loamy outwash. The Ashkum series consists of very deep, poorly drained soils on till plains. They formed in colluvial sediments and in the underlying silty clay loam till. The Elliott series consists of very deep, somewhat poorly drained soils on till plains which formed in loess or other silty material and in the underlying silty clay loam till. The Drummer series consists of very deep, poorly drained soils formed in loess or other silty material and in the underlying loamy stratified outwash on nearly level or depressional parts of outwash plains, stream terraces, and till plains. The Bryce series consists of very deep, poorly drained soils formed in clayey water-sorted sediments and in the underlying clayey till on till plains or glacial lake plains (USDA-NRCS 2011).

3.5 Hydrology

The Plan Area encompasses area within the watersheds of several rivers in Illinois. Most of the area in Iroquois County is in the Iroquois watershed. Small areas in the north and eastern parts of the county are within the Kankakee and Vermilion (Illinois Basin) watersheds, respectively, and the southeastern and southwestern corners are within the Vermilion (Wabash Basin) watershed. Land in Ford County feeds into the Iroquois, Vermilion (Wabash Basin), Sangamon, Mackinaw, Vermilion (Illinois Basin), Illinois River Valley, and Kankakee watersheds (McConkey et al. 2011).

Small, intermittent streams and drainages are common within the Plan Area. A few perennial streams also occur within the Plan Area, including Spring Creek, Pigeon Creek, and Sugar Creek. Larger waterways that are located outside of the Plan Area include the Iroquois River and the Middle Fork of the Vermillion River.

National Wetlands Inventory (NWI) data indicate that small wetlands are scattered throughout the Plan Area, occurring in higher densities along the larger waterways. There are approximately 10,421 acres (4,217 ha) of NWI wetlands in Iroquois County, comprising 1.5% of the county. Ford County has approximately 1,369 acres (554 ha) of NWI wetlands, comprising 0.4% of the county.

3.6 Land Cover

Land cover in the Plan Area was historically dominated by prairie ecosystems, with narrow, linear tracts of forest encroaching in southern Ford County and northeastern Iroquois County (Barnhardt 2011). Based on the National Land Cover Database (NLCD), land cover within Iroquois and Ford counties is currently dominated by agriculture (88% and 91%, respectively), mostly row crops of corn and soybeans (Table 1). Cultivated crops comprise 95% of the land use within the Project boundary. Developed open space (approximately 3%) and low intensity development (approximately 2%) cover nearly all of the remaining land within the parcels. Forested areas are limited to fragmented, linear tracts and small forested bands associated with larger streams. Figure 2 shows the distribution of land cover within the Project boundary.

Table 1. National Land Cover Database Land Cover Types and Extents within the Pioneer Trail Wind Farm Project Boundary (Iroquois and Ford Counties, Illinois)

Land Cover Type	Acres (ha)	Approximate Percent Composition
Open Water	1 (0.4)	<0.1%
Developed, Open Space	371 (150)	3.0%
Developed, Low Intensity	269 (109)	2.1%
Developed, Medium Intensity	2 (0.8)	<0.1%
Developed, High Intensity	1 (0.4)	<0.1%
Deciduous Forest	5 (2)	<0.1%
Pasture Hay	18 (7)	0.1%
Cultivated Crops	11,820 (4,783)	95%

3.7 Wildlife in the Plan Area

Wildlife in the Plan Area and surrounding counties is likely comprised primarily of species adapted to a landscape of fragmented habitats and human disturbance. Disturbance-tolerant species such as white-tailed deer (*Odocoileus virginianus*), raccoons (*Procyon lotor*), squirrels (*Sciurus spp.*), coyotes (*Canis latrans*), wild turkey (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), hawks, owls, and various songbirds, are common and widespread and are expected to represent the majority of wildlife within the Plan Area. Many species of fish, amphibians, reptiles, and waterfowl may occur in the creeks and drainages of the Plan Area.

3.8 Threatened and Endangered Species

Ford and Iroquois counties are within the range of one federally listed wildlife species, the Indiana bat, and one species proposed for listing, the northern-long eared bat (USFWS 2014b). Because these two species are the only federally listed/proposed wildlife species likely to be incidentally taken by the proposed action, they are the only species to be covered by the ITP issued in association with this HCP. The biology, habitat requirements, and status within the Plan Area of these two species are discussed in detail in Section 5. Expected impacts from the Plan's proposed action and the conservation plan for Indiana and northern long-eared bats are described in Sections 6 and 7, respectively.

3.9 Other Sensitive Species

3.9.1 Non-Listed Bats

A total of 12 species of bat occur in Illinois. Nine species, all members of the family Vespertilionidae, have geographic distributions that include Ford and Iroquois counties: Indiana bat, evening bat (*Nycticeius humeralis*), little brown bat, northern long-eared bat, silver-haired bat (*Lasionycteris noctivagans*), red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), tri-colored bat (*Perimyotis subflavus*), and big brown bat (*Eptesicus fuscus*) (Schwartz and Schwartz 1986; Harvey et al. 1999; Bat Conservation International, Inc. [BatCon] 2014). Of these, only the Indiana bat is currently listed as threatened or endangered (Illinois-state and federally endangered). The northern long-eared bat has been proposed for listing as endangered by USFWS after publication of the 12-month finding (USFWS 2013a). This species is not currently listed by the State of Illinois, however per the Illinois Endangered Species Protection Act (Section 2.3.5), if the species becomes federally listed it will automatically also be listed by the State. The Service is also collecting information for a status review of the little brown bat to determine if threats to the species may be increasing its risk of extinction.

All nine bat species use woodland habitat for feeding or roosting at some time during the year. In addition, many species of bats feed along stream corridors or over water. A limited number of narrow, linear tracts of woodland associated with stream corridors are found within the Plan Area (Figure 2). These areas may, at times, provide potentially suitable foraging and roosting habitat for bats. Bats, particularly big brown bats and evening bats, may occasionally forage over crops within the Plan Area but most species in the region are more likely to use forested and open water habitats (BatCon 2014).

Acoustic surveys confirmed the presence of five species at the Plan Area: big brown bat, silver-haired bat, eastern red bat, hoary bat, and tri-colored bat (Appendix A). In addition, several *Myotis sp.* calls were recorded during the acoustic surveys but, due to the overlap in call characteristics between *Myotis* species and the quality of the calls, positive identification to species was always not possible. Three of these *Myotis* calls were identified to the species level through automated identification programs, including one northern long-eared bat call and two little brown bat calls. The results of these surveys are discussed in detail in Section 3.10.

Although the Indiana bat and northern long-eared bat are the only species covered under this HCP, it is expected that the avoidance and minimization measures implemented under this HCP will reduce direct mortality of other bat species occurring in the Plan Area as well. Note that the Regional MSHCP, currently under development, anticipates inclusion of several additional species potentially including the little brown bat. PTWF is not seeking take coverage for this species in this HCP because it is not currently listed and insufficient scientific information is available on which to base an HCP. Should it be warranted and available, however, PTWF may contemplate opting in for coverage for this species under the Regional MSHCP in the future.

3.9.2 Bald and Golden Eagles

Bald eagles and golden eagles are protected under the federal BGEPA (16 USC §§668-668d). The Plan Area is within the historic breeding, wintering, and migration range of the bald eagle. Bald eagles have been noted by the Service (USFWS 2008) to occur in many Illinois counties. The bald eagle population in Illinois continues to increase, with 100 pairs recorded in 2006 (USFWS 2008). By 2008, the number of counties where nesting occurs had risen to 67 counties (IDNR 2009). The population trend for wintering bald eagles in Illinois fluctuates due mainly to weather conditions, but recent counts have indicated a healthy age structure of both adults and immatures (IDNR 2009). Bald eagles winter primarily along the Mississippi, Rock, and Illinois Rivers in the state; none of these rivers are within or adjacent to the Plan Area. The Illinois River is closest to the Plan Area, but is more than 20 miles (32 km) away at its nearest point. The bald eagle was officially delisted from by the State of Illinois in 2009 (IDNR 2009).

Based on the species' limited geographic distribution within the state and the lack of highly suitable wintering or breeding habitat in the Plan Area, bald eagles are expected to occur only rarely within the Plan Area. No known occurrences were listed by the Service for Iroquois County at the time that Project development began and initial consultations with the Service were conducted (USFWS 2008). Bald eagles were not observed during the resident/breeding bird or migratory bird surveys conducted within the Plan Area (ARCADIS 2010). Additional inquiries to the Service (USFWS 2012a) indicated that no bald eagle nest locations were known to occur within 10 miles (16 km) of the Plan Area. More recent discussions with the Service indicate that two bald eagle nests are now known to exist in the county forest preserve located approximately 2.75 miles (4.4 km) to the south of Pioneer Trail. Although no observations of bald eagles flying over the Project site have been made in the course of other field activities at the site, PTWF will conduct one year of monitoring to field-verify the lack of eagle activity at the site.

Golden eagles have never been common in the eastern U.S. and are not currently known to occur in Illinois except as occasional transient visitors. Golden eagles will occupy a wide variety of plant communities within open habitats, but prefer cliffs and large trees with large horizontal branches for roosting, perching, and nesting (Tesky 1994). Nesting habitat for golden eagles is very limited within the Plan Area and the species was not observed during the resident/breeding bird or migratory bird surveys conducted within the Plan Area (ARCADIS 2010). Inquiries to the Service and IDNR in 2012 and 2011, respectively, indicated that no golden eagle nest locations are known to occur within 10 miles (16 km) of the Plan Area. Golden eagles are, therefore, not expected to occur within the Plan Area.

3.10 Pre-Construction Bat Surveys

PTWF conducted acoustic surveys in the Plan Area from 15 April through 4 November, 2010 to detect the presence of various species of bats. This section presents a summary of the survey results; the full survey report is included as Appendix A to this HCP. Acoustic surveys incorporated both stationary (i.e., passive) and mobile (i.e., active) echolocation detectors, which have been proven to be acceptable methodologies for bat/wind farm screening (e.g., Kunz et al. 2007a, Redell et al. 2006). Surveys were divided among time periods, or seasons, generally recognized as appropriate for pre-construction screening-level surveys at wind farms (Table 2).

Table 2. Timing and Frequency of Bat Surveys Conducted at the
Pioneer Trail Wind Farm (Iroquois and Ford Counties, Illinois)

Screening Survey Period	2010																											
	April				May				June				July				August				September				October			
Spring Migration		x	x	x	x	x																						
Summer											x	x																
Fall Migration															x			x	x	x		x	x	x			x	

Seasonal stationary detector survey periods (yellow shading: Spring Migration April week 1 – May week 2; Summer May week 3 – July week 2; Fall Migration July week 3 – October week 4)

x Mobile field survey visits

3.10.1 Stationary Survey

Stationary detectors were used to determine species presence and relative activity levels at varying heights. One Remote Bat Acoustic Technology System (ReBAT™; Pandion Systems, Inc., Gainesville, Florida) array was deployed on one 197 ft (60-m) tall meteorological (met) tower located within the Plan Area. Two receivers were deployed on the met tower at different heights in a vertical transect to capture information about bat species flying at variable altitudes. Based on accepted methodology, receivers were placed at 16.5 ft (5 m) and 190 ft (58 m; within the rotor swept zone).

The ReBAT™ unit was operational between 17 April and 4 November, for a total of 402 detector nights (one detector for one night = one detector night; therefore, there are two detector nights for each night that both detectors are operational). Bats were recorded on 145 of 201 (72.1%) survey nights at the detector. A total of 1,026 classifiable bat passes (mean = 2.6 passes/detector night) were recorded by the stationary detectors during the activity season (Table 3). It is estimated that 243 unclassifiable passes were removed during the filtering process. Therefore, the adjusted total bat passes for the 2010 activity season at Pioneer Trail is 1,269 (mean = 3.2 passes/detector night) (Table 3).

Table 3. Summary of Bat Passes (mean per night) by Detector Height, Season and Frequency Group for Stationary Pre-Construction Surveys at the Pioneer Trail Wind Farm (Iroquois and Ford Counties, Illinois, 2010).

	5 Meter	**58 Meter**	**Total**
Spring			
Low Freq. Bat Passes	18 (0.6)	41 (1.4)	59 (1.0)
High Freq. Bat Passes	10 (0.3)	3 (0.1)	13 (0.2)
Total Passes (Spring)*	**29 (1.0)**	**45 (1.6)**	**74 (1.3)**
Summer			
Low Freq. Bat Passes	77 (1.3)	83 (1.4)	160 (1.3)
High Freq. Bat Passes	15 (0.2)	10 (0.2)	25 (0.2)
Total Passes (Summer)*	**97 (1.6)**	**96 (1.6)**	**193 (1.6)**
Fall			
Low Freq. Bat Passes	244 (2.2)	376 (3.4)	620 (2.8)
High Freq. Bat Passes	44 (0.4)	56 (0.5)	100 (0.5)
Total Passes (Fall)*	**309 (2.8)**	**450 (4.1)**	**759 (3.4)**
Total Low Frequency Passes for Activity Season	**339 (1.7)**	**500 (2.5)**	**839 (2.1)**
Total High Frequency Passes for Activity Season	**69 (0.3)**	**69 (0.3)**	**138 (0.3)**
Total Classifiable Passes for Activity Season*	**435 (2.2)**	**591 (2.9)**	**1026 (2.6)**
Est. Total Unclassifiable Passes for Activity Season	**243**		
Adjusted Total Passes for Activity Season	**1269 (3.2)**		

*Some recorded bat sound files contained both low and high frequency species or were too poor quality to characterize the call by frequency group. Therefore, the sum of bat passes for these groups may not equal the "Total Passes" recorded.

3.10.2 Mobile Survey

Mobile surveys using hand-held Anabat detectors (Titley Electronics, Australia) were performed to supplement the stationary surveys. Six mobile transects were selected along roads within the Plan Area. Survey routes were selected in a variety of habitat types to adequately represent the Plan Area (e.g., agricultural fields, woodlots, wetlands or stream corridors). Transects were driven at a slow rate of speed (<5 miles per hour [mph]) by surveyors while holding the mobile bat echolocation detector outside of the vehicle. A total of 15 mobile surveys were conducted (spring – 5, summer – 2, fall – 8), with emphasis placed on the critical fall migration period.

During the 90 mobile surveys (15 surveys of 6 transects), 58 definitive bat passes (mean = 0.6 passes/transect/night) were recorded (Table 4). Among the transects, Transect 4, located in the southwest corner of the Plan Area, recorded the highest number of total bat passes at 28 (mean = 1.9/night) (Table 4). Transects 1 and 3, located in the northwestern portion of the Plan Area, recorded the lowest total number of bat passes at only 2 each (mean = 0.1/night) (Table 4).

Table 4. Bat Passes (mean per transect per survey night) for Mobile Pre-Construction Surveys at Pioneer Trail (Iroquois and Ford Counties, Illinois, 2010).

	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6
Low Frequency Bat Passes	0 (0.0)	3 (0.2)	2 (0.1)	14 (0.9)	4 (0.3)	4 (0.3)
High Frequency Bat Passes	2 (0.1)	2 (0.1)	0 (0.0)	9 (0.6)	10 (0.7)	3 (0.2)
Total Passes	2 (0.1)	5 (0.1)	2 (0.1)	28 (1.9)	14 (0.9)	7 (0.5)
Total Passes for Activity Season*	**58 (0.6)**					

*Some recorded bat sound files contained both low and high frequency species. Therefore, the sum of bat passes for these groups may not equal the "Total Passes" recorded.

3.10.3 Bat Species and Frequency Groups Detected During Surveys

Using classifiable calls and files that contained high quality bat passes, a species list was developed for the Plan Area. Approximately 73.5% of the 1,026 classifiable calls recorded during the stationary survey and 72.4%of the 58 calls recorded during the mobile surveys were identifiable to species or species group (e.g., big brown bat/silver-haired bat, *Myotis* sp.). Seven bat species were confirmed by an experienced bat biologist to be present at the site:

- Big brown bat
- Silver-haired bat
- Eastern red bat
- Hoary bat
- Tri-colored bat
- Little brown bat
- Northern long-eared bat

None of the species confirmed in the Plan Area are listed as state or federally threatened or endangered. Six confirmed *Myotis* calls were recorded by the 16.5 ft (5 m) receiver during the stationary survey. A single call was recorded on 3 July, 27 July, 11 August and 14 August, and two calls were recorded on 11 October. All six calls exhibited characteristics typical of *Myotis* calls; however, due to the overlap in call characteristics between *Myotis* species and the quality of the calls, positive manual identification to species was not possible. These six call files were also run through a USFWS candidate automated acoustic identification software program (Kaleidoscope Pro), as recommended by USFWS in their 2013 Indiana Bat Summer Survey Guidance. Due to overlap in call characteristics between *Myotis* species and the quality of the recorded calls, four of these calls were still not identifiable to the species level. Of the remaining three calls, two were identified as little brown bats and one as a northern long-eared bat (27 July 2010). However, the northern long-eared bat identification could not be confirmed by a bat expert, and only 2 of the 10 pulses in the call fit the criteria in Kaleidoscope for the species. Based on the detection zone of the receivers, bats recorded by the 16.5 ft (5 m) detector were not within the rotor swept zone (>127 ft [38.75 m]). There were no confirmed Indiana bat calls, and only one possible northern long-eared bat call (0.1% of all identifiable calls).

Three confirmed *Myotis* calls were recorded during mobile surveys: one along Transect 5 on 20 August and two along Transect 4 on 25 August. *Myotis* calls represented 7% of the identifiable calls recorded during the mobile survey, but only 0.8% of the identifiable calls recorded during the stationary survey. None of these could be identified to the species level.

3.10.4 Seasonal Distribution of Bat Activity

During the 2010 activity season, bat activity within the Plan Area was highest from mid-July through early October, peaking in early August and again in early October. Bat passes at the two stationary detector heights was similar throughout much of the activity season; during the fall season, more activity was recorded at the upper detector (Table 3).

The total number of bat passes at the stationary detectors during the spring season (74) was the lowest among the three seasons (74; mean = 1.3 passes/detector night) (Table 3). Low frequency species were recorded more than four times as often as high frequency species at the stationary detectors during the spring season.

The total number of bat passes at the stationary detector during the summer season (193) increased over what was observed during the spring season (74); and the average number of passes/detector night increased from 1.3 to 1.6 (Appendix A). Low frequency species were recorded at the stationary detector more than six times as often as high frequency species. Bat activity recorded during summer mobile surveys was significantly lower than spring (5 total passes vs. 20 total passes), with twice as many high frequency bats recorded as low frequency bats.

The total number of bat passes at the stationary detector was highest during the fall season (759). The average number of passes/detector night in the fall (3.4) was over two times the average number of passes/detector night recorded in the spring or summer (1.3 and 1.6 respectively) (Table 3). Low frequency species were recorded at the stationary detector more than six times as often as high frequency species. Total bat passes recorded during fall mobile surveys (25) were nearly equal to what was recorded in the spring (27) and four times that recorded in the summer (6).

4. Description of the Proposed Action

4.1 Project Purpose and Need

The purposes and need for the Project are:

- To provide an affordable and reliable source of renewable energy to serve the regional electrical grid and energy demand that neither emits pollutants, contributes to climate change and its effects, nor generates the adverse impacts that accompany fossil fuel extraction, processing, waste and by-product disposal, transportation, and combustion.
- To meet the renewable energy goals of the U.S. and Illinois (Illinois enacted legislation, Public Act 95-0481, established that electric utilities in Illinois are required to provide at least 25% of their retail electric supply from renewable energy sources, including wind, by 2025).
- To support and diversify the local and regional economies through job creation and increased tax revenue.

Evaluation leading to the selection of the Plan Area and Project began in 2008 with an initial feasibility assessment. Feasibility evaluation, with regard to wind resources and other environmental and community issues, continued through construction to work towards meeting the purpose of Pioneer Trail.

The need for the ITP reflects the uncertainty associated with Indiana and northern long-eared bat migratory activity. Although significant consideration and field study has been completed to confirm that the Plan Area is an area with relatively low levels of bat activity, because the location of the Plan Area is within the range of both the Indiana and northern long-eared bat, the possibility of their presence – principally as a result of seasonal migration through the Plan Area – cannot be completely ruled out. This HCP, therefore, serves the purpose of documenting the steps taken by PTWF to avoid and minimize the impact of the Project on Indiana and northern long-eared bats and to provide mitigation for the Project's projected impacts.

4.2 Project Description

Pioneer Trail is a state-of-the-art wind energy facility located in Iroquois and Ford counties, Illinois, just east of the towns of Paxton and Loda (Figure 1). The Project is designed to generate approximately 150 MW with 94 1.6-MW WTGs and associated operations and maintenance building, access roads, collector line system, and substation. Approximately 3.0 miles (4.8 km) of overhead transmission line extends from the existing Paxton West substation to a newly constructed substation on the Project site.

4.2.1 Site Selection

The Pioneer Trail site was first identified through a review of available wind resource mapping. As a renewable resource, wind is classified according to wind power classes, which are based on typical wind speeds. These classes range from Class 1 (the lowest) to Class 7 (the highest). Strong wind resources were indicated in the Iroquois and Ford County area.

In addition to a strong, reliable wind resource, a wind project requires interconnection to the overall electrical grid via an existing transmission line with sufficient capacity to accommodate the full output of the wind turbines. E.ON identified an existing 138 kilovolt (kV) high voltage transmission line in the Project area early on, and this, combined with the robust wind resource, led E.ON to continue its development efforts in Iroquois and Ford counties. E.ON initiated landowner contacts, and engaged ARCADIS to conduct a fatal flaw evaluation of the proposed Project lands.

No fatal flaws were identified during the fatal flaw analysis, including no known bat hibernacula or summer maternity colonies in the Plan Area. PTWF continued to develop agreements with participating landowners within the general Plan Area, filling in and slightly expanding the original boundaries considered. Buildable areas within the overall Plan Area were refined based on county-required setbacks, noise compliance distances, and avoidance of special habitat areas such as prairie remnants mapped by the Illinois Natural Area Inventory. During the USFWS meeting on January 14, 2011, the Service identified summer maternity habitat for Indiana bats located to the south of the Pioneer Trail project area, and provided guidance on evaluation and setback distances to avoid impacts to resident Indiana bats. Based upon that input, PTWF adjusted the WTG layout to include sufficient setback distances for avoiding impacts to known maternity habitat consistent with USFWS recommendations. Specifically, the proposed locations of two turbines were moved to ensure that all Project turbines are located more than 1,000 feet (305 m) from contiguous forested habitat that is within 2 miles (3.2 km) of the known maternity colony (Figure 4). This setback distance was suggested by the USFWS as the best practice for avoiding potential habitat impact.

Landowner contracts and agreements have been finalized and the Project has been constructed and began commercial operation in January 2012. The final Project boundary and layout (shown in Figure 1 and Figure 3) represent a concerted effort by PTWF to adjust the Project development area to reduce the potential for Project impacts to sensitive species, including the Indiana and northern long-eared bat.

At this site, significant agricultural land use occurs throughout the Plan Area, comprising 95% of the area within the Project boundary. Except for the immediate Project footprint, this use would be expected to continue. The character of the overall landscape, therefore, will be minimally changed.

Avoiding negative natural resource and community impacts is a priority for all E.ON projects. For this Project, avoidance of stream and wetland areas, as well as mature trees, has been a priority for the Project layout. Of the total approximately 12,500 acres (5,060 ha) of participating landowner property within the Project boundary, only about 3,200 acres (1,300 ha) were considered “developable” by PTWF and only a very small percentage of this buildable area is affected by Project infrastructure. Throughout development of the Project layout, the focus of turbine placement and permanent Project infrastructure was confined to the small areas of the overall Plan Area considered to have the least environmental and community impact.

4.2.2 Project Characteristics

The Plan Area is located just east of the towns of Paxton and Loda, Illinois. Land use throughout much of the Plan Area is dominated by agriculture (i.e., row crops and pasture), interspersed with creeks, drainages, and small clusters of development.

The Project is designed to generate approximately 150 MW with 1.6-MW WTGs and associated operations and maintenance building, access roads, collector line system, and substation. The Project is located on land leased from participating landowners, who will continue existing use of the land. As a leaseholder, PTWF’s rights are limited to those incorporated in the lease agreement to allow for safe and effective construction, operation, maintenance and decommissioning of the Project. PTWF has no control over landowner activities on the property within which the Project will be located to the extent not covered in specific lease provisions.

Additional detail of various Project components is provided in the following sections.

4.2.2.1 Turbines

There are 94 turbines associated with Pioneer Trail. Each wind turbine consists of three major components; the tower, the nacelle, and the rotor. The height of the tower, or "hub height" (height from foundation to top of tower) is approximately 362 ft (80 m). The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. The total turbine height (i.e., height at the highest blade tip position) is approximately 398 ft (121 m). Descriptions of each of the turbine components are provided below.

Tower: The tubular towers used for this Project are conical steel structures manufactured in multiple sections. The towers have a base diameter of 14 ft (4.3 m) and a top diameter of approximately 8.4 ft (2.6 m). Each tower has an access door, internal lighting, and an internal ladder to access the nacelle. The towers are painted light gray to make the structure visible to aircraft (viewing against the ground) but decrease visibility against the sky.

Nacelle: The main mechanical components of the wind turbine are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is housed in a steel reinforced fiberglass shell that protects internal machinery from the environment and dampens noise emissions. The housing is designed to allow for adequate ventilation to cool internal machinery. The nacelle is equipped with an external anemometer and a wind vane that signals wind speed and direction information to an electronic controller. The nacelle is mounted on a bearing that allows it to rotate (yaw) into the wind to maximize energy capture. Attached to the top of each nacelle located on the outside perimeter of the Plan Area and some additional locations within the Plan Area, per specifications of the Federal Aviation Administration (FAA), is a single, medium intensity aviation warning light. These lights are flashing red strobes (L-864) and operate only at night.

Rotor: A rotor assembly is mounted to the nacelle to operate upwind of the tower. Each rotor consists of three composite blades that are approximately 135 ft (41.25 m) in length (total rotor diameter of 271 ft [82.5 m]). The rotor attaches to the drive train at the front of the nacelle. Hydraulic motors within the rotor hub feather each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds. The rotor can spin at varying speeds to operate more efficiently at lower wind speeds. The wind turbines begin generating energy (i.e., cut-in) at wind speeds as low as 7.8 mph (3.54 meters per second [m/s]) and cut out when wind speeds reach 60 mph (25 m/s) for 10 minutes.

Steel reinforced concrete foundations were constructed to anchor each WTG. A pad mounted transformer was installed at the base of each WTG which collects electricity generated by each turbine through cables routed down the inside of the tower.

4.2.2.2 Access Roads

The Project includes new or improved roads to provide access to the turbines and substation site, including a ring-road around each turbine. The location of Project access roads is shown in Figure 3. The roads were constructed to a width of 40 ft (12 m) initially to allow for crane travel; however, all but approximately 16 ft (5 m) of each road has been returned to agricultural use following construction. The roads are gravel-surfaced.

4.2.2.3 Collection System and Substation

Pioneer Trail includes an underground power collection system (with cables ranging from approximately 2 to 5 inches [5 to 13 cm] in outside diameter) between the pad mounted transformers and a collector substation.

4.2.2.4 Transmission Line

Approximately 3.0 miles (4.8 km) of overhead transmission line extends from the existing Paxton West substation to a newly constructed substation on the Project site. A pad-mounted transformer was installed at the base of each WTG and collects electricity generated by each turbine through cables routed down the inside of the tower.

4.2.2.5 Meteorological Towers

One 262 ft (80 m) tall permanent met tower has been installed to collect wind data and support performance testing of the Project (shown on Figure 3). The tower is a self-supporting, lattice steel structure and is unguyed. The tower includes wind monitoring instruments.

4.2.2.6 Operations and Maintenance Building

An operations and maintenance building and associated storage yard has been constructed to house operations personnel, equipment, and materials and provide staff parking (shown on Figure 3). Dimensions of the building are 50 ft x 64 ft (15.2 m x 19.5 m).

4.3 Covered Activities

4.3.1 Operation and Maintenance

The potential for take exists during the operation and maintenance phase of the Project. Project maintenance activities during this phase may include turbine maintenance as needed, vegetation control if necessary, periodic re-grading, and reviewing the Project drainage plans. Due to the absence of Indiana and northern long-eared bat habitat within the Plan Area, and the fact that maintenance activities will be taking place during daylight hours, no significant potential for take is anticipated to exist as a result of Project maintenance activities. The potential for take arises from the operation of the turbines at times when Indiana and northern long-eared bats may be present in the Plan Area, as the potential exists for individuals to be injured or killed through interactions with rotating turbine blades. The potential impacts of Project operation are fully described and evaluated in Section 6.

To avoid risk to these species during operations prior to issuance of an ITP for the Project, PTWF developed and implemented an Avian and Bat Protection Plan (ABPP) calling for the curtailment of Project operations during periods of expected risk to Indiana bats. USFWS issued a Technical Assistance Letter (TAL) to PTWF on March 29, 2012 indicating that, if the Project operates in accordance with the terms of the ABPP, it is presumed that take of Indiana bats will be avoided. At the time, the northern long-eared bat had not yet been proposed for listing, though it is assumed that any conservation measure implemented to avoid the take of Indiana bats would also effectively avoid the take of northern long-eared bats as well. Pioneer Trail is currently operating under the terms of the TAL and the supporting ABPP while review of the HCP is completed and until an ITP is issued.

Upon issuance of an ITP, this HCP will authorize the operation of the Project with a more targeted, less restrictive set of avoidance and minimization measures more fully described in Section 7.2, but including:

- Operational adjustments that will increase the wind speed at which the turbines cut in above design capacity, thereby reducing Indiana and northern long-eared bat mortality; and

- Monitoring the operational Project to allow for appropriate adaptive management.

4.3.2 Decommissioning

Commercial WTGs typically have a life expectancy of 20 to 25 years, although their operational life may be extended through maintenance or repair. At the end of their useful life, or if turbines are non-operational for an extended period of time with no expectation of their returning to operation, the turbines will be decommissioned. Decommissioning will be performed under a decommissioning plan that will address removal of Project components/improvements as well as site/land reclamation. Complete decommissioning of the facility or individual wind turbines will be completed within 12 months after the end of the useful life of the facility or of individual wind turbines, in accordance with local ordinances. Areas disturbed during decommissioning will be re-graded, reseeded, and restored. Because decommissioning activities do not involve the operation of wind turbines, PTWF anticipates that these activities will not pose a risk of take to Indiana or northern long-eared bats.

4.3.3 Mitigation and Monitoring

This HCP includes mitigation actions (see Section 7.2.3) that will be conducted to offset the impacts of Indiana and northern long-eared bat take that may result from the Project. A range of mitigation actions were considered, including enhancement or protection activities at hibernacula, maternity colony and swarming habitat enhancement or protection, or funding contribution to other important research on threats to these species. The mitigation options selected are described in Section 7.2.3. It is possible that take of Indiana and/or northern long-eared bats, in the form of harassment or other temporary harm, may occur during the implementation of mitigation activities.

Post-construction mortality will occur during the life of the ITP to ensure compliance with the ITP (see Section 7.3). During mortality monitoring injured or dead Indiana and/or northern long-eared bats may be collected. Dead Indiana or northern long-eared bats, if any, will be retained by PTWF or their contractors or turned over to the Service.

4.4 Alternatives to Take

Section 10(a)(2)(A) of the ESA and federal regulation 50 CFR 17.22(b)(1), 17.32(b)(1), and 222.22 require an HCP to provide a description of alternative actions that were considered to reduce impacts to listed species, in this case, the Indiana and northern long-eared bats. The Habitat Conservation Planning Handbook (USFWS and NOAA 1996) states that at least two types of alternatives are commonly included in HCPs:

- A No-Action Alternative, which means that federal action (i.e., issuance of an ITP by the Service), would not occur because Covered Activities would not occur, and no HCP would be needed to minimize and mitigate impacts to the listed species, and

- Any alternative that would reduce incidental take below levels anticipated as a result of Covered Activities.

Each of these alternatives is discussed below.

4.4.1 Take Avoidance Alternative

Under this alternative, take of Indiana and northern long-eared bats would be completely avoided by:

- Raising cut-in speeds to 15.4 mph (6.9 m/s) for the period from August 15 to October 15 each year for the life of the project, from sunset to sunrise, when the ambient temperature is above 50°F (10°C) based on a 10-minute rolling average. The hub would not be locked, but blades would be feathered to the wind such that revolutions per minute (rpm) would be minimal during periods when wind speed is less than 15.4 mph (6.9 m/s).
- Conducting post-construction monitoring for the life of the Project, as described in Section 7.3, to confirm avoidance of take.

Because take would be completely avoided, no HCP would be prepared, no mitigation would be implemented, and no ITP would be issued. This alternative was considered but rejected because it did not meet the project's purpose and need (see Section 4.1), and because it was determined to be not practicable or economically sustainable over the projected operating life of the Project.

4.4.2 5.0 m/s Cut-In Speed Alternative (Proposed Scenario)

The 5.0 m/s Cut-In Speed Alternative is the result of consideration of the range of alternatives to select a Project scenario that meets Project goals while minimizing potential threats to the Indiana and northern long-eared bat to the greatest extent possible.

Under the 5.0 m/s Cut-In Speed Alternative:

- Cut-In Speed would be raised to 11.2 mph (5.0 m/s) for the period from August 15 to October 15 each year, from sunset to sunrise, when the ambient temperature is above 50°F (10°C) based on a 10-minute rolling average. This operational protocol was developed based on the best available scientific information (see Section 7.2.2). The hub will not be locked, but blades will be feathered to the wind such that rpm will be minimal during periods when wind speed is less than 11.2 mph (5.0 m/s). The feathering/cut-in process will be computer-controlled on a real-time basis. Accordingly, turbines will cut-in or feather throughout the night as the wind speed fluctuates above and below 11.2 mph (5.0 m/s).
- Post-construction monitoring would be conducted for the life of the Project (see Section 7.3). Baseline monitoring will be conducted at 100% of the turbine sites in both the spring (April 1 through May 15) and fall (August 15 through October 15) seasons during the first two years of operation following issuance of the ITP. Once the baseline monitoring concludes, follow-up monitoring will be conducted at 30% of the Project turbines once every five years for the life of the Project. During all monitoring periods, 80% of turbine sites being monitored will be searched using a road-and-pad method and 20% will be searched using cleared plots (as detailed in Section 7.3.4.1.2). If, as expected, no estimated Indiana or northern long-eared bat take is detected in the spring (i.e., the lower 90% confidence intervals of spring Indiana and northern long-eared bat take estimates are not greater than 0.5 bats/spring season)

during baseline monitoring, spring monitoring will be discontinued, and follow-up monitoring will be conducted during the fall every five years. If estimated Indiana or northern long-eared bat take is detected in the spring during baseline monitoring, then follow-up monitoring will be conducted in the spring season in addition to the fall.

- Based upon the results of the monitoring, adjustments may be made to increase or decrease cut-in speeds. Following any adaptive management change, an additional two-year fall monitoring period will be implemented during which 30% of the Project turbines will be searched in the manner described above.
- Although risk to both Indiana and northern long-eared bats is considered extremely low, mitigation measures have been incorporated into the Project to provide a long-term benefit to both species that would mitigate for the impacts of the permitted levels of take. As more specifically described in Section 7.2.3, initial mitigation would include hibernaculum protection/enhancement measures at Griffiths Cave located in Hardin County, Illinois and coordinating with local land preservation entities in the vicinity of PTWF to restore and/or preserve and enhance 206 acres of Indiana and northern long-eared bat summer maternity habitat. The mitigation plan will be implemented in close cooperation with USFWS and IDNR.

4.5 Public Participation

PTWF has been active in the local community since 2008, meeting with prospective landowners and local officials. In addition to this long-term informal contact, each county requires a public hearing associated with its zoning review process for wind energy projects. Hearings in both Ford and Iroquois counties occurred prior to local approval of the Project. An overview of the Project was presented, including discussion of environmental studies associated with birds and bats. Other than clarifying questions, no specific issues were raised about bat activity at the Plan Area.

5. Covered Species

5.1 Indiana Bat

The Indiana bat was originally listed on March 11, 1967 as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001). The species is currently listed as endangered under the ESA of 1973, as amended.

A USFWS 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 1999b), but was never finalized. The "Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision" (the "draft Revised Recovery Plan") was made available for public comment on April 16, 2007 (72 FR 19015-19016) (USFWS 2007). The draft Revised Recovery Plan describes three recovery objectives for reclassification of the species as threatened (USFWS 2007):

1. Permanent protection of 80% of Priority 1 hibernacula.
2. A minimum overall population number equal to the 2005 estimate (457,000).
3. Documentation of a positive population growth rate over five sequential survey periods.

In addition, the draft Revised Recovery Plan describes three recovery objectives for delisting of the species (USFWS 2007):

1. Permanent protection of 50% of Priority 2 hibernacula.
2. A minimum overall population number equal to the 2005 estimate.
3. Continued documentation of a positive population growth rate over an additional five sequential survey periods.

Information regarding the species' characteristics, habitat requirements, range and status in the vicinity of the Project is provided in the sections below.

5.1.1 Species Description

Indiana bats are medium-sized, grayish brown bats with a forearm length of 1.4 to 1.6 inches (3.6 to 4.1 cm) and a total length of 2.8 to 3.8 inches (7.1 to 9.6 cm). The tragus (a fleshy projection arising from the base of the inner ear that directs sound into the ear) is short and blunt and measures slightly less than half the height of the ear. The tail is approximately 80% of the length of the head and body. The skull has a small sagittal crest and a small, narrow braincase. Indiana bats may be distinguished from the similar little brown bat and the northern long-eared bat by the presence of a keeled calcar and toe hairs on the hind feet that are shorter than the claws.

5.1.2 Habitat Description

Indiana bats require specific hibernacula conditions (e.g., stable temperature, humidity and air movement), and typically hibernate in large, dense clusters that range from 300 individuals per square foot (Clawson et al. 1980) up to 100,000 individuals per cluster. Studies have found that over 90% of the range-wide population of Indiana bats hibernate in just five states: Indiana, Missouri, Kentucky, Illinois, and New York (USFWS 2007).

The summer habitat requirements of Indiana bats are not fully understood. Until recently, it was believed that floodplain and riparian forests were the preferred habitats for roosting and foraging (Humphrey et al. 1977); however, recent studies have shown that upland forests are also used by Indiana bats for roosting and that suitable foraging habitats may include upland forests, old fields (clearings with early successional vegetation), edges of croplands, wooded fencerows, and pastures with scattered trees and/or farm ponds (USFWS 2007).

The presence of Indiana bats in a particular area during the summer appears to be determined largely by the availability of suitable, natural roost structures. The suitability of a particular tree as a roost site is determined by its condition (live or dead), the amount of exfoliating bark, the tree's exposure to solar radiation, its relative location to other trees, as well as a permanent water source and foraging areas (USFWS 2007).

Thirty-three species of trees have been documented as roosts for female Indiana bats and their young, with 87% of documented roosts located in various ash (*Fraxinus*), elm (*Ulmus*), hickory (*Carya*), maple (*Acer*), poplar (*Populus*), and oak (*Quercus*) species (USFWS 2007). However, the species of the roost tree appears to be a less important factor than the tree's structure (i.e., the availability of exfoliating bark with roost space underneath) and local availability. Studies show that Indiana bats have strong fidelity to summer habitats. Females have been documented returning to the same roosts from one year to the next (Humphrey et al. 1977; Gardner et al. 1991; Callahan et al. 1997) and males have been recaptured when foraging in habitat occupied during previous summers (Gardner et al. 1991).

5.1.3 Reproduction and Maternity Roost Habitat Requirements

Indiana bats mate during the fall, just prior to hibernation. Male and female bats congregate near the opening of a cave (usually their hibernaculum), and swarm, a behavior in which large numbers of bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day (Cope and Humphrey 1977). Swarming lasts over a period of several weeks with mating occurring during the latter part of that period. Once females have mated, they enter the hibernacula and begin hibernation, whereas males will remain active longer, likely attempting to mate with additional females as they arrive at the hibernacula. Adult females store sperm during the winter with fertilization delayed until soon after they emerge from hibernation.

Females emerge from the hibernacula ahead of the males, usually by mid- to late April, and migrate by the beginning of May to their summer roost habitats where they form small maternity colonies (Whitaker and Hamilton 1998). Maternity colonies generally have several separate roost areas located near one another that collectively provide the colony with the necessary roosting resources (including cover and correct temperature provided by exfoliating bark) needed during different environmental conditions. These colonies typically utilize one to a few primary roost trees (Callahan et al. 1997), which provide the proper roosting conditions most of the time, and are normally large, dead trees with exfoliating bark that are exposed to abundant sunlight (Miller et al. 2002; Whitaker and Brack 2002).

The habitat in which the primary roosts have been found varies considerably. Roost trees have been found in dense or open woods, strips of riparian forest, small patches of woods, as well as open land; however, the roosts are normally located in open areas subjected to prolonged sunlight (Whitaker and Brack 2002; Miller et al. 2002). During extreme environmental conditions, such as rain, wind, or temperature extremes, the maternity colony may use alternate roost trees, which likely provide the bats with microclimate conditions that the primary roost trees cannot during times of sub-optimal environmental conditions. The locations of these alternate roosts vary from open areas or in the interior of forest stands. A study of bats in northern Missouri revealed that usage of dead trees in the forest interior increased significantly in response to unusually warm temperatures, and the usage of both interior live and dead trees increased during periods of precipitation (Miller et al. 2002). The primary roosts are typically inhabited by many females and young throughout the summer, whereas alternate roost trees receive only intermittent use by individuals or a small number of bats. Females give birth to a single young in June or early July (USFWS 2007).

5.1.4 Foods and Feeding

Indiana bats are a nocturnal insectivore that feeds exclusively on flying insects, with both terrestrial and aquatic insects being consumed. Diet varies seasonally and variation is seen between different ages, sexes, reproductive status groups and geographic regions (USFWS 2007). A number of studies conducted on the diet of Indiana bats have found the major prey groups to include moths (Lepidoptera), caddisflies (Trichoptera), flies, mosquitoes and midges (Diptera), bees, wasps, and flying ants (Hymenoptera), beetles (Coleoptera), stoneflies (Plecoptera), leafhoppers and treehoppers (Homoptera) and lacewings (Neuroptera) (USFWS 1999b), with Coleoptera, Diptera, Lepidoptera and Trichoptera contributing most to the diet (USFWS 2007).

Studies indicate that Indiana bats typically forage from 6 to 100 ft (1.8 to 30 m) above the ground and hunt primarily around, not within, the canopy of trees (USFWS 2007). Foraging areas are most often located in closed to semi-open forested habitats and forest edges, with radio-telemetry data consistently indicating that wooded areas are preferred as foraging sites, although open habitats such as old fields and agricultural areas may also be used (USFWS 2007). Sparks et al. (2005) found that woodlands were used by foraging Indiana bats nearly twice as often as availability alone would suggest, supporting the idea that Indiana bats preferentially forage in woodlands.

5.1.5 Migration

The timing of spring emergence from hibernacula varies across the range of the species, but in general, females emerge first, from mid- to late April, and males emerge later, from late April to mid-May (USFWS 2007). Females may leave for summer habitat immediately after emerging or shortly thereafter and often travel quickly to where they will spend the summer. Some individuals may travel several hundred miles from their hibernacula, but studies in Indiana and New York found Indiana bats using summer habitat only 30 – 50 miles (48 – 80 km) from their hibernacula (USFWS 2007). Maternity colonies begin breaking up in early August at which time females head back to their hibernacula (USFWS 2007).

5.1.6 Rangewide Status

A population decrease of 28% over the Indiana bat's total range was reported from 1960 to 1975 (Thomson 1982). The rangewide population estimate dropped 57% from 1965 to 2001 (USFWS 2007). As of 2006, the Service had records of extant winter populations at approximately 281 hibernacula in 19 states and 269 maternity colonies in 16 states (USFWS 2007). The estimated rangewide Indiana bat population in 2013 was at 534,239 bats (USFWS 2013b). The closest known hibernaculum to PTWF is Blackball Mine located in LaSalle County, Illinois approximately 120 miles (190 km) to the northwest of the site (USFWS 2007).

Current threats to the Indiana bat include modifications to hibernacula that change airflow and alter the microclimate, human disturbance and vandalism during hibernation resulting in direct mortality, natural events during winter affecting large numbers of individuals, disease, and habitat degradation and loss (USFWS 2007).

A relatively recent, and potentially devastating, threat to Indiana bats is a disease known as white-nose syndrome (WNS). WNS is a fungal infection that was first identified in eastern New York during the winter of 2006-2007. It was named for the visible presence of a white fungus around the muzzles, ears, and wing membranes of affected bats. A previously unreported species of cold-loving fungus (*Geomyces destructans*), which thrives in the darkness, low temperatures (40-50ºF), and high levels of humidity (>90%) characteristic of bat hibernacula, is now known to be the primary pathogen.[3] Bats afflicted with WNS wake more frequently from hibernation, causing them to lose fat reserves that are needed to survive hibernation.[4] It is thought that WNS is transmitted primarily from bat to bat; however, the possibility exists that it may also be transmitted by humans inadvertently carrying the fungus from cave to cave on their clothing and gear.

Since first being reported in New York, WNS has been confirmed to be present in 23 states.[5] WNS was confirmed present in LaSalle, Monroe, Hardin and Pope Counties, Illinois in February 2014. Most species of bats that hibernate in the east are now known to be affected, with the little brown bat, northern long-eared bat, and Indiana bat particularly hard hit.[6] The Service estimates the Indiana bat population in the USFWS' Appalachian Region, where WNS has more recently spread, dropped 45.8% from 2011 to 2013 based on the 2013 count of Indiana bats (USFWS 2013b). Previously, between 2009 and 2011, the Northeast Region dropped 30% based on the 2011 count of Indiana bats (USFWS 2012b), though no such decline was seen between 2011 and 2013 (USFWS 2013b).

5.1.7 Ozark-Central Recovery Unit Status

The draft Revised Recovery Plan for the Indiana bat divides the species' range into four recovery units based on several factors such as traditional taxonomic studies, banding returns, and genetic variation (USFWS 2007). The Plan Area is located within the Ozark-Central Recovery Unit (OCRU), which includes the range of Indiana bat within the states of Illinois, Missouri, Arkansas, and Oklahoma (USFWS 2007). According to the 2013 Rangewide Population Estimate (USFWS 2013b), the overall Indiana bat population in Illinois was approximately 55,956 in 2011 and 57,074 in 2013 (Table 5; USFWS 2012b). This represents approximately 10.7% of the overall 2013 population estimate for Indiana bats and 29% of the Indiana bat population in the OCRU (197,707) (USFWS 2013b). The overall population estimate for the OCRU increased by approximately 1.1% between 2011 and 2013 (Table 5; USFWS 2013b).

[3] http://www.fort.usgs.gov/WNS/.

[4] http://www.fws.gov/northeast/pdf/white-nosefaqs.pdf.

[5] www.whitenosesyndrome.org/about/where-is-it-now

[6] http://www.fort.usgs.gov/WNS/.

Table 5. Indiana Bat Population Estimates for the Ozark-Central Recovery Unit

State	2005	2007	2009	2011	2013
Illinois	55,090	53,823	53,342	55,956	57,074
Missouri[1]	139,038	138,831	136,624	138,379	139,772
Arkansas	2,067	1,829	1,480	1,206	856
Oklahoma	2	0	0	13	5
Total	**73,261**	**71,547**	**68,510**	**70,822**	**197,707**

[1]A previously unknown Indiana bat hibernaculum was discovered in Missouri in 2012, which contained 123,000 bats when surveyed in January 2013, which has been added to each previous survey year due to first-hand accounts of large clusters/numbers of hibernating bats for the past several decades prior to discovery by bat biologists.
Source: USFWS 2013b

5.1.8 Illinois Status

The Indiana bat is listed as state endangered in Illinois. State-listed species are protected under Illinois Endangered Species Protection Act-520 ILCS 10/1, with regulatory authority under state law the responsibility of IDNR. Estimates of the size of hibernating populations of the Indiana bat vary across the state of Illinois. Within the southern portion of the state, estimates ranged from 14,700 in 1965 to 19,491 in 2001, with the most recent estimate (2005) at 42,539 (USFWS 2007). Within the northern portion of the state, estimates ranged from 100 in 1965 to 1,562 in 2001, with the most recent estimate (2005) at 1,804 (USFWS 2007). Recorded maternity colonies are known from 20 counties (USFWS 2007). Known hibernacula in Illinois include:

- 1 – Priority 1 (current and/or observed historic winter populations of ≥ 10,000 bats and currently have suitable and stable microclimates)
- 6 – Priority 2 (current or observed historic population of 1,000 – 10,000 bats)
- 7 – Priority 3 (current or observed historic population of 50 – 1,000 bats)
- 8 – Priority 4 (current or observed historic population of <50 bats)

Of the 22 previously recorded hibernacula, 16 sites have recorded at least one bat since 1995 (USFWS 2007).

5.1.9 Status within the Plan Area

Indiana bat maternity colonies are historically known from Ford County (USFWS 2007). Recent records include a July 2010 survey that identified an Indiana bat maternity colony on the Middle Fork of the Vermilion River in Ford and Champaign counties (IDNR 2010). Maternity colonies are also known from Vermillion County, located adjacent to Ford County to the southeast (USFWS 2007). No records of Indiana bats are known from Iroquois County (USFWS 2007). The closest known hibernaculum is Blackball Mine located in LaSalle County, Illinois approximately 120 miles (190 km) to the northwest of the site (USFWS 2007). No known hibernacula occur within the Plan Area or within Ford or Iroquois counties (USFWS 2007).

Approximately 5 acres (2 ha) of deciduous forest cover is found within the Project boundary. Results of a desktop Indiana bat habitat assessment, based on Illinois Gap Analysis Program (GAP) data, indicate that no woodland tracts within the Plan Area meet the requirement for suitable Indiana bat summer habitat. However, suitable summer habitat is present in the larger woodland tracts located south and west of the Plan Area. In addition, a number of creeks and unnamed drainages are also present within the Plan Area.

5.2 Northern Long-eared Bat

On October 2, 2013, USFWS announced a 12-month finding on a petition to list the northern long-eared bat as endangered or threatened under the ESA, as amended, and to designate critical habitat (78 FR 61046 – 61080). The status review conducted by the USFWS identified WNS as the primary threat to the northern long-eared bat, although other threats do exist as well. After review of the best available scientific and commercial information, the USFWS proposes to list the northern long-eared bat as endangered throughout its range, which does include the entire state of Illinois. No critical habitat is designated at this time. An Interim Conference and Planning Guidance was published on January 6, 2014 (USFWS 2014a). A final ruling on whether to list the northern long-eared bat as endangered is anticipated in October 2014.

Information regarding the species' characteristics, habitat requirements, range and status in the vicinity of the Project is provided in the sections below.

5.2.1 Species Description

Northern long-eared bats are medium-sized yellowish brown bats with a forearm length of 1.3 to 1.5 inches (3.2 to 3.9 cm) and a total length of 3.0 to 3.4 inches (7.6 to 8.7 cm). The tragus is long, pointed and measures more than one-half the height of the ear and is not obviously curved. Northern long-eared bats may be distinguished from the similar little brown bat and Indiana bat by longer ears and a longer, pointed tragus. The calcar is usually slightly keeled, and the toe hairs are medium long and sparse.

5.2.2 Habitat Description

Suitable summer habitat for northern-long eared bats is quite variable. They will utilize a wide variety of forested habitats for roosting, foraging and traveling, and may also utilize some adjacent and interspersed non-forested habitat such as emergent wetlands and edges of fields. Males and non-reproductive females may utilize cooler roost spots such as caves or mines.

Winter habitat includes underground caves and cave-like structures such as mines and railroad tunnels. These hibernacula typically have high humidity, minimal air current, large passages with cracks and crevices for roosting, and maintain a relatively cool temperature (0 - 9 degrees Celsius) (USFWS 2014a). The hibernation season in Illinois is November 1 through March 31 (USFWS 2014a). Currently, 36 hibernacula sites with one or more winter records are known in Illinois (USFWS 2013a).

5.2.3 Reproduction and Maternity Roost Habitat Requirements

Roosting habitat includes forested areas with live trees and/or snags with a diameter at breast height (DBH) of at least 3 inches (7.6 cm) with exfoliating bark, cracks, crevices and/or other cavities. Trees are considered suitable if they meet those requirements, and are located within 1000 ft (305 m) of the nearest suitable roost tree, woodlot, or wooded fencerow (USFWS 2014a). Maternity habitat is defined as suitable summer habitat that is used by juveniles and reproductive females. The summer maternity season in Illinois is April 1 through September 30 (USFWS 2014a).

5.2.4 Foods and Feeding

Northern long-eared bats begin foraging at dusk, focusing on upland and lowland woodlots and tree-lined corridors, catching insects in flight. They will also feed by gleaning insects from vegetation and water surfaces (USFWS 2014a). Prey includes moths, flies, leafhoppers, caddisflies, and beetles.

5.2.5 Migration

Northern long-eared bats migrate between their winter hibernacula and summer habitat, typically between mid-March and mid-May in the spring, and mid-August and mid-October in the fall. They are considered a short-distance migrant (typically 40 - 50 miles [64 - 81 km]), although their known migratory distances can vary greatly between 5 miles (8 km) and 168 miles (270 km) (USFWS 2014a).

5.2.6 Rangewide Status

The northern-long eared bat is a commonly encountered species throughout the majority of the Midwest, often commonly captured in mist-net surveys (USFWS 2013a). However, their distribution among hibernacula in the Midwest is not very well known. The northern long-eared bat is less common in the southern and western portions of its range than in the north, though they are considered abundant in the Black Hills National Forest of South Dakota. In Canada, the species occurs throughout a majority of the forested regions, though similar to the United States, it is more commonly encountered in the eastern portions of its range (USFWS 2013a).

5.2.7 Illinois Status

The northern long-eared bat is not currently listed within the State of Illinois, but should they become federally listed, they will subsequently also become listed under the Illinois Endangered Species Protection Act (Section 2.3.5). Northern-long eared bats are commonly captured in the Shawnee National Forest in southern Illinois, and have been captured fairly consistently during surveys between 1999 and 2011 at Oakwood Bottoms in the Shawnee National Forest (USFWS 2013a). There are 36 known hibernacula (sites with one or more winter records) in the State (USFWS 2013a).

5.2.8 Status within the Plan Area

Because the northern long-eared bat has only recently been proposed for listing, public records of captures are limited. Within Illinois, most records are from the Shawnee National Forest, which is located in southern Illinois. However, the Plan Area does fall within the known range of the northern long-eared bat, and they are likely present at certain times of the year.

Approximately 5 acres (2 ha) of deciduous forest cover is found within the Project boundary. The northern long-eared bat generally selects roosts with more canopy cover than Indiana bats select (USFWS 2014a), suggesting that none of the woodland tracts within the Plan area would meet their forest cover requirements of >44% to >84% (USFWS 2014a). However, suitable summer habitat may be present in the larger woodland tracts located south and west of the Plan Area. In addition, a number of creeks and unnamed drainages are also present within the Plan Area.

6. Effects of the Proposed Action

6.1 Direct Effects

6.1.1 Habitat Loss

No loss of summer maternity habitat resulted from the construction of Pioneer Trail. A desktop habitat assessment conducted during the siting process concluded that no suitable Indiana bat summer maternity habitat is found within the Plan Area (Appendix A), and this also suggests that no suitable northern long-eared bat maternity habitat is present or was lost during construction, due to similar habitat requirements between the species (USFWS 2014). Indiana bat summer maternity habitat has been identified by the Service south of the Pioneer Trail Plan Area along the Middle Fork of the Vermillion River (during the meeting held on January 14, 2011). Woodland with a direct connection to this summer maternity habitat does enter the Plan Area at one point along the southern boundary of the Plan Area (Figure 2). In an effort to avoid affecting potential summer maternity habitat, PTWF relocated two turbines that were within 1,000 ft (300 m) of these woodlands, thereby avoiding all impacts to potential summer maternity habitat. The estimated distance to the edge of the maternity colony (USFWS 2012c) is more than 2.5 miles (4 km) from PTWF's southernmost turbines. The distance, as well as the lack of continuous habitat connection, precludes the potential for that maternity colony to extend into the Plan Area. Therefore, it is not anticipated that effects of operation of Pioneer Trail during the summer maternity season would result in any take of the Indiana bat or northern long-eared bat.

6.1.2 Mortality

Bat mortality has been documented at wind energy facilities worldwide (Arnett et al. 2008). The primary bat species affected by wind facilities are migratory, foliage- and tree-roosting lasiurine species that undergo long distance migrations and do not hibernate. Arnett et al. (2008) compiled data from 21 studies at 19 wind facilities in the United States and Canada and found that mortality has been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, the hoary bat, eastern red bat, and silver haired bat have the highest mortality rates, with the hoary bat comprising 61.7% of all fatalities (Arnett et al. 2008).

Prior to September 2009, no mortality of species listed as threatened or endangered under the ESA had been reported in connection with wind energy facilities, including the Indiana bat (Arnett et al. 2008). In September 2009, the first documented take of an endangered Indiana bat occurred at BP Wind Energy's Fowler Ridge wind farm located in Benton County, Indiana. A total of five Indiana bats have been documented in total, at four separate wind farms in the northeastern and Midwestern United States. A summary of these fatalities is provided in Table 6.

As of 2011, only 13 northern long-eared bat fatalities have been recorded from wind-energy facilities located in the United States, representing less than 0.2% of the total bat mortality (USFWS 2013a). The northern long-eared bat was not listed or proposed for listing when any of these fatalities occurred; however, these records do provide information on the rarity of northern long-eared bat fatalities, given the large number of wind energy facilities operating within the species' range. A summary of northern long-eared bat fatalities is provided in Table 6 below.

Table 6. Summary of publically available Indiana and northern long-eared bat fatalities at wind energy facilities in the United States.

Species	Wind Farm	State	Number Taken	Year(s)	Season	Source
Indiana Bat	Fowler Ridge	Indiana	2	2009, 2010	Fall	WEST Inc. 2013
	North Allegheny	Pennsylvania	1	2011	Fall	USFWS 2011a
	Laurel Mountain	West Virginia	1	2012	Summer	USFWS 2012d
	Blue Creek	Ohio	1	2012	Fall	USFWS 2012e
Northern Long-eared Bat	Mountaineer	West Virginia	6	2003	Fall	Kerns and Kerlinger 2004
	Meyersdale	Pennsylvania	2	2004	Fall	Kerns et al. 2005
	Mt. Storm	West Virginia	1	2008	Fall	Young et al. 2009
	Ellenburg	New York	1	2008	Unknown[1]	Jain et al. 2009
	Fowler	Indiana	1	2009	Fall	WEST Inc. 2013
	Cohocton and Dutch Hill	New York	1	2010	Summer	Stantec 2011
	Wethersfield	New York	1	2010	Summer	Jain et al. 2011

[1]This fatality was an incidental find, and no information on the timing was available in the report.

Due to the absence of significant Indiana and northern long-eared bat records, it is instructive to consider general information regarding bat mortality to understand what type of mortality has been recorded and for what species.

Bat mortality at wind facilities has been reported from direct impact with a spinning turbine blade or from barotrauma. Barotrauma involves tissue damage to air-containing structures (e.g., lungs) caused by rapid or excessive pressure change (Baerwald et al. 2008). As turbine blades spin, the blades create areas of low pressure. Bats flying through these areas may suffer barotrauma. Baerwald et al. (2008) found that approximately 90% of bat fatalities at wind facilities they studied involved hemorrhaging consistent with barotrauma, and that contact with turbine blades accounted for approximately 50% of the fatalities.

The results of the acoustic bat survey conducted in 2010 at Pioneer Trail (Appendix A), with only nine confirmed *Myotis* calls during the stationary and mobile surveys (0.7% of total calls), none of which could be positively identified as an Indiana and only one possible northern long-eared bat call, do not suggest high levels of *Myotis* activity within the Plan Area. Only one of the nine confirmed *Myotis* calls recorded was recorded outside of the fall migratory period (15 July – 31 October), a call recorded on 3 July (see Section 3.10.4). The occurrence of a small number of *Myotis* in the Plan Area during the summer is not unexpected, as the common little brown bat is known to occur in the Plan Area and is known to use buildings as roosting and maternity sites.

The *Myotis* passage rate recorded during fall migration at the stationary detectors within the Plan Area was moderate compared to *Myotis* passage rates recorded during fall migration at other wind energy sites surveyed by Stantec, and at the Fowler Ridge Wind Farm (Table 7). Nevertheless, little is known about the migration patterns of bats; specifically, how they disperse across the landscape during migration or whether and how they use echolocation during migration. Therefore, it is not possible to accurately predict an individual bat's route during migration. Based on this, migratory risk could exist anywhere within a species' geographic range, and the potential does exist for both Indiana and northern long-eared bats to migrate through the Plan Area and for take to occur, although any take that may occur is expected to be minimal.

Table 7. Comparison of Fall Migration *Myotis* Activity at Wind Energy Facilities in the Midwest Surveyed by Stantec and at Fowler Ridge Wind Farm

Wind Energy Facility Site Location	Total # *Myotis* Passes (Mean/Detector Night) Passive Survey - Fall Migration Season
Northwest Ohio	216 (0.32)[1]
Central Iowa	33 (0.150)
Fowler Ridge, Indiana (Good et al. 2011)	(0.100)[1, 2]
Northwest Missouri	11 (0.050)
Southern Michigan	7 (0.032)[3]
Pioneer Trail Wind Farm	6 (0.027)
Northern Indiana	8 (0.019)[3]
Northwest Missouri	3 (0.018)
Northeastern Illinois	2 (0.018)
Eastern Illinois	1 (0.005)

[1]Indiana bat and northern long-eared bat presence confirmed at site based on mist-netting or post-construction monitoring results.
[2]Number of *Myotis* calls not reported; passage rate data reported only for spring and fall seasons combined.
[3]Northern long-eared bat confirmed; Indiana bat probable absence presumed at site based on mist-netting results.

6.2 Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time but are still reasonably certain to occur. For the purposes of an HCP, the indirect effects in question must be reasonably foreseeable, a proximate consequence of the covered activities proposed under the HCP, and must rise to the level of take (USFWS and NOAA 1996) if they are to be included as a covered activity. None of the indirect effects associated with the operation or decommissioning of Pioneer Trail are likely to result in take of either Indiana or northern long-eared bats.

Pioneer Trail is intended to supply electricity to the regional electrical grid to address existing and projected future energy needs. As such, significant local community growth is not anticipated as a consequence of the Project's energy contribution. The operation of the PTWF also is not expected to result in significant local community growth. The Project is currently staffed by six to nine full-time personnel. Agricultural, recreational, and other customary activities on the lands surrounding the turbines continue to take place as they did prior to the construction of the wind farm.

A potentially positive indirect effect on Indiana and northern long-eared bats is the addition of Pioneer Trail as a renewable energy source, offsetting the potential operation of fossil fuel-fired generating sources and with the potential to slow the effects of climate change on species including Indiana and northern long-eared bats. However, the specific level of such benefit attributable to the Pioneer Trail facility is not readily quantifiable.

The mitigation associated with Pioneer Trail (cave/mine entrance improvements and increased restoration and protection of summer habitat) is not anticipated to result in an indirect negative effect to either species, but should directly enhance species viability.

6.3 Effects on Critical Habitat

A final rule designating critical habitat for the Indiana bat was published on September 24, 1976 (41 FR 41914). The critical habitat consists of 11 caves and two mines in six states:

- Illinois – Blackball Mine (LaSalle County)
- Indiana – Big Wyandotte Cave (Crawford County), Ray's Cave (Greene County)
- Kentucky – Bat Cave (Carter County), Coach Cave (Edmonson County)
- Missouri – Cave 021 (Crawford County), Caves 009 and 017 (Franklin County), Pilot Knob Mine (Iron County), Bat Cave (Shannon County), Cave 029 (Washington County)
- Tennessee – White Oak Blowhole Cave (Blount County)
- West Virginia – Hellhole Cave (Pendelton County)

The Plan Area does not occur within or in close proximity to, nor will it directly affect, designated Indiana bat critical habitat; therefore, none will be affected. The closest Indiana bat critical habitat area (Blackball Mine) is located approximately 120 miles (190 km) to the northwest of the Plan Area.

At this time, no critical habitat has been designated for the northern long-eared bat; therefore, none will be affected.

6.4 Incidental Take Permit

The Service will issue an ITP upon a finding that this HCP meets the permit issuance criteria set forth in 50 CFR § 17.32(b)(2), including that the actions proposed by PTWF will not appreciably reduce the likelihood of the survival and recovery of the Indiana or northern long-eared bat in the wild, and that PTWF has minimized and mitigated the effects of its activities to the maximum extent practicable. The minimization and mitigation measures that PTWF will implement to meet this standard are described in the Conservation Plan in Section of this HCP.

6.4.1 Scope of the Incidental Take Permit

6.4.1.1 Permit Period and Area

PTWF is seeking a 43-year ITP for the Indiana and northern long-eared bat within the Plan Area. This HCP identifies the measures intended to assure that the effects of the incidental take will be minimized and mitigated to the maximum extent practicable.

6.4.1.2 Type of Take

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such activity [ESA §3(19)]. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding or sheltering. Harass is defined by the Service as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt behavior patterns which include, but are not limited to, breeding, feeding or sheltering [50 CFR §17.3].

The Project has the potential, albeit small, to result in take of both the Indiana and northern long-eared bat during operation of the Project through mortality due to collision with turbine blades or as a result of barotrauma; through temporary harm or harassment of individuals in the course of implementation of mitigation activities; or through certain activities that may be required during decommissioning the turbines, such as minor tree clearing. Accordingly, the ITP will cover potential incidental take occurring in connection with otherwise lawful activities related to the operation of Pioneer Trail, the implementation of mitigation activities pursuant to this HCP, and decommissioning of the turbines after the useful life of the Project.

6.4.2 Take Estimate

Fatality rates at wind energy facilities located in agricultural landscapes in the Midwest have ranged from 1.88 to 27.23 bats/MW/year (Table 8). Bat fatality rates at most Midwest sites, particularly agricultural sites, have been at the lower end of this range (Kunz et al. 2007a and b, Poulton 2010). Recently, higher-than-expected bat fatality rates were reported at the Blue Sky Green Field and Cedar Ridge wind facilities in Wisconsin, increasing the upper limit of bat fatalities in the Midwest (Gruver et al. 2009). Both facilities are located in agricultural landscapes and are sited away from habitat features believed to increase bat presence, yet fatality rates at these facilities are similar to those reported at facilities located on forested ridgetops in the Appalachian Region (Poulton 2010). The Pioneer Trail Plan Area demonstrates no indicators of increased risk to bats; however, the reasons behind the higher fatality rates at the Blue Sky Green Field and Cedar Ridge facilities remain unclear.

Table 8. Summary of Bat Fatality Studies in the Midwest.

Project	State	Total MW	Bat fatalities per MW per year[a]	Study Period(s)	Reference
Buffalo Ridge, Phases I-III	MN	235.6	2.30	15 Mar-15 Nov 1996 15 Mar-15 Nov 1997 15 Mar-15 Nov 1998 15 Mar-15 Nov 1999	Johnson et al. 2003a
Buffalo Ridge, Lake Benton I & II	MN	210.8	2.88	15 June-15 Sep 2001 15 June-15 Sep 2002	Johnson et al. 2003b, Johnson et al. 2004
Blue Sky Green Field	WI	145	24.6	21 Jul-31 Oct 2008 15 Mar-31 May 2009	Gruver et al. 2009
Kewaunee County	WI	20.5	6.45	Jul 1999-Jul 2001	Howe et al. 2002
Cedar Ridge	WI	68	27.23	Mar-May 2009 Jul-Nov 2009 Mar-May 2010 Jul-Nov 2010	BHE 2011
Crescent Ridge	IL	49.5	1.88	Sep-Nov 2005 Mar-May 2006 Aug 2006	Kerlinger et al. 2007
Top of Iowa	IA	80.1	8.58	15 Apr-15 Dec 2003 15 Apr – 15 Dec 2004	Jain 2005
Forward Energy Center	WI	129	15.63	15 Jul–15 Nov 2008 15 Apr–31 May 2009 15 Jul-15 Oct 2009 15 Apr-31 May 2010	Grodsky and Drake 2011
Fowler Ridge	IN	600	18.91	13 Apr-15 May 2010 1 Aug-15 Oct 2010 1 April – 15 May 2011 15 July – 29 Oct 2011	Good et al. 2012
Arithmetic mean of bat fatalities per MW per year:			12.05		

[a] estimations based on available study periods within a year-long period

In addition to being located in a highly agricultural landscape, Pioneer trail has only moderate levels of bat activity when compared with other Midwest locations (Table 9). The Plan Area demonstrates no unusual characteristics or indicators of increased risk to bats, as currently understood. Bat fatality rates in the Plan Area are, therefore, likely to be at the lower end of the range of fatality rates reported at other wind energy facilities located in agricultural landscapes in the Midwest (1.88 – 27.23 bats/MW/year) (Table 8).

Table 9. Comparison of Bat Activity at Wind Energy Facilities in the Midwest Surveyed by Stantec.

Wind Farm Site Location	Total # Bat Passes (Mean/Night) Stationary Survey	Total # Bat Passes (Mean/Night) Mobile Survey	Land Use
Northeast Iowa	2313 (6.0)	105 (2.8)	83% Agricultural 2% Forest
Northwest Illinois	1905 (4.8)	196 (2.6)	>90% Agricultural >6% Forest
Central Indiana	1800 (4.5)	93 (1.0)	93% Agricultural 0.6% Forest
Southwest Illinois	1721 (5.1)	26 (0.3)	90% Agricultural 1.2% Forest
East Central Wisconsin	1647 (3.9)	95 (1.5)	88% Agricultural 2% Forest
Pioneer Trail Wind Farm	1269 (3.2)	58 (0.6)	96% Agricultural <0.01% Forest
Central Iowa	183 (0.4)	95 (4.5)	81% Agricultural 0.1% Forest

6.4.2.1 Fowler Ridge-Based Take Estimate

In an effort to make use of the most up-to-date data available, the take estimate was calculated by applying actual data from Fowler Ridge to PTWF and compensating for the different scales of the two projects. This method is considered conservative, since Fowler Ridge has experienced a higher-than-average fatality rate compared to other facilities in the Midwest (Table 8).

Following the first documented Indiana bat mortality event at the Fowler Ridge wind energy facility, an extensive program of study was initiated to not only develop a take estimate for the facility but to evaluate operational adjustments and consider layout features that could contribute to minimizing that projected take. The resulting studies provide information potentially relevant to sites with similar landform characteristics, such as Pioneer Trail. Both Fowler Ridge and Pioneer Trail have a lack of summer roosting habitat and are in active agricultural use. Both sites have minimal topography and, while drainage channels extend within both Plan Areas, associated tree cover is minimal. The PTWF is located approximately 52 miles (84 km) from the Fowler Ridge facility. The Fowler Ridge facility is substantially larger than PTWF, incorporating a maximum build out of 449 turbines over an area of 72,947 acres.

As a result of the discovery of an Indiana bat carcass during the fall 2009 monitoring at Fowler Ridge, Fowler was issued a two-year Scientific Research and Recovery Permit for the Indiana bat by USFWS Region 3 to help build a better scientific basis for the potential minimization and mitigation measures for Indiana bat HCP development. As part of the research conducted under the permit, daily carcass searches were conducted in 2010 and 2011 at the Fowler Ridge facility. The results of these daily carcass searches were used to develop bat fatality estimates and to approximate the proportion of Indiana bats to all other bats killed at the wind energy facility. Curtailment studies were also conducted under the permit to assess the effectiveness of raising cut-in speeds and feathering turbines below various cut-in speeds in reducing bat mortality. Fowler is currently the only wind facility with an available take estimate based on actual Indiana bat mortality. Although the North Allegheny Wind facility in Cambria and Blair counties, Pennsylvania, the Laurel Mountain Wind Power facility near Elkins, West Virginia, and the Blue Creek Wind Farm near Van Wert, Ohio have also caused take of an Indiana bat, take estimates have not yet been developed for these facilities (USFWS 2011a, 2012d, e). While northern long-eared bat fatalities have occurred at several facilities (see Table 6), the nearest fatality to PTWF occurred at Fowler, which is also the most comparable facility due to the surrounding habitat and landscape.

Similar to Fowler, take at Pioneer Trail is expected to occur only during the fall migration season (August 15 – October 15), based on the seasonal distribution of bat activity recorded in the Plan Area (Section 3.10.4) and the lack of suitable summer habitat and hibernacula within the Plan Area (Sections 5.1.9 and 5.2.8). There is no summer roosting habitat within the Plan Area; therefore, no take will occur during the summer months. Spring migratory risk is anticipated to be extremely low, based on all Indiana and northern long-eared bat mortality associated with wind energy facilities, including Fowler Ridge. Although initial confirmatory monitoring will be proposed to confirm the low spring risk, the potential for take is anticipated to be during the fall migratory season only. Based on the extensive similarities between the Fowler Ridge and Pioneer Trail facilities, it is reasonable to use data obtained at Fowler Ridge to develop a take estimate for Pioneer Trail, after adjusting the Fowler data to account for the smaller size of the Pioneer Trail facility (94 turbines and 12,500 acres).

Based on the 2010 and 2011 monitoring efforts, fall bat fatality at Fowler Ridge was estimated to average 30.17 (90% CI = 24.60-37.13) bats/turbine/fall season. Of the 1,246 total bat carcasses found during the three (2009-2011) fall search seasons at Fowler, two (2) carcasses were Indiana bats and one (1) carcass was a northern long-eared bat. The percent composition of Indiana bat fatality was therefore calculated to be 0.16% of the total bat fatality, and the percent composition of northern long-eared bat fatality was calculated to be 0.08% of the total bat fatality. Applying the Fowler Ridge average fatality estimate to Pioneer Trail (30.17 bats/turbine/fall season x 94 turbines) produces an estimated bat fatality of 2,836 (90% CI = 2,312-3,490) bats/fall season. Considering that 0.16% of all bat fatalities are estimated to be Indiana bats, approximately 5 (90% CI = 4-6) Indiana bats would be taken at Pioneer Trail each fall, without minimization measures. Utilizing the 0.08% of all bat fatalities that are estimated to be northern long-eared bats, approximately 3 (90% CI = 2-3) northern long-eared bats would be taken at Pioneer Trail each fall if no minimization measures were in place.

6.4.2.2 Take Estimates Adjusted for Minimization Measures

The minimization measures to be implemented at the Project are expected to reduce the estimated take below the Fowler-based take estimates. All Pioneer Trail turbines will be curtailed at 11.2 mph (5.0 m/s) during the fall migration season (August 15 – October 15) from sunset to sunrise when ambient temperature is above 50°F (10°C) (see Section 7.2.2) based on a 10-minute rolling average.

This curtailment schedule targets the season during which the majority of all bat mortalities (Cryan 2008a), 80% of the known Indiana bat mortality and 83% of the known northern long-eared bat mortality for which there are data, have occurred at wind energy facilities (Table 6). In addition, this schedule includes the period when migrating/dispersing bats, which appear to comprise most bat mortalities at wind energy facilities (Erickson et al. 2002), are expected to be present in the Plan Area and the only time period during which Indiana and northern long-eared bat take is expected to occur at the Project due to the lack of summer habitat within the Plan Area.

All publicly available curtailment studies to date show a consistent inverse relationship between cut-in speeds and bat mortality (Baerwald et al. 2009, Arnett et al. 2010, Good et al. 2011, Kerns et al. 2005, Fiedler 2004). Baerwald et al. (2009) found that increasing turbine cut-in speed to 12.3 mph (5.5 m/s) or turbine feathering at wind speeds less than 12.3 mph (5.5 m/s) reduced fatality of hoary bats and silver-haired bats from 50% to 70%. Arnett et al. (2010) found that increasing turbine cut-in speed to 11.2 mph

(5.0 m/s) or 13.4 mph (6.0 m/s) resulted in reductions in average nightly bat fatality ranging from 53% to 93%. Similarly, Good et al. (2011) found that bat fatalities were reduced by a mean of 50% when cut-in speeds were increased to 11.2 mph (5.0 m/s). Common *Myotis* species, such as the little brown bat, are relatively small bodied bats (as are Indiana and northern long-eared bats) whose activity is known to decrease on nights with high wind speeds. Therefore, curtailment actions effective at reducing risk of collision for common *Myotis* species should also be effective for Indiana and northern long-eared bats, in the event these species do occasionally occur within the Plan Area.

Nightly bat activity is also correlated with temperature both over an annual time period and on a nightly basis (USFWS 2007, Reynolds 2006, Fiedler 2004, O'Farrell and Bradley 1970, Vaughan et al. 1997). Several studies have shown that bats and their prey become constrained by falling temperatures as autumn progresses (USFWS 2007). The relative abundance of insect prey in open, exposed agricultural lands decreases with cooling temperatures and crop harvest, causing bat use to switch more heavily to forested areas as autumn progresses (Brack 2006). Therefore, the exposure potential of bats to turbines located in agricultural landscapes (as the Pioneer turbines are) declines greatly with decreasing temperatures. Additionally, Reynolds (2006) found that temperatures during the night (between 1900-0700 hours) significantly influenced migratory activity, with no detectable bat activity below 51°F (10.5°C). High migratory activity was most strongly influenced by daily maximum temperature; days with high bat activity had a mean maximum temperature of 75 ± 7.9°F (23.9 ± 4.4°C) compared to 49.6 ± 8.6°F (9.8 ± 4.8°C) for days with no bat activity (Reynolds 2006). Fiedler (2004) found that bat activity during the July-September seasonal period at the Buffalo Mountain wind energy facility in West Virginia was most closely correlated with average nightly temperature among the weather variables considered, with lower average nightly temperature resulting in less bat activity. The data presented in the scientific literature above, and professional experience, have led to the general conclusion among experts that among all bat species, activity declines in heavy rain, high wind, and cold weather (some specifically mentioned temperatures below 50-55°F [10-13°C]) (USFWS 2011b).

A study of the relationship between weather conditions and bat mortality at the Fowler Ridge wind energy facility in Indiana found that bat casualty rates were highest on nights with higher mean temperature and increasing variance in temperature (Good et al. 2011). Specifically, 91% of all bat fatalities during the fall migration period occurred on nights with mean nightly temperatures above 68°F (20°C). Regression analysis indicated that bat mortalities increased by 15% for every 1.8°F (1.0°C) increase in average nightly temperature at the Fowler site (Good et al. 2011).

Based on the results of these studies, and the uncertainty in the estimated reductions in bat mortality, specifically Indiana and northern long-eared bat mortality, PTWF conservatively estimates that raising turbine cut-in speeds to 11.2 mph (5.0 m/s) during the fall migration season (August 15 – October 15) from sunset to sunrise when ambient temperature is above 50°F (10°C) based on a 10-minute rolling average, and feathering turbines below cut-in during those periods, would reduce all bat mortality, including Indiana and northern long-eared bat mortality, by at least 50% (i.e., 3 Indiana bats/year and 2 northern long-eared bats/year) based on the Fowler approach. Based on a 43-year ITP term, the total estimated, minimized Indiana bat take over the 43-year ITP term is 129 Indiana bats, and the total estimated, minimized northern long-eared bat take over the 43-year ITP term is 86 northern long-eared bats. These take estimates are considered to be conservative, and actual mortality is likely to be lower, because the estimates are based on the minimum reductions in mortality that were observed in studies using similar operational adjustments, and all take estimates were rounded up to the nearest whole number (i.e., actual calculations would have been 2.3 Indiana bats/year and 1.2 northern long-eared bats/year with no rounding)

6.4.2.3 Proposed Take Limits

No Indiana or northern long-eared bat mortality is expected to occur during maintenance, decommissioning, or mitigation activities. The only Project activity expected to result in Indiana or northern long-eared bat take (mortality) is operation. PTWF requests a take limit of 129 Indiana bats and 86 northern long-eared bats based on the cumulative estimated average annual takes over the 43-year ITP term.

Due to annual variation in environmental factors that may affect Indiana and northern long-eared bat population sizes and migration, annual mortality can be expected to differ from year to year. In an effort to be responsive to this variation, and to ensure that the 43-year take limits are not exceeded, this HCP includes post-construction monitoring and annual and intra-year adaptive management take thresholds, which are described in detail in Sections 7.3 and 7.4. This expanded timeframe for measuring take compliance will allow, if necessary based on monitoring results, for changes to be made to the minimization measures that will ensure that take will not exceed the cumulative limit of 129 Indiana bats and/or 86 northern long-eared bats. Cumulative records of calculated annual Indiana bat mortality and northern long-eared bat mortality will be kept throughout the 43-year operational life of the Project.

6.4.3 Impacts of Estimated Take

To assess the overall impacts of the estimated take for the Project, an understanding must be developed of the likely demographics of the affected individuals and the subpopulations and metapopulations to which they belong. As described above, PTWF is estimated to take 3 Indiana bats/year or 129 Indiana bats over the 43-year life of the Project, and 2 northern long-eared bats/year or 86 northern long-eared bats over the 43-year life of the Project. Due to the location of the Plan Area away from known maternity colonies of either species, potential summer maternity habitat, and known hibernacula, any Indiana or northern long-eared bats taken at PTWF will likely originate from more than one maternity colony and more than one hibernaculum. The nearest known Indiana bat and northern long-eared bat maternity colonies to the Project area are located several miles south of the Project area along the Middle Fork of the Vermilion River. The nearest Indiana bat hibernaculum to the Project area is the Blackball Mine, approximately 120 miles (190 km) northwest of the Project area. Bats in the Indiana bat maternity colony along the Middle Fork of the Vermilion River may originate from the Blackball Mine, or from hibernacula in southwestern Indiana and Kentucky, or they may migrate in both directions, with bats from different caves mingling during the summer (IDNR 2010). If Indiana bats from the Middle Fork of the Vermilion River maternity colony hibernate in the Blackball Mine, their migration route may take them through the Project area and present a risk of mortality for these bats (although bat movement patterns in fall often do not follow a simple linear path of migration from summer habitat to hibernacula [USFWS 2007]). Conversely, if the Indiana bats hibernate to the south or southeast, the Project turbines are unlikely to pose a risk.

There are 36 known northern long-eared bat hibernacula in Illinois (USFWS 2013a), yet they are not often found in high concentrations in any one hibernaculum. Additionally, northern long-eared bats are not known as long-distance migrants, typically migrating only 40-50 miles (64-81 km; though distances can vary between 5 and 168 miles [8-270 km]). Based on this, northern long-eared bat take at Pioneer Trail is not expected to effect the population at large, and northern long-eared bats may be at even less risk than Indiana bats due to their shorter migration distances which implies fewer opportunities for turbine interactions.

The relatively low level of bat activity, including *Myotis* activity (see Section3.10.3), recorded within the Project area during the fall migration season, the lack of any confirmed Indiana bat calls, and a single northern long-eared bat call supports the conclusion that while both species may pass through the Project area, concentrated Indiana bat or northern long-eared bat migration or migration of groups of individuals of these species (such as those from a maternity colony) is not likely to occur. Given that migratory routes for Indiana bats and northern long-eared bats in the Midwest remain generally unknown, it cannot be predicted with certainty from which maternity colonies or hibernacula bats migrating through the Plan Area may originate. Therefore, take from the PTWF is not expected to inordinately affect any single maternity colony or hibernaculum and take is not expected to result in permanent loss of the reproductive potential of a maternity colony, or of the maternity colony itself. Additionally, loss of the anticipated small number of bats is unlikely to adversely impact any hibernating populations to which these individuals belong. Based on the maximum known migration distance for Indiana bats (357 miles [574 km]) (USFWS 2011b) and the location of known hibernacula relative to the Plan Area, it is expected that all or most of the Indiana bats taken by Pioneer Trail will belong to the OCRU population.

Indiana and northern long-eared bats taken by Pioneer Trail may include non-reproductive juveniles as well as adult female and male bats. Mortality statistics are skewed towards males of the four most commonly-killed species at wind energy facilities: the hoary bat, eastern red bat, silver-haired bat, and tri-colored bat (Arnett et al. 2008). Behavioral-based risk factors have been hypothesized to increase the exposure potential for male tree-bats at turbines (Cryan 2008b). Of the five known Indiana bat fatalities (Table 6), four have been females killed during the fall migration season. The Indiana bat found at the Laurel Mountain project was an adult male; however, that fatality occurred during the 2012 summer breeding season; the project is located in a forested landscape with an abundance of roost sites, foraging habitat, and a known, small Indiana bat population in the vicinity (USFWS 2013c). Additionally, there are no data that suggest that male *Myotis* bats may be more vulnerable to wind turbine mortality (USFWS 2011b). Gruver et al. (2009) recorded an equal number of male and female *Myotis* fatalities at a wind energy facility in Wisconsin and BHE Environmental (2011) recorded more female *Myotis* fatalities than male *Myotis* fatalities at another wind energy facility in Wisconsin. Because Pioneer Trail is expected to take migrating individuals originating from a variety of unknown locations, it is currently most reasonable to assume equal risk for male and female bats within the Plan Area.

To determine the impact of the take, the Service's Draft Region 3 Indiana Bat Resource Equivalency Analysis Model for Wind Energy Projects (REA Model) (USFWS 2013d) was used. Although the REA model uses parameters from studies on Indiana bats, it represents the best, and most conservative, substitute at this time for northern long-eared bat population dynamic parameters as well. The REA model used the resource service of reproduction as the unit of measurement for debits and credits, and specifically on the reproductive potential of females from the population. This is based on the principle that when an adult female bat is prematurely taken at a wind energy facility, her and her offspring's reproductive potential is lost. Similarly, when mitigation is applied, females and their future reproductive potential are gained.

Although the overall ratio of females to males in the Indiana bat population within the OCRU is assumed to be 1:1, female Indiana bats are expected to occur more frequently than males in the population as distance from hibernacula increases. Female Indiana bats disperse from hibernacula to join summer maternity colonies, while male Indiana bats typically remain closer to hibernacula throughout the summer. Therefore, more female Indiana bats than male Indiana bats would be expected to migrate through the Plan Area, based on the distance of the Plan Area from the nearest hibernaculum (120 miles [190 km]). The Service estimates a 3:1 ratio of female to male Indiana bats migrating through the Plan Area each fall (USFWS 2012f). Consequently, approximately 75% of the 129 Indiana bats taken at Pioneer Trail are expected to be female, for an estimated take of 2.25 female bats/year, or 97 total female bats over the 43-year Project life. The loss of female bats also represents lost reproductive potential from these individuals.

Due to their recent proposal for listing, research into the sex ratios of northern long-eared bats has been limited. However, there is no evidence to suggest that a 1:1 sex ratio is improbable. Unlike Indiana bats, the northern long-eared bat shows less dispersal from hibernacula (USFWS 2014a), suggesting that females and males may be expected to migrate through the Plan Area in equal proportions. Consequently, of the 86 northern long-eared bats estimated to be taken at Pioneer Trail over the life of the project, 50% (43 bats) are expected to be female, for an estimated take of 1 female bat/year over the 43-year Project life. The loss of female bats also represents lost reproductive potential from these individuals.

The reproductive potential which may be lost from the population due to the estimated take of 97 female Indiana bats and 43 northern long-eared female bats at Pioneer Trail was calculated based on the following assumptions (USFWS 2012f):

- Summer habitat of lost bat remains functional on landscape;
- Colony persists with additional loss from wind energy take;
- Taken bat is reproductively active adult female;
- Taken bat is from stable colony with saturated summer habitat; and
- Available non-reproductive females will occupy vacant summer habitat within two years.

The number of young that each taken female bat would have produced over two breeding seasons was calculated using the REA Model. The REA Model, based on a "stationary condition", gives an average fecundity of 0.60 and an average adult survival rate of 0.87. These parameters are the same for both years, as they represent average annual rates. The model returns an average of 1.9 lost young that would have been produced by each taken female over two breeding seasons. Therefore, over the life of Pioneer Trail, it is estimated that the lost reproductive potential of 97 female Indiana bats taken by the Project will equal 184 juvenile bats, and the lost reproductive potential of 43 female northern long-eared bats taken by the Project will equal 82 juvenile bats:

$$
\begin{aligned}
Y = Year\ 1\ &\left[\left(B_p \times B_s\right) \times \left(S_w \times S_s\right)\right] \\
&+ Year\ 2\ \left[\left(S_w \times S_s\right) \times \left(B_p \times B_s\right) \times \left(S_w \times S_s\right)\right]
\end{aligned}
$$

The Indiana bat debits accrued over the 43-year life of the Project includes the female take estimate (97) as well as the lost reproductive contribution of the taken female Indiana bats (184): approximately 281 total Indiana bats. This represents 0.14% of the estimated 2013 population of the OCRU (197,707 Indiana bats) and will be distributed over 43 years. Considering the overall low level of expected take and the compensatory mitigation measures PTWF will implement to compensate for the take, it is highly unlikely that the impact of the Project will appreciably reduce the likelihood of survival and recovery of the Indiana bat. Given that no reductions are anticipated in the recruitment or distribution of Indiana bats within the OCRU or in the species' overall range, the action is not likely to jeopardize the continued existence of the Indiana bat. In the event that some of the bats taken at Pioneer Trail belong to the Midwest Recovery Unit population, overall impacts to this population would be very minimal. In 2013, the Midwest Recovery Unit population was estimated to exceed the OCRU population by 102,968 individuals (USFWS 2013b).

The northern long-eared bat debits accrued over the 43-year life of the Project include the female take estimate (43) as well as the lost reproductive contribution of the taken female northern long-eared bats (82), resulting in approximately 125 total northern long-eared bats. The northern long-eared bat population in Illinois has not yet seen the declines which have occurred in the eastern United States. Due to this, and the low level of estimated take, it is likely that overall impacts to the local population from take at Pioneer Trail would be minimal. Due to the common occurrence of northern long-eared bats at mist-netting sites throughout large portions of their range, it is generally assumed that the range-wide northern long-eared bat population is significantly larger than the range-wide Indiana bat population (534,239; USFWS 2013b). However, even if the northern long-eared bat population were this size, the take resulting from the Project would represent only 0.023% of the estimated population.

As WNS spreads into and across the Midwest (see discussion in Section 8.2.2.3), it may significantly affect the OCRU Indiana bat population as well as the local northern long-eared bat population. WNS is causing severe declines in the populations of cave-hibernating bats throughout eastern North America. The Service has estimated that WNS caused a decline of approximately 36% in the Indiana bat Northeast Recovery Unit population between 2007 and 2009 (USFWS 2011c), a decline of approximately 54% between 2009 and 2011 (USFWS 2012b), but populations appear to have steadied between 2011 and 2013 with a 13.3% increase in the Northeast Recovery Unit Population (USFWS 2013b). In addition, there has been a sharp decline in the northern long-eared bat in the northeastern part of its range due to WNS, and WNS has been confirmed on bats from New York, Tennessee, Kentucky and Ohio (USFWS 2014a), indicating that they are highly susceptible to the disease. The decline within surveyed hibernacula from 8 states is approximately 99% for the northern long-eared bat (USFWS 2014a). If WNS becomes widespread across the Midwest, and specifically within Illinois, this level of take from Pioneer Trail would represent a greater proportion of the local populations; however, the level of take experienced by the Project would be expected to decline proportionally. The amount of take that the Project will contribute in addition to losses from WNS would not cause the OCRU Indiana bat population or the local northern long-eared bat population to decline appreciably sooner than it would decline as a result of WNS alone. The possible effects of WNS on these populations and, subsequently, PTWF's mitigation and conservation measures, are addressed in Section 8.2, Unforeseen and Changed Circumstances.

7. Conservation Plan

7.1 Biological Goals and Objectives

The biological goals define the expected outcome of this conservation plan. These goals are broad, representing the guiding principles for operation of the conservation program described in this HCP and forming the basis for the minimization and mitigation strategies employed. The biological objectives represent the steps through which the biological goals will be achieved, and provide a basis for measuring progress towards and achievement of those goals.

The biological goals and objectives of this conservation plan are set forth in Table 10.

Table 10. Biological Goals and Objectives of the Pioneer Trail HCP.

Number	Goal	Objective
1	Minimize Indiana and northern long-eared bat mortality in the Project area.	Implement an operational strategy that will decrease fall bat mortality by at least 50% compared to predicted uncurtailed levels, thereby decreasing actual mortality of all bats, and specifically Indiana and northern long-eared bats to no more than 129 Indiana bats and/or 86 northern long-eared bats over the 43-year operational life of the Project.
2	Protect a vulnerable wintering population of Indiana bats, thereby promoting the security of a critical component of the Indiana bat population in the OCRU.	Implement a mitigation project that will install a new gate at Griffiths Cave and subsequently monitor gate success.
3	Increase survival and reproductive capacity of Indiana and northern long-eared bats on their summer range, thereby promoting population growth of Indiana bat maternity colonies in the OCRU.	Implement a mitigation project that will protect and restore a minimum of 206 acres of summer habitat in blocks with a minimum size of 46 acres within the range of extant Indiana bat maternity colonies in the 8-digit Hydrologic Unit Code (HUC) of the PTWF, and subsequently monitor restoration success.

7.2 Measures to Achieve Biological Goals and Objectives

7.2.1 Avoidance of Habitat Loss

No suitable Indiana bat or northern long-eared bat summer maternity habitat is found within the Plan Area. As shown in Figure 4, PTWF relocated two turbines that were within 1,000 ft (300 m) of woodland with a direct connection to summer maternity habitat for both species located approximately 2.5 miles (4.0 km) outside of the Plan Area, thereby avoiding all impacts to potential summer maternity habitat.

7.2.2 Minimization of Direct Mortality by Approximately 50% over Unrestricted Operations

All publicly available curtailment studies to-date show a consistent inverse relationship between cut-in speeds and bat mortality; demonstrating that as cut-in speed increases, bat mortality decreases (see Section 7.2.2). Reductions in bat mortality of 50% to 93% have been documented, with several studies showing that bat fatalities were reduced by a mean of 50% when cut-in speeds were increased to 11.2 mph (5.0 m/s). A relationship between weather conditions and bat mortality at wind energy facilities has also been documented. Good et al. (2011) found that bat casualty rates were highest on nights with higher mean temperature and increasing variance in temperature, and that 91% of all bat fatalities during the fall migration period occurred on nights with mean nightly temperatures above 68°F (20°C).

PTWF has committed to raising turbine cut-in speeds (i.e., the wind speed at which turbines begin generating power and sending it to the grid) from the manufacturer's rated cut-in speed of 7.8 mph (3.5 m/s) to 11.2 mph (5.0 m/s) from sunset to sunrise when the ambient temperature is above 50°F (10°C) based on a 10-minute rolling average during the fall migratory period from 15 August through 15 October. Turbines will remain fully feathered (i.e., turbine blades are pitched parallel with the wind direction, causing them to spin only at very low rpms, if at all) when the ambient temperature is above 50°F (10°C) based on a 10-minute rolling average until the cut-in speed is reached. At that time, blades will be pitched into the wind to enable the turbine to begin spinning and generating electricity.

The raised cut-in speed will be reduced back down to the manufacturer's rated cut-in speed and turbines will no longer be feathered if ambient temperatures fall below 50°F (10°C) for 30 consecutive minutes based on a 10-minute rolling average. If cut-in speeds have been reduced to the manufacturer's rated cut-in speed on any particular night based on ambient temperature, and the ambient temperature subsequently rises above 50°F (10°C) for 30 consecutive minutes, cut-in speeds will be raised back to 11.2 mph (5.0 m/s) and turbines will again be fully feathered.

These operational minimization measures will be implemented every night during the fall migration season, from 15 August through 15 October. After 15 October, migrating Indiana and northern long-eared bats are not expected to occur within the Plan Area. For Indiana bats to arrive at hibernacula, especially those farther from the Project, within the fall swarming and mating season (typically mid-August through mid-October), Indiana bats are expected to have passed through the Plan Area and surrounding vicinity by the end of September at the latest. For northern long-eared bats, the hibernation season in Illinois is estimated to begin by 1 November (USFWS 2014), indicating that individuals are expected to have passed through the Plan Area and surrounding vicinity by the middle of October at the latest. Additionally, northern long-eared bats swarm within 4.55 miles (7.32 km) of their roost tree (USFWS 2014a), indicating an overall low likelihood of swarming behavior in the Plan Area due to the lack of summer habitat. Additionally, average nightly temperatures typically begin to decline throughout September, constraining bat activity and inducing bats to enter hibernation (USFWS 2007).

A nighttime cut-in speed of 11.2 mph (5.0 m/s) when ambient temperature is above 50°F (10°C) based on a 10-minute rolling average during the fall migration season is expected to minimize take of Indiana and northern long-eared bats. It is conservatively estimated that the proposed curtailment strategy will reduce overall bat fatality, as well as Indiana and northern long-eared bat fatality at the Project, by at least 50%, although the actual reduction in mortality may be greater than 50%.

7.2.3 Mitigation for Direct and Indirect Mortality

As set forth in Section 6.4.2, PTWF is estimating take of 2.25 female Indiana bats and 1 female northern long-eared bat per year after implementation of the avoidance and minimization measures described in Sections 7.2.1 and 7.2.2 above, for a total take of 97 female Indiana bats and 43 female northern long-eared bats over the 43-year life of the Project. The potential take is expected to occur during the migratory season only, as no maternity colonies are known or assumed to be vulnerable to the Project.

PTWF has utilized the REA Model (USFWS 2013d) as a guide for determining an appropriate level of mitigation as well as a strategy to achieve the desired mitigation. PTWF has determined, through discussions with the Service and IDNR, that appropriate mitigation should account for the loss of 281female Indiana bats (direct mortality of 97 Indiana bats plus the loss of 184 prospective juveniles [see Section 6.4.3]), and that because of the Indiana bat's complex life-cycle and the importance of both summer and winter habitat to that life-cycle, should provide benefits to the Indiana bat population through improvements to winter habitat and restoration/enhancement of summer maternity habitat.

The proposed mitigation projects (described below) would compensate for 315 female Indiana bats, offsetting the direct take and impact of take of 281 female Indiana bats. This would be accomplished through a combination of winter mitigation (72 female Indiana bat credits) and summer habitat protection (242 female Indiana bat credits) based upon the REA model (USFWS 2013d). See below for details on these specific projects.

PTWF also utilized the REA Model (USFWS 2013d) for the northern long-eared bat. While it is understood that fecundity rates and other demographic factors likely differ between Indiana bats and northern long-eared bats, and between different regions within the range of a species, the Indiana bat REA model is currently the best available model for estimating the reproductive loss resulting from removal of females from the population. Due to a lack of a suitable species specific strategy for the newly proposed northern long-eared bat and a large number of similarities in habitat use between the northern long-eared bat and the Indiana bat (USFWS 2014), the mitigation proposed below would offset the direct take and impact of take of 125 female northern long-eared bats.

7.2.3.1 Winter Habitat Mitigation

In cases where a vulnerable population of Indiana bats is under imminent threat of human disturbance at a hibernaculum, the USFWS will accept gating as mitigation for the impact of take (USFWS 2012g). Through consultation with USFWS and IDNR regarding the impacts of the Project and the vulnerabilities of the regional Indiana bat population, PTWF has selected Griffiths Cave, located in Hardin County, as the proposed winter habitat mitigation site. Griffiths Cave had an estimated Indiana bat population in February 2013 of 2,150 individuals and 2 northern long-eared bat individuals (Bob Lindsay, IDNR, personal communication 2013) and is located in one of four counties in Illinois where WNS has been found. PTWF will provide hibernacula protection/enhancement measures through the installation of one gate, in order to preserve and secure the site and promote long-term use of the hibernaculum by Indiana bats. Securing the cave entrance may prevent or retard the inadvertent introduction by humans of WNS and other disease vectors that may threaten Indiana bats and northern long-eared bats in this hibernacula and region-wide. PTWF will develop a specific plan in cooperation with USFWS and IDNR for design and implementation of these protective measures (which could incorporate entrance protection as well as stabilization, depending upon the identified needs). PTWF will also work with USFWS and IDNR to develop a scope for a three-year follow-up study that will evaluate effectiveness of the measures implemented at the Griffiths Cave. The need for and priority of additional conservation measures that can be undertaken by others in the future may also be identified through this study. PTWF will endeavor to complete the gating project within one year after issuance of the ITP, such that this component of mitigation including the follow-up study will be complete within five years after issuance of the ITP.

In the case where a vulnerable population is under imminent threat, the USFWS (USFWS 2012g) assumes a gating project would avert a marginal baseline impact, equating to a loss of 1% of that vulnerable population. Increased survival of 1% is a benefit that the Service (USFWS 2012g) assumes has a high probability of accruing over the life of the cave gating project, provided the necessary baseline conditions for a cave gating project (vulnerable population and imminent threat) are in place. Therefore, based on the mitigation valuation system developed by the REA Model (USFWS 2013d), the Griffiths Cave gating project is assumed to equate to the minimum mitigation credit equal to at least 1% of the vulnerable population, plus the impact of that population. Based on the most recent winter census (2013), the number of Indiana bats vulnerable to human disturbance at Griffiths Cave was estimated at 2,150 bats (Rod McClanahan, U.S. Forest Service, pers, comm.). Therefore, the Griffiths Cave gating project will compensate for at least 21 female bats, or 1% of the total number of vulnerable bats prior to gating, plus the gained reproduction of 51 female pups, for a total mitigation credit of 72 female Indiana bats.

PTWF believes that the proposed mitigation is the most practicable means of mitigation available for the Project. The risk of take presented by Project operations is to migrating Indiana and northern long-eared bats, either coming from or returning to nearby hibernacula. Implementation of these measures will contribute to winter survival of both species in Griffiths Cave and have the most direct, beneficial impact on the number of Indiana and northern long-eared bats migrating through the Plan Area. It also will benefit a vulnerable Indiana bat population within the OCRU. Further, IDNR has successfully undertaken such measures at other locations in the past, and the private owner of Griffiths Cave is amenable to a project such as this including entering into an easement to permanently protect the cave, a significant factor in evaluating the practicability of this approach.

In addition to the Griffiths Cave gating project, PTWF will continue to seek additional cave/mine entrance gating or stabilization projects that would provide additional winter habitat mitigation. In the event that suitable projects are identified, PTWF will notify the Service and may elect to increase the relative proportion of winter versus summer habitat mitigation, but in any case PTWF will perform a minimum of 206 acres of summer habitat mitigation, as described in Section 7.2.3.2 below.

7.2.3.2 Summer Habitat Mitigation

As previously noted, summer maternity colonies of Indiana bats and northern long-eared bats are known to exist to the south of the Project, within the riparian area located along the Middle Fork of the Vermillion River. This element of Project mitigation is designed to provide enhanced habitat and connectivity of habitat to increase foraging area and potential roosting areas that would be expected to contribute to persistence of maternity colonies and ultimately juvenile survival.

Because the wooded habitats in this area are so severely degraded, it was assumed that forest restoration efforts (which include permanent protection as well) are equal in value to preservation measures. For summer habitat mitigation, PTWF is proposing to restore and permanently protect 157 acres of land within the Middle Fork Vermillion River corridor. The restoration would include planting and managing trees in areas which are currently used for cropland. Additionally, a total of 49 acres of currently wooded habitat within this corridor would be preserved. Using the REA model (USFWS 2013b), these 206 acres of permanently protected roosting and foraging habitat would provide mitigation for 242 female Indiana bats, by directly adding 72 adult females to the population, as well as the gained reproduction of 170 female Indiana bat pups. Because of the habitat similarities between Indiana bats and northern long-eared bats (USFWS 2014a), it is assumed that any habitat mitigation for Indiana bats will also provide habitat for northern long-eared bats. Additional native grass buffer zones will be planted along the edge of some of the restoration areas, in order to provide increased foraging opportunities for Indiana bats and decrease competition for foraging within the forest block.

In addition, PTWF proposes to incorporate up to 10 artificial roost trees comprised of BrandenBark[7] attached to utility pole structures in the restoration parcels, which have the potential to decrease the temporal lag that usually accompanies restoration projects prior to occupation. Unlike previous artificial roost structures, BrandenBark has been found to be utilized by northern long-eared bats and little brown bats, as well as by Indiana bat maternity colonies (Gumbert et al. 2013). It has been designed to mimic the naturally exfoliating bark of dead trees, including modifications to allow bats to grip and hang from the bark undersurface (Gumbert et al. 2013). The general design would be a group of 3-5 7.6 m (24.9 ft) telephone poles placed 1.5 m (4.9 ft) deep in the ground with a sheet of BrandenBark attached at the top of the pole with a gap allowing bats to access a space under the bark. These sites will be monitored for bat use during any year in which post-construction mortality monitoring is occurring at PTWF (Table 11) utilizing guano traps, exit counts, mist-netting, or acoustic monitoring. PTWF will prepare a detailed study plan in coordination with the USFWS prior to implementing the artificial roost study.

PTWF is working with local conservation entities, such as the Middle Fork Forest Preserve, to identify whether adjacent lands have been earmarked for conservation. A financial contribution would be made to acquire the appropriate acreage. Long-term management of the conservation property would be assigned to the applicable local conservation entity. The agreement between PTWF and the conservation entity will detail required actions or enhancements that will maintain habitat quality for the life of the Project, and additional funding will be provided to the conservation entity to fund the implementation and monitoring of these measures. PTWF will endeavor to identify and secure the required acreage and execute a conservation agreement with a local entity within six years after issuance of the ITP.

7.3 Mortality Monitoring and Reporting

A summary of the proposed monitoring program for Pioneer Trail is outlined in Table 11, with additional detail provided below.

Table 11. Pioneer Trail Monitoring Summary.

<table>
<tr><th>Survey Period</th><th>Survey Frequency</th><th>Trigger for Additional Monitoring</th><th>Monitoring</th></tr>
<tr><td>Spring (1 April to 15 May)*</td><td>First 2 years of operation post-ITP</td><td>If the lower 90% confidence interval estimates greater than 0.5 bat/season for either species</td><td rowspan="2">• 50 of the 94 turbines will be sampled weekly – random selection weighted to southern Project area
• Weekly search in randomized order
• 80% of sampled turbines will utilize road-and-pad method
• 20% of sampled turbines will utilize cleared 80 x 80 m plots</td></tr>
<tr><td>Fall (15 August to 15 October)*</td><td>First 2 years of operation post-ITP; every 5 years thereafter</td><td>If less restrictive minimization measures are adopted through adaptive management, monitoring will occur for the subsequent 2-year period, with the 5-year frequency resumed thereafter.</td></tr>
</table>

*From sunset to sunrise when ambient temperature is above 50°F (10°C) based on a 10-minute rolling average.

[7] http://copperheadconsulting.com/brandenbark

7.3.1 Background and Goals

A detailed post-construction monitoring plan has been developed for the Project to provide a means of monitoring and ensuring compliance with the take numbers estimated in this HCP and authorized in the ITP, and assessing the effectiveness of the HCP in meeting the biological objective of minimizing direct mortality to Indiana and northern long-eared bats set forth in Section 7.2.2 of this HCP. Included in the post-construction monitoring plan are standardized carcass searches, searcher efficiency trials, and carcass removal trials. The goals of the post-construction monitoring are to determine overall bat fatality rates from the Project, estimate Indiana and northern long-eared bat mortality at the species level, and evaluate the circumstances under which fatalities occur. Post-construction monitoring results will also provide triggers for adaptive management, as described in Section 7.4.

7.3.2 Species to be Monitored

The post-construction monitoring plan will address all bird and bat fatalities observed within the Plan Area. Based on the analysis provided in Section 6, Indiana and northern long-eared bat mortalities are expected to occur only rarely, if at all; therefore, the monitoring plan is designed to detect carcasses of all bird and bat species and calculate bat fatality estimates with enough precision to determine if the operational curtailment protocols are effective in reducing overall bat fatalities at the Project. The monitoring plan is also designed to enable comparison with other operating wind energy projects. Within the overall bat fatality estimates, estimates by species will be made, if possible, based on the number of carcasses detected.

Indiana and northern long-eared bat mortality will be estimated based on the percent composition of Indiana bat fatality (0.16%) and northern long-eared bat fatality (0.08%) of total bat fatality that has been calculated from the 2009 – 2011 studies at the Fowler Ridge Wind Farm. The Fowler Ridge take estimate was scaled to calculate the take estimate for Pioneer Trail (Section 6.4.2.1); therefore, the most appropriate initial method for evaluating compliance with this take estimate is to calculate estimated Indiana and northern long-eared bat mortality at Pioneer Trail based on the observed proportion of these species in the mortality population at Fowler Ridge.

Data collected during mortality monitoring at Pioneer Trail may produce a site-specific ratio of Indiana bat mortality to overall bat mortality and/or a site-specific ratio of northern long-eared bat mortality of overall bat mortality; if so, the site-specific ratio(s) will replace the Fowler Ridge ratio(s) for evaluation of ITP compliance at Pioneer Trail. In any given year, evaluation of ITP compliance will be calculated using the cumulative ratio produced from all available Pioneer Trail mortality data; however, until suitable Project data exist (i.e., an actual Indiana bat mortality and/or northern long-eared bat mortality is found in the Plan Area), the Fowler Ridge ratios will be used. The monitoring plan design will also allow for detection of Indiana bat or northern long-eared bat carcasses at each turbine. However, the entire area around each turbine will not be searched for carcasses. Such a study would require extensive ground surveys and considerable expense for the purposes of attempting to detect every single unlikely event. The 10 turbines at which full plots will be searched will provide a site-specific estimate of the number of carcasses which may be missed by road-and-pad searches at all other turbines.

7.3.3 Permits and Wildlife Handling Procedures

7.3.3.1 Permits

All necessary wildlife salvage/collection permits will be obtained from IDNR Division of Wildlife Resources and the Service to facilitate legal transport of injured animals and/or carcasses.

7.3.3.2 Wildlife Handling Procedures

All bat carcasses found will be labeled with a unique number, individually bagged, and retained in a freezer at the Pioneer Trail 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; however, mice purchased through a commercial source may be used as a surrogate. In the event that a carcass of an ESA- or state-listed species is found, PTWF 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. All bird carcasses will be left where found, but photographed for documentation and identification to the species level when possible.

7.3.4 Intensive Monitoring

7.3.4.1 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). PTWF'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 initial monitoring during the first two years of operation ("baseline monitoring") and follow-up monitoring conducted once every five years after the completion of the baseline monitoring period, for the life of the Project. Standardized carcass searches will be conducted during the spring (1 April to 15 May) and fall (15 August to 15 October) in the first two years of operations. If spring monitoring results confirm expected low risk (i.e., the lower 90% confidence interval estimates less than 0.5 bat/season) and if no adaptive management measures are implemented pursuant to Section 7.4, follow-up monitoring in subsequent years would occur during the fall migratory season only.

All monitoring periods will include searcher efficiency trials and carcass removal trials in addition to the standardized carcass searches. 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., weather, location). 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. (2007a) and the USFWS (2012h) Land-Based Wind Energy Guidelines 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.

7.3.4.1.1 Focus Species

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

7.3.4.1.2 Sample Size

Standardized carcass searches will be conducted at 50 of the 94 turbines weekly. This sample size optimizes field survey effort while maximizing expected confidence in the data and associated results. The 50 turbines to be sampled will be determined using a stratified random sampling approach with a weighted component; 50% of the sample turbines will be selected from the southern 25% of the Project area (closer to the Middle Fork of the Vermilion River Indiana bat and northern long-eared bat maternity colonies). This approach will meet the study goal of detecting and analyzing overall bat fatalities at the facility by providing sufficient sample size to support reliable data analysis and related interpretations and conclusions. It will also enable fatalities of all bat species to serve as a surrogate estimator from which Indiana and northern long-eared bat fatalities may be inferred based on the observed relative abundances of Indiana and northern long-eared bats to all bats killed at Fowler Ridge or from Pioneer if available (see Section 7.3.5.1), Due to the very low expected number of Indiana and northern long-eared bat fatalities at Pioneer Trail, designing the monitoring plan such that a representative estimate of site-wide bat fatality is available as a surrogate estimator of Indiana and northern long-eared bat fatality has greater potential to provide a more accurate estimate of fatality for these species than would a study designed specifically to survey turbines nearest to suitable Indiana or northern long-eared bat habitat, in a potentially futile attempt to detect fatalities of these species. Additionally, the weighted approach to selecting the sample turbines will provide increased coverage of turbines closer to known bat habitat, including both Indiana and northern long-eared bats.

7.3.4.1.3 Search Interval

The search interval will be once weekly for all turbines within the sample during the first two years of monitoring as well as during the follow-up monitoring every fifth year. 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 intensive monitoring is deemed necessary following initial data collection (i.e., carcass removal trials indicate that average carcass persistence is less than seven days) at the Plan Area, the search intervals will be modified accordingly. The Service's Land-Based Wind Energy Guidelines recommend that "carcass searching protocol should be adequate to answer applicable…questions at an appropriate level of precision to make general conclusions about the project" (USFWS 2012h). 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; Strickland et al. 2011), such that the added effort associated with more frequent intervals is not warranted.

7.3.4.2 Field Methods

7.3.4.2.1 Plot Size, Vegetation Mowing, Visibility Classes

During each monitoring period at 80% of the turbines sampled only the turbine pads and access roads out to 262 ft (80 m) from the turbine will be searched. This method targets the areas shown to support the highest searcher efficiency while greatly reducing the financial and logistical constraints associated with clearing and searching large study plots, enabling much broader sampling coverage of the facility.

At the remaining 20% of the turbines sampled, 262 ft x 262 ft (80 m x 80 m) plots will be cleared and searched using a full-coverage transect methodology. Several studies have indicated that the majority of bird and bat carcasses typically fall within 100 ft (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; USFWS 2010). This plot size will exceed one-half the maximum turbine rotor height of the Project turbines (246 ft [75 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.

Study turbines will remain assigned to either the pads-and-roads search group or the cleared plot search group throughout the entire search year. The subset of full-coverage turbines will provide a reference for estimating the number of fatalities that may fall outside the searched area at the other turbines. This mixed sampling methodology is consistent with other post-construction monitoring studies being conducted (e.g., Good et al. 2011) and will enable comparison of study results.

Each 262 ft x 262 ft (80 m x 80 m) search plot will be centered on a turbine location. Thirteen 20 ft (6-m) transects will be established in each plot for complete survey coverage. Vegetation will be mowed to a reasonable search height (< 5 inches [13 cm]) in each plot prior to the beginning of each study period to improve searcher efficiency. Searchers will notify PTWF staff when vegetation requires mowing throughout the study period to ensure vegetation does not hinder search results.

7.3.4.2.2 Timing and Duration

Standardized carcass searches will be conducted within the Plan Area for a total of six weeks in the spring (1 April to 15 May) and nine weeks during fall (15 August to 15 October). Carcass searches will be conducted during the first two years of Project operation after issuance of the ITP, and every fifth year thereafter for the life of the Project. Following two years of monitoring with no estimated Indiana or northern long-eared bat take in the spring (i.e., lower 90% confidence intervals of spring take estimates are not greater than 0.5 Indiana bats[or northern long-eared bats]/spring season), spring monitoring will be discontinued, and only fall monitoring will be conducted every five years.

7.3.4.2.3 Standardized Carcass Searches

Carcass searches will be conducted by qualified biologists, operating under applicable permits and experienced in conducting fatality search methods, including proper handling and reporting of carcasses. Searchers will be familiar with and able to accurately identify bird and bat species likely to be found in the Plan Area. Prior to initiation of survey work under the ITP, the Service will be provided information regarding the selected search team to indicate their qualifications for completing survey efforts. Any unknown bats or suspected Indiana or northern long-eared bats discovered during fatality searches will be sent to a qualified

USFWS-approved bat expert for positive identification. Bird carcasses will be photographed from several angles to provide the best chance of photographic identifications, and photos will be verified by a USFWS-approved bird expert for positive identification when possible. 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),
- Global positioning system (GPS) location,
- Distance and bearing to turbine,
- Substrate/ground cover conditions,
- Condition (intact, scavenged),
- Any notes on presumed cause of death, and
- Wind speeds and direction and general weather conditions for nights preceding search.

A digital picture of each detected carcass will be taken before the carcass is handled and removed. Bird carcasses will be documented in place and not removed. As previously mentioned, all bat carcasses will be labeled with a unique number, bagged, and stored frozen as needed for future studies (with a copy of the original data sheet) at the Pioneer Trail operations and maintenance building.

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

7.3.4.2.4 Searcher Efficiency and Carcass Removal Trials

Searcher efficiency trials will be used to estimate the percentage of all bat fatalities that are detected during the carcass searches. Similarly, carcass removal trials will be used to estimate the percentage of 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 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 searched areas (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. The number of trial carcasses used will depend on the number of carcasses available following initial carcass searches in the Plan Area, though surrogate carcasses (such as mice) may be used in order to achieve a sufficient sample size. Searcher efficiency and carcass removal trials will be limited to one spring and one fall trial each year to avoid attracting scavengers to the Plan Area 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, and distance and direction from turbine will be recorded. 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 the 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.

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, 6, 7, 10, 14, 20, and 30, when possible. The status of each trial carcass will be recorded throughout the trial.

7.3.4.3 Statistical Methods for Estimating Fatality Rates

The methodology for estimating overall 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 that 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 (2003) or Shoenfeld (2004) estimators, which tend towards negative biases, problematic. Therefore, maintaining the same biases and assumptions in estimating overall bat fatality at the Plan Area 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 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).

7.3.4.3.1 Mean Observed Number of Casualties (c)

The estimated mean observed number of bat 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 searched area or by maintenance personnel) will not be included in this calculation, nor in the estimated fatality rate.

7.3.4.3.2 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 that remained available during the trial (non-scavenged). Searcher efficiency will be calculated for each season and for all search methods (i.e., roads and pads, full plots).

7.3.4.3.3 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 the Plan Area. Mean carcass removal time (t) will represent the average length of time a planted carcass remained at the Plan Area 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. 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 sc 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 and for all search methods (i.e., roads and pads, full plots).

7.3.4.3.4 Search Area Adjustment (A)

Approximation of *A*, the adjustment for areas which were not searched, will be adapted from the Erickson et al. (2003) estimator, as modified by Young et al. (2009), to accommodate differences in carcass search study design (discussed in Section 7.3.4.2.1). For the Pioneer Trail fatality estimates, *A* will represent the adjustment for the proportion of carcasses which likely fell outside of the area searched. The value for *A* will be approximated using the following formula, or a variation thereof:

$$\mathrm{A} = \frac{\left(\frac{C_{RP}}{P_{RP} * S_{RP}}\right) + \left(\frac{C_{FP}}{P_{FP} * S_{FP}}\right)}{\left(\frac{C_{RP}}{P_{RP}}\right) + \left(\frac{C_{FP}}{P_{FP}}\right)}$$

where C_{RP} is the number of observed casualties on roads and pads, C_{FP} is the number of observed casualties on full plots, P_{RP} is the searcher efficiency on roads and pads, P_{FP} is the searcher efficiency on full plots, S_{RP} is the proportion of roads and pads searched across all study turbines, and S_{FP} is the proportion of full plots searched across all study turbines. For this study, $S_{RP} = 0.8$ and $S_{FP} = 0.2$, as only roads and pads will be searched at 80% of the study turbines and full plot searches will be conducted at the remaining 20% of the study turbines.

7.3.4.3.5 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:

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

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

7.3.4.3.6 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:

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

7.3.5 Data Analysis, Reporting and Consultation

7.3.5.1 Data Analysis

Analysis of data collected during the post-construction mortality monitoring will include spring and fall season fatality estimates for all bats to the taxonomic level where fatality estimates can be calculated (i.e., it is difficult to calculate representative fatality rates from small numbers of carcasses, so species- and genus-level fatality calculations may not be possible for some species/genera). To evaluate compliance with the ITP, Indiana bat and northern long-eared bat mortality will be estimated based on the percentage of Indiana bat mortality (0.16%) and northern long-eared bat mortality (0.08%) observed during studies at the Fowler Ridge Wind Farm, unless sufficient data are collected at Pioneer Trail to support calculation of site-specific ratios (i.e., an actual Indiana bat and/or northern long-eared bat carcass is found). In any given year, evaluation of ITP compliance will be calculated using the cumulative ratio produced from all available Pioneer Trail mortality data; however, until suitable Project data exist, the Fowler Ridge ratios will be used. Data analysis will be performed to assess fatality estimates by turbine location. Data will also be analyzed to determine the influence of factors such as date and location on bat fatality rates.

A variety of statistical tests may be applied to the data to analyze the patterns of fatality rates in relationship to species/genera, 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 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.

7.3.5.2 Reporting

PTWF will provide an annual mortality monitoring report to the Service following the completion of each year of post-construction monitoring. The report will include fatality estimates, data summaries, and assessment of correlations between fatality rates and potentially influential variables such as weather, location, turbine operation, etc. Fatalities will be expressed both in terms of fatalities/turbine/season and in terms of fatalities/MW/season, as recommended by the Service's Land-Based Wind Energy Guidelines (USFWS 2012h) 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, PTWF will promptly report fatalities of ESA-listed species or eagles to the Service. PTWF will report the discovery of any actual Indiana bat or northern long-eared bat fatalities to the Service within 48 hours of discovery. In the event that estimated Indiana or northern long-eared bat mortality exceeds the thresholds set forth in Section 7.4, adaptive management measures will be implemented as specified in Section 7.4, informed by the relevant variables identified in the fatality monitoring report. No violation of the ITP shall be deemed to have occurred unless Indiana bat mortality is estimated to be greater than 129 or northern long-eared bat mortality is estimated to be greater than 96 over the life of the project; however, adaptive management measures described in Section 7.4 will be triggered if more than 3 Indiana bats or 2 northern long-eared bats are estimated to have been taken in any given calendar year. Any adaptive management measures implemented shall be described in the annual fatality monitoring report.

7.4 Adaptive Management

Adaptive management is a process that will allow PTWF to adjust the minimization measures outlined in this conservation plan to reflect new information or changing conditions in order to reach a goal – in this case, minimization of take and conservation of the Indiana and northern long-eared bats, while minimizing effects on the operation of Pioneer Trail. PTWF will use adaptive management processes to minimize take related to the operation of Pioneer Trail and to promote the long-term survival of both the Indiana and northern long-eared bats.

Adaptive management will allow PTWF 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 mortality monitoring activities described in Section 7.3 and from other new research as it becomes available. Monitoring data will be analyzed to determine if the objectives of this HCP are being met. If the conservation measures are not producing the desired results, adjustments will be made to the HCP as necessary to achieve the biological objectives of this HCP. If post-construction mortality monitoring indicates that the conservation measures specified in this HCP exceed that necessary to achieve the biological objectives, adaptive management will enable PTWF to conservatively scale back conservation measures to reduce the impact on the Project's operations while still avoiding and minimizing direct mortality to the Indiana bat.

Adaptive management at Pioneer Trail will be implemented as described below. All references to a monitoring year shall mean one spring season (1 April through 15 May) and one fall season (15 August through 15 October) of monitoring. All cut-in speed limitations shall refer only to the period from sunset until sunrise when ambient temperature is above 50°F (10°C) based on a 10-minute rolling average during the spring and/or fall season, as indicated. Adaptive management measures are summarized in Table 12, and more fully described below.

Table 12. Pioneer Trail Adaptive Management Measures

Trigger for Adaptive Management	Action	Follow-up Actions
Estimated Indiana bat mortality >3 in a single year; OR estimated northern long-eared bat mortality >2 in a single year	Monitor for additional year	Assume adaptive management as described below if necessary.
Estimated Indiana bat mortality >3 each year following 2 years of monitoring; OR estimated northern long-eared bat mortality >2 each year following 2 years of monitoring.	Raise cut-in speed by 0.5 m/s	2 consecutive years of monitoring, with 5-year frequency resumed thereafter
Estimated Indiana bat mortality ≤ 2 each year following 2 years of monitoring; OR estimated northern long-eared bat mortality ≤ 1 each year following 2 years of monitoring	Lower cut-in speed by 0.5 m/s	2 consecutive years of monitoring, with 5-year frequency resumed thereafter

7.4.1 Further Increases in Cut-In Speeds

If, during the initial two years of baseline post-construction monitoring (see Section 7.3), estimated Indiana bat mortality averages greater than 3 bats/year or estimated northern long-eared bat mortality is greater than 2 bats/year, PTWF shall further raise turbine cut-in speeds. Cut-in speeds shall be raised from 11.2 mph (5.0 m/s) to 12.3 mph (5.5 m/s) during the fall season, if the estimated mortality occurred during the fall season only, or during the spring and fall seasons if any estimated Indiana or northern long-eared bat mortality is found during the spring season.

After an increase in cut-in speeds to 12.3 mph (5.5 m/s), mortality monitoring will be conducted at 50 of the 94 turbines (20% full plot, 80% road and pad) for two consecutive monitoring years following that increase to confirm that estimated Indiana bat mortality remains below 3 bats per year and estimated northern long-eared bat mortality remains below 2 bats each year.

In the event that estimated mortality exceeds 3 for the Indiana bat or 2 for the northern long-eared bat during follow-up mortality monitoring in any given year, then monitoring will continue for an additional year. If the average yearly mortality across the two years of monitoring exceeds 3 Indiana bats or 2 northern long-eared bats per year, cut-in speeds will be increased in increments of 1.1 mph (0.5 m/s), and mortality monitoring shall continue at 50 of the turbines (20% full plot, 80% road and pad) for at least two monitoring years following that increase, and thereafter until mortality searches result in an average yearly estimate of 3 or fewer Indiana bat mortalities and 2 or fewer northern long-eared bat mortalities.

7.4.2 Reductions in Cut-In Speeds

Following the initial two-year baseline post-construction mortality monitoring period, if the average Indiana bat mortality estimate is equal to or less than 2 Indiana bats per year for the entire Plan Area, and the combined northern long-eared bat mortality estimate is equal to or less than 1 northern long-eared bat per year for the entire Plan Area, then PTWF may reduce turbine cut-in speeds to 10.1 mph (4.5 m/s). Thereafter, and/or after any subsequent two-year monitoring period, if the cumulative estimated mortality remains at or below 2 in a given year for Indiana bats, and at or below 1 in a given year for northern long-eared bats, PTWF may reduce cut-in speeds by an additional 1.1 mph (0.5 m/s), or such smaller increment as PTWF deems appropriate in light of the mortality monitoring data. If at any time following a reduction in cut-in speeds mortality monitoring results in estimated Indiana bat mortality exceeding 2 per year or estimated northern long-eared bat mortality exceeding 1 per year, a second year of monitoring will be conducted. If the average yearly mortality across the two years of monitoring exceeds 2 Indiana bats per year or 1 northern long-eared bat per year, cut-in speeds will be increased in increments of 1.1 mph (0.5 m/s), and mortality monitoring shall continue at 50 of the turbines (20% full plot, 80% road and pad) for at least two monitoring years following that increase. This monitoring will continue at cut-in speeds below 5.0 m/s until mortality searches result in an average yearly estimate of 2 or fewer Indiana bat mortalities or 1 or fewer northern long-eared bat mortalities, or if adaptive management changes result in a cut-in speed of 5.0 m/s or greater, then mortality monitoring will be conducted until mortality searches result in an average yearly estimate of 3 or fewer Indiana bats or 2 or fewer northern long-eared bats.

7.4.3 Reporting

PTWF shall provide written notification to the Service prior to the implementation of any adaptive management measures set forth in this section. Annual mortality monitoring reports submitted in accordance with Section 7.3.5 of this HCP shall include a discussion of the effectiveness of the measures implemented.

8. Implementation of the HCP

As the permit holder, PTWF will have the authority and responsibility to implement decisions related to the ITP and the HCP. The HCP will be implemented through an Implementing Agreement (IA) (to be jointly developed between PTWF and the Service) entered into between PTWF and the Service. The IA defines the roles and responsibilities of PTWF regarding implementation of the HCP. The IA and the HCP are complementary to each other. The processes for addressing changed and unforeseen circumstances, amending the HCP, reviewing implementation of the HCP, and funding of the conservation measures included in the HCP are discussed in the HCP and/or the IA.

8.1 PTWF Commitments

For the duration of the ITP, PTWF will provide staff members and resources for the implementation of the HCP as described below.

8.1.1 HCP Administration

The PTWF Operations Manager will be designated by PTWF as the HCP coordinator with the task of overseeing the implementation of the HCP.

8.1.2 Implementation Schedule

Table 13 provides a schedule for implementation of the various conservation and mitigation measures. Note that additional conservation measures may be implemented, or above measures may be modified, through adaptive management as set forth in Section 7.4.

Table 13. Conservation and Mitigation Measure Implementation Schedule.

Conservation Measure	Implementation Schedule
Turbine Layout Modifications	Already implemented
Cut-in Speed Restrictions (11.2 mph [5.0 m/s])	Annually from 15 August – 15 October unless post-construction monitoring results indicate lifting or relaxation of such restrictions
Post-Construction Monitoring (Spring and Fall)	Years 1 and 2 post ITP
Post-Construction Monitoring (Fall only)	Every 5 years after Year 2 unless Year 1 and 2 data show the need for continued spring monitoring
Post-Construction Monitoring Reporting	Submitted to the Service by 31 December in monitoring years
Griffiths Cave Gating	Within 2 years of ITP issuance
Spring Migratory Survey at Griffiths Cave	Years 1, 2 and 3 following gate installation
Summer Habitat Mitigation	Within 8 years of ITP issuance
Artificial Roost Study	Years 1 and 2 post ITP; Every 5 years after Year 2
Program Review	Every 5 years following issuance of the permit

8.1.3 Implementation Costs

The avoidance, minimization, and monitoring measures identified in this HCP require a financial commitment on the part of PTWF to ensure that adequate funds are available for their implementation and maintenance. PTWF has met or will meet these commitments as described in the following sections.

8.1.3.1 Avoidance Measures

Avoidance measures implemented at the Pioneer Trail site consist of the relocation of two turbines that were planned within 1,000 ft (300 m) of woodlands with a direct connection to known Indiana bat and northern long-eared bat maternity habitat located approximately 2.5 miles (4.0 km) outside of the Plan Area. The cost of this modification due to reduction in the Project's power output is difficult to determine precisely, but the resulting impact on the Project power estimate has been accounted for in the economic models for the Project. No additional funding is required for this conservation measure.

8.1.3.2 Minimization Measures

Minimization measures implemented at PTWF consist of an increase in cut-in speeds from the designed 6.7 mph (3.0 m/s) to 11.2 mph (5.0 m/s) on nights during the fall migratory period (15 August through 15 October) when the ambient temperature is above 50°F (10°C) based on a 10-minute rolling average. This increase in cut-in speeds will reduce the annual power output of the Project and result in loss of revenues that PTWF would otherwise have expected to earn. However, as with the avoidance measures described above, this minimization measure does not require out-of-pocket expenditure by PTWF, and the economic model of the Project has been adjusted downward to account for the lost revenue.

8.1.3.3 Post-Construction Mortality Monitoring

PTWF will conduct post-construction mortality monitoring and reporting in accordance with the plan outlined in Section 7.3. Implementation of the monitoring plan is expected to cost approximately $150,000 per year for the first two years, and $80,000 per year for monitoring every five years following baseline monitoring completion. This incorporates costs associated with permits for wildlife handling, monitoring services, and data analysis. Reporting is estimated to require $10,000 during each monitoring year. PTWF will select qualified contractors to complete this work, with cost only a secondary factor. Costs, therefore, may be greater or lesser than identified here, depending upon seasonal, weather or other factors. PTWF has accounted for this cost in, and will fund the monitoring activities out of, the Project's annual operations budget. Prior to initiation of survey work under the ITP, the Service will be provided information regarding the selected search team to indicate their qualifications for completing survey efforts.

8.1.3.4 Mitigation Measures

Although final details have not yet been developed regarding the proposed mitigation, planning-level costs have been identified for the current mitigation strategy.

- Installation of one gate at Griffiths Cave – presumed cost of approximately $10,000 (including expenses, approvals and installation) = $10,000.

- Annual spring monitoring study at Griffiths Cave, conducted for three years – presumed cost of approximately $30,000 per year (including permits, field studies, and reporting) x 3 = $90,000.

- Acquire ownership or control of 206 acres of land located in proximity to the Middle Fork of the Vermillion River, and management and conservation payments – presumed purchase cost of $10,000/acre x 206 = $2,060,000. Assuming 157 acres will be targeted for restoration (tree planting) at an average cost of $1,600/acre, and 49 acres will be preserved/enhanced at an initial cost of $17,500, implementation of the summer mitigation is estimated at $2,328,700. Summer mitigation monitoring would be conducted in years 3 and 7 following completion of the habitat restoration, at a cost of $17,000 per year. Management and conservation payments are estimated at $8,000 per year for five years. These costs will be adjusted pending identification of specific land and development of a specific implementation strategy.

- Installation of up to 10 artificial bark roost trees within the restored parcels, at a cost of $4,000 each is assumed, with an additional cost of $20,000 per year for monitoring.

8.1.4 Funding

As indicated above, certain avoidance measures have already been implemented and require no funding. The principal minimization measure – raised cut-in speeds – does not require material out-of-pocket expense for implementation; rather, it reduces the amount of power and resulting revenues generated. Therefore, no discrete funding source is required. Funding is required for post-construction monitoring and mitigation activities however. The following **Table 14** summarizes the activities which require funding for implementation:

Table 14. Habitat Conservation Plan Implementation Budget for the Pioneer Trail Wind Farm[1].

Conservation Measure	Implementation Schedule	Annual Cost	Total Project Cost
Mortality Monitoring			
Baseline Post-Construction Monitoring (Fall)	Years 1, and 2 after ITP issuance	$140,000	$280,000
Follow-Up Post-Construction Monitoring (Fall only)	Every 5 years after baseline monitoring unless baseline data show the need for continued spring monitoring; every 2-year period following an adaptive management change	$80,000	At least $640,000 (9 events)
Post-Construction Monitoring Reporting	Submitted to the Service by 31 December in monitoring years	$10,000	At least $100,000 (10 events)
Winter Habitat Mitigation			
Griffiths Cave Gating Project	Year 1	$10,000	$10,000
Griffiths Cave Entrance Monitoring & Reporting	Three years	$30,000	$90,000

Conservation Measure	Implementation Schedule	Annual Cost	Total Project Cost
Summer Habitat Mitigation			
Summer Habitat Acquisition (206 acres)	157 acres restoration (tree planting) 49 acres preservation	$N/A	$2,060,000
Summer Habitat Restoration, Preservation & Maintenance	**Restoration (157 acres)** – Restoration activities will generally include site preparation followed by a combination of direct seeding, planting of seedlings, and planting of RPM (root preservation method) sized trees.	$1,600/ac	$251,200
	Artificial Roost Tree (10) – A total of 10 artificial roost trees will be installed in the 157 acres of restored summer habitat.	N/A	$40,000
	Preservation Implementation (206 acres) – Preservation will include Installation of boundary signs, fencing, gates, etc.	$N/A	$17,500
	Annual Maintenance (206 acres) – Exotic species control, tree care, mowing as appropriate to reduce competition of herbaceous weeds and invasive shrub establishment for the first five years following restoration.	$8,000	$40,000
Summer Mitigation Monitoring & Reporting	Includes 2 habitat surveys: one 3 years after restoration to check 70% survival rate; and one 7 years after restoration to check 70% survival rate and to document the presence of invasive species that may pose a threat to the establishment of Indiana bat habitat; specifically the presence of invasive shrub species. Tree density determinations will be based on sample plot counts. Surveys assume 157 acres will need to be surveyed (i.e., the restored acres). A summary report describing the restoration status of the site will be prepared following the two monitoring events. Cost includes survey time, travel expenses, report preparation, and project management. Cost based on 2014 estimate	$17,000	$34,000
	Monitoring and research will be conducted yearly for the first 3 years at the artificial roost trees, and subsequent monitoring will occur whenever post-construction monitoring at the Project is being conducted (minimum of once every five years) .	$20,000	$60,000
Changed Circumstances	See Section 8.2.2.	N/A	$1,000,000

NOTE: Costs are planning-level estimates only based on the specific scope and assumptions identified and are subject to change, including as a result of bids received from contractors through future RFP processes and other market factors.

As indicated in Table 14, the total cost for the monitoring and mitigation components of this HCP are anticipated to be approximately $3,622,700. Mitigation costs will be spread over the first 10-15 years of the permit term, depending upon availability of mitigation lands and opportunities, while monitoring and reporting costs will be spread out over the full 43-year permit term. The occurrence of any one or more changed circumstances, and the resulting need for, timing and cost of corrective actions necessitated thereby, is inherently uncertain. However, it is not anticipated that changed circumstances will be so frequent or extensive as to increase the cost for the monitoring and mitigation components by more than $1,000,000 (approximately 28% of the total monitoring/mitigation budget). Accordingly, PTWF has budgeted for a changed circumstances fund in the amount of $1,000,000.

It is anticipated that all of the budgeted costs reflected in Table 14, including costs associated with any changed circumstances, will be paid for out of PTWF's operations budget. In the event that PTWF was unable to meet its financial commitment for any reason, its corporate parent, E.ON Climate & Renewables North America (ECRNA), has sufficient resources to fund these measures. ECRNA is a subsidiary of E.ON AG, one of the world's largest energy companies and the largest investor-owned utility in the world. However, in order to provide the USFWS with additional financial security, PTWF will provide a Letter of Credit in the amount of $3,650,000 to assure the Service that all commitments of this HCP will be met. The Letter of Credit will renew on an annual basis, with the total amount reduced each year to reflect the estimated cost of the remaining financial commitment. However, to ensure that adequate funds will always remain available to address remaining commitments as well as any changed circumstances that may arise, the Letter of Credit will at all times remain at an amount no less than $1 million.

8.2 Unforeseen and Changed Circumstances

The HCP Assurances (No Surprises) Final Rule defined and clarified unforeseen circumstances and changed circumstances (63 FR 8859-8873). These two types of circumstances are key elements of the USFWS and National Marine Fisheries Service (jointly referred to as the Services) No Surprises Rule developed to provide ITP applicants with long-term economic and regulatory certainty. The differentiation between *unforeseen* and *changed* circumstances is important, because depending on the type of event that occurs, PTWF may or may not be responsible for implementing additional conservation measures.

Unforeseen circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan that could not reasonably have been anticipated by plan developers and the Services at the time of the conservation plan's negotiation and development, and that result in a substantial and adverse change in the status of a covered species (63 FR 8870-8871).

Changed circumstances means changes in circumstances affecting a species or geographic area covered by a conservation plan that can reasonably be anticipated by plan developers and the Services and that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events) (63 FR 8870).

8.2.1 Unforeseen Circumstances

If unforeseen circumstances arise, the Service will not require, without the consent of the permittee, the commitment of additional mitigation in the form of land, water, or funds nor will it require additional restrictions on the use of land, water, or funds from any permittee who is adequately implementing or has implemented an approved HCP (63 FR 8868). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, the Service may require additional measures of the permittee where the HCP is being properly implemented, but only if such measures are limited to modifications to the conservation measures set forth in the HCP. The assurances of the No Surprises regulations apply only “where the conservation plan is being properly implemented, and apply only with respect to species adequately covered by the conservation plan” (63 FR 8867).

If extraordinary circumstances occur that could have a significant negative effect on either Indiana bats, northern long-eared bats, or both, or could affect the ability of PTWF to effectively implement activities under this HCP, PTWF will discuss the unforeseen circumstance with USFWS personnel and other affected parties, as applicable. If the extraordinary circumstances warrant additional mitigation measures and PTWF is in compliance with its obligations under this HCP, any additional mitigation measures must be limited to modifications to the HCP’s operating conservation program for the Indiana and northern long-eared bats, maintaining the original terms of the HCP to the maximum extent possible. Unless agreed to by PTWF, additional mitigation measures will not involve the commitment of additional land, water, or financial compensation, will not impose additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the HCP, and will not impose new restrictions or financial compensation on PTWF’s activities or operations.

8.2.2 Changed Circumstances

PTWF and the Service anticipate that circumstances could change during the term of the ITP that could affect the ability of PTWF to properly implement the HCP. Events that could occur during the term of the HCP that are identified as changed circumstances are addressed below. Funding for corrective actions necessary to respond to changed circumstances is expected to be paid out of PTWF’s operations budget, but a sum of money sufficient to cover reasonably foreseeable changed circumstances (the “Changed Circumstances Fund”) has been accounted for in the Letter of Credit.

8.2.2.1 Listing of a New Species

Trigger

Listing of a currently unlisted species as federally endangered or threatened pursuant to the ESA after the ITP has been issued.

Response

PTWF will request that the Service make a determination as to whether there is a potential for incidental take of the newly listed species to occur while conducting activities covered by the HCP. If so, PTWF can choose to modify its operations in coordination with the Service to ensure that incidental take of the species will be unlikely to occur, and/or seek to include the newly listed species under the ITP

If PTWF requests ITP coverage for the newly listed species, it shall confer with the Service to determine if the conservation measures addressing the Indiana and northern long-eared bat are adequate for conservation of the newly listed species. If the existing measures are determined by the Service to be adequate, PTWF may request addition of the newly listed species to the ITP. If conservation of the newly listed species is not adequately assured by the existing HCP, then PTWF will coordinate further with the Service to develop and incorporate into a revised or supplementary HCP such additional conservation measures as may be necessary to support incidental take authorization. After appropriate changes, if any, have been made to the HCP, such additional NEPA and Section 7 consultation shall be undertaken by the Service as may be necessary to revise and/or reissue the ITP.

Note that some of the species most likely to be listed, such as the little brown bat, may be covered under the Regional MSHCP currently under development. Should conditions warrant and the MSHCP permit, PTWF may in the future seek incidental take authorization for such species under the framework of the Regional MSHCP rather than through modification of this HCP.

8.2.2.2 Delisting of a Species

If the Indiana bat, northern long-eared bat, or other listed species covered by this HCP (pursuant to 8.2.2.1) is delisted by the Service during the life of the ITP, requirements and restrictions under the ITP and conservation measures under this HCP may cease to be relevant for species protection

Trigger

Delisting of the Indiana bat, northern long-eared bat, or other listed species covered by this HCP (pursuant to Section 8.2.2.1).

Response

PTWF will coordinate with the Service to determine whether modification of this HCP and/or the terms and conditions of the ITP is appropriate, and further, whether coverage under the ITP is still warranted for the continued operation of Pioneer Trail.

8.2.2.3 Widespread Impact of White Nose Syndrome Within Ozark-Central Recovery Unit

WNS is a poorly understood infectious disease currently affecting hibernating bats in eastern North America. The condition is named for a distinctive white fungal (*Geomyces destructans*) growth around the muzzles and on the wings of affected animals. WNS was first identified in Howe Cave near Albany, New York in 2006. The disease spread rapidly and bats with WNS have been confirmed in 23 states[8] in the northeastern and mid-Atlantic regions in the U.S., as well five provinces[9] in eastern Canada (USFWS 2013d). The fungus *G. destructans* has been confirmed in three additional states.[10] The disease had been confirmed in at least 115 hibernacula by 2010, some of which are located more than 746 miles (1,200 km) from Howe Cave (Frick et al. 2010). As of 14 February, 2014, WNS has been confirmed in 12 counties (in Illinois, Missouri and Arkansas) and suspected in 10 other counties (in Iowa, Missouri and Arkansas) within the OCRU (USFWS 2014c). However, the widespread mortality associated with WNS in the eastern U.S.

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[8] New York, Vermont, New Hampshire, Maine, Massachusetts, Connecticut, Pennsylvania, New Jersey, Delaware, Ohio, West Virginia, Maryland, Virginia, Indiana, Kentucky, Tennessee, North Carolina, Missouri, Alabama, Georgia, Illinois, South Carolina, and Arkansas.

[9] Nova Scotia, New Brunswick, Quebec, Prince Edward Island and Ontario.

[10] Oklahoma, Iowa and Minnesota.

has not yet been observed in the OCRU; the Service has estimated that the OCRU's Indiana bat population increased by 1.1% from 2011 to 2013 (USFWS 2013b).

The fungus is directly associated with the deaths of bats (Puechmaille et al. 2010) and is widely considered to be the causal agent of WNS (USGS 2010). Loss of winter fat stores, pneumonia, and the disruption of hibernation and feeding cycles are associated with the death of infected bats. A recent study indicates that WNS mortality may result from the catastrophic disruption of wing-dependent physiological functions (including water balance, circulation, cutaneous respiration, thermoregulation, and flight) caused by *G. destructans* damage to wing tissue (Cryan et al. 2010). Infected hibernacula are experiencing annual population decreases ranging from 30% to 99%, with a mean of 73% throughout eastern North America. The Service currently estimates that WNS has killed more than 5.5 million bats in North America (USFWS 2012j). All hibernacula surveyed have become infected within two years of WNS arriving in their respective regions. WNS is causing unprecedented mortality among at least six species of hibernating bats (Frick et al. 2010), five of which may occur within the Plan Area: little brown bat, northern long-eared bat, Indiana bat, tri-colored bat, and big brown bat (USGS 2010). All 25 North American bat species which rely on hibernation may potentially be affected by WNS (USGS 2010). Resistance or decreased susceptibility to WNS does not appear to develop; survivors attempting to overwinter in contaminated sites may quickly become re-infected (Cameron 2010). In addition to extreme mortality, the disease may be further impacting bat populations by lowering the reproductive rates of surviving colony members (Frick et al. 2009). Overall, the cumulative effects from WNS are being monitoring closely by the Service and state conservation agencies (DNR/DOC). Should it be determined at some point in the future that WNS is causing widespread mortality within the OCRU, or local northern long-eared bat population, PTWF will continue to monitor the prevalence of WNS in the OCRU and will coordinate with the Service as necessary.

Trigger

The Service at some point in the future, through its monitoring efforts, reaches the conclusion that the spread of WNS has changed the circumstances of the Indiana bat population within the OCRU and/or the local population of northern long-eared bats.

Response

PTWF will evaluate data available from the Service and other sources to determine whether the likelihood of survival and recovery of the species (or both species) will be appreciably reduced by the authorized take as a result of the reduced population, and whether the impacts of the authorized take on the reduced population(s) of Indiana or northern long-eared bats has increased, such that additional minimization and mitigation measures are necessary to ensure that the approved measures remain proportional to the take. If additional measures are determined to be necessary, PTWF will consult with the Service to determine whether (a) incremental measures in cut-in speed in accordance with the adaptive management provisions of Section 7.4, or (b) additional summer or winter habitat mitigation, would be more efficacious and cost-effective. The effectiveness of the selected measures would be monitored in accordance with the relevant monitoring protocols set forth in this HCP.

8.2.2.4 Repowering/Extension of Project Operating Life

The Project is currently anticipated to operate for 43 years based on existing leases. However, PTWF could determine that additional operating life is desired and extend property leases.

Trigger

PTWF determines that additional operating life is desired and extends property leases

Response

PTWF will coordinate with the Service to determine whether modification of this HCP and/or the terms and conditions of the ITP is appropriate, and further, whether coverage under the ITP is still warranted for the continued operation of Pioneer Trail. A permit extension or renewal, if applicable, will be sought under the provisions outlined in Section 8.3.1.

8.2.2.5 Climate Change

Climate change refers to changes in the values or variability of states of the climate (e.g., temperature, precipitation, etc.) that can be statistically identified and persist for extended periods, typically decades or longer (IPCC 2007). Warming of the climate system is now considered unequivocal, based on observed increases in global average temperatures, widespread melting of snow and ice, and rising global average sea level (IPCC 2007). Carbon dioxide and other greenhouse gases released into the atmosphere by human activities are largely responsible for recent climate change (USEPA 2013a and IPCC 2007).

In the Midwest, average annual temperatures increased over the last several decades. Heat waves are becoming more frequent and cold periods are becoming rarer. Heavy downpours now occur twice as frequently as they did a century ago. Average summer temperatures are predicted to increase by 3°F (1.67°C) over the next few decades and could increase by over 10°F (5.56°C) by the end of the century (USEPA 2013b). Precipitation in the Midwest is likely to fall more frequently in heavy downpours, increasing the potential for flooding events. Between heavy rainfall events, there will likely be longer periods without precipitation. Combined with longer and more intense heat waves, these periods without rainfall are likely to result in more droughts in the Midwest (USEPA 2013b).

8.2.2.5.1 Climate change alters bat life history

The effects of climate change on wildlife are expected to vary widely. Species with certain traits, including: specialized habitat requirements, poor ability to disperse to a new range, dependence on specific environmental triggers for life history events, and dependence on inter-species interactions are more likely to be negatively affected by climate change (IUCN 2007). The Indiana and northern long-eared bat have specific requirements for maternity habitat and hibernacula and rely on environmental cues for spring dispersal and fall migration. Additionally, the Indiana bat is already a vulnerable endangered species that has several traits which may worsen the impacts of climate change effects, including a low reproductive rate and small population size (IUCN 2007), and the northern long-eared bat is proposed as an endangered species due to significant population declines from WNS (USFWS 2014). Climate change has been identified by the USFWS as an anthropogenic factor that may affect the continued existence of Indiana bats (USFWS 2009) and northern long-eared bats (USFWS 2013a). Warmer temperatures or changes in regional weather patterns may alter the spring and fall dispersal and migration periods. Parmesan and Yohe (2003) demonstrated that even 10 years ago, 62% of the species available for review (n=677) already indicated trends of life history event timing, such as migration and dispersal, occurring earlier in the year than expected from climate change. There was a mean shift towards earlier timing of 2.3 days per decade.

Trigger

A USFWS-wide announcement through a public medium (e.g., Endangered Species website, regional or field office website, five-year status review of the Indiana bat, etc.) of a shift in the Indiana bat and/or northern long-eared bat dispersal and migration periods would trigger corrective action.

Response

PTWF has committed to increasing turbine cut-in speeds from the designed 7.8 mph (3.5 m/s) to 11.2 mph (5.0 m/s) on nights when the 10-minute rolling average ambient temperature is above 50°F (10°C) during the current Indiana and northern long-eared bat fall migration period in Illinois (15 August through 15 October). If the changed circumstance trigger is met, PTWF will modify the timing of operational restrictions such that they are implemented for the duration of the new Indiana or northern long-eared bat fall migration period in Indiana. Changes to the operational protocol will take effect in the first fall migration season after the USFWS announcement is made.

Warmer temperatures or changes in regional weather patterns may cause the range of either or both species to shift in response to prey distributions, habitat suitability, or other factors. Evidence from a wide range of species shows that recent warming is strongly affecting terrestrial biological systems, including upward shifts in species ranges (IPCC 2007). Parmesan and Yohe (2003) also assessed species for range shifts associated with climate change; of the 434 species appropriate for review 10 years ago, 80% demonstrated range shifts northward as expected from climate change. The analysis showed that the range limits had shifted northward at an average rate of 3.4 miles (6.1 km) per decade. Climate change models have predicted a northern expansion of the hibernation range of the little brown bat; the USFWS considers it likely that modeling for Indiana bat range shifts would have a similar prediction (USFWS 2009), which may also result in a range shift for the northern long-eared bat.

Trigger

A USFWS announcement through a public medium (e.g., Endangered Species website, regional or field office website, five-year status review, etc.) of a shift in the Indiana bat range and/or northern long-eared bat range would trigger corrective action.

Response

A USFWS-announced shift in the range or either the Indiana or northern long-eared bat would prompt thorough review by PTWF to evaluate the location of the Project and the mitigation projects relative to the new range(s). If either species' new range excludes the location of the summer or winter habitat mitigation project, mitigation efforts at the current site will be suspended and PTWF will attempt to identify a new location for the mitigation project within the new range(s). PTWF will implement the mitigation at the new site within five years of the USFWS announcement. If either species' new range excludes the Project location, PTWF will consult with USFWS regarding termination or modification of the ITP and/or the operational protocol and mitigation projects set forth in this HCP.

More than two dispersal or migration period shifts and more than one range shift triggering corrective action during the 43-year ITP Term will be considered unforeseen circumstances, based on the average rates of species responses to climate change thus far (Parmesan and

Yohe 2003). Corrective actions for such unforeseen circumstances will be consistent with ITP obligations.

8.2.2.5.2 Climate change affects mitigation projects

Climate change may impact the effectiveness of the mitigation measures proposed in Section 7.2.3 by increasing the frequency and magnitude of natural disasters above historic patterns (see Section 8.2.2.6, below). As described above, climate change is expected to increase the frequency and severity of droughts, consequently also increasing the potential for wildfires (IPCC 2007). Heavy precipitation events are expected to continue to increase and become more severe, making floods more likely (IPCC 2007); in particular, winters and springs in Illinois are expected to become wetter. Climate change may also result in more frequent and more violent severe weather episodes, including thunderstorms and tornadoes. However, there is currently insufficient evidence to determine whether trends associated with climate change exist in small-scale phenomena such as tornadoes, hail, lightning, and other storms (IPCC 2007). The influence of climate change on the frequency and magnitude of natural disasters impacting mitigation efforts cannot be predicted. However, the triggers and management responses described for each foreseeable natural disaster below are based on the effects of the natural disaster and will therefore accommodate more frequent (to a practicable degree) or more severe events resulting from climate change.

8.2.2.6 Natural Disasters

8.2.2.6.1 Drought

Drought is a deficiency in precipitation over an extended period of time. It is a normal, recurrent feature of climate that occurs in nearly all climate zones. Drought may develop quickly due to extreme heat and/or wind or more gradually due to more subtle climate changes that persist over a long period of time. The duration of droughts varies widely; drought may last for a relatively short period of time or span multiple years or even decades (NWS 2012). Drought is difficult to measure due to the wide variety of disciplines affected by drought and the diversity of its geographical and temporal scales. Two indices are primarily used to measure drought in the U.S.: the Palmer drought index (PDI) and the Standardized Precipitation Index (SPI). The PDI is comprised of water balance indices that consider water supply, demand, and loss. The SPI is a probability index that considers only precipitation. Both indices are negative for drought and positive for wet conditions, increasing in scale with the severity of the conditions (NCDC 2012). The U.S. Drought Monitor (http://www.droughtmonitor.unl.edu/ monitor.html) provides a map of weekly drought condition data from across the U.S., ranked in intensity from Abnormally Dry (D1) to Drought - Exceptional (D4).

A study of the historic drought patterns and projected future climate in Indiana and Illinois identified eight major drought spells between 1916 and 2007: 1916-21, 1934-36, 1940-45, 1953-57, 1960-66, 1971-72, 1976-77, and 1987-89 (Mishra et al. 2010). Within this time period, 20 years with Extreme (D3) to Exceptional (D4) drought conditions were identified. Meteorological drought of Extreme (D3) or Exceptional (D4) intensity was found to have been in effect during about 12.5% of the early-century (1916-1945) and mid-century (1946-1975) 30-year periods, decreasing to about 11.3% of the late-century (1976-2007) 30-year period. Results of Mishra et al.'s (2010) large-scale hydrology model indicated that although droughts are a common phenomenon in Illinois, the state has been experiencing reduced extreme and exceptional droughts with lesser geographic extent in recent decades. This pattern was attributed to the observed increase in total and extreme precipitation in most of Illinois in recent years. However, 2012 was characterized by large areas of the U.S., including Illinois, experiencing dry and very warm weather that persisted for much of the year and hit record extremes. Across the state, Illinois's nine-month SPI values for March-November 2012 ranged from extremely dry (-1.99 to -1.60) to abnormally dry (-0.79 to -0.51) (NCDC 2013).

Although droughts often cause increased tree mortality and can result in increases in snag density, which may improve roosting habitat available to Indiana and northern long-eared bats, severe or prolonged droughts can cause extreme tree mortality and result in unsuitable habitat for both species of bats.

Trigger

Negative impacts of drought on the summer habitat mitigation project would trigger corrective action if during or immediately following (same season) an Extreme (D3) to Exceptional (D4) drought as determined by the U.S. Drought Monitor (http://www.droughtmonitor.unl.edu/monitor.html) the mitigation metrics (e.g., tree density, snag size-class density metrics, understory composition, etc.) are >25% below the target values.

Response

Within one year of the end of a drought triggering corrective action, one or more of the following restoration actions will be taken, depending on the mitigation metric(s) affected by the drought:

- Tree planting in areas where the tree density is >25% below the mitigation metric target value,
- Tree girdling in areas where the snag density is >25% below the mitigation metric target value (this will be done on a size-class specific basis), and
- Non-native woody invasive species control in areas where the native understory composition is >25% below the mitigation metric target value.

Effective restoration actions cannot be implemented until after the drought is over. Prolonged drought lasting beyond the 43-year ITP Term will constitute an unforeseen circumstance. Additionally, Extreme (D3) or Exceptional (D4) intensity droughts occurring during more than 15% of the 43-year ITP Term will be considered unforeseen circumstances based on the historic and projected patterns of droughts in Illinois (Mishra et al. 2010). Response actions for such unforeseen circumstances will be consistent with existing ITP obligations.

8.2.2.6.2 Fire

Fire is a naturally occurring component of most ecosystems although the frequency and severity of fire regimes varies greatly. In the Midwest, historical fire regimes differed based on land cover: forested areas were ruled by low severity or mixed severity fires occurring with a zero to 35 year frequency while the prairie plains were ruled by stand replacement severity fires occurring with a zero to 35 year frequency (FFS 2000a). Throughout grasslands in southern, central, and eastern Illinois, the historical fire regime was dominated by low severity fires that occurred with zero to 35 year frequency. Fire regimes in the western and northeastern areas of the state consisted of stand replacement severity fires that occurred with a zero to 35 year frequency. Small areas of historical mixed severity, 35 to 100+ year frequency fire regimes are also scattered across the state. Currently, most of Illinois is classified as agricultural and non-vegetated areas (FFS 2000b). The fragments of forested or grassland habitat in the state are mostly classified as having fire regimes that have been moderately to significantly altered from their historical range. These classifications (Condition Class 2 and 3) indicate that fire frequencies have departed from historical frequencies and landscape patterns and vegetation attributes have been altered from their historical range. Consequently, there is a moderate to high risk of losing key ecosystem components in these areas and fire size, intensity, and severity patterns have changed (Schmidt et al. 2002).

Human-caused wildfires have been a regular disturbance factor in Illinois's ecosystem for centuries (Yates 2011). Studies of tree rings in southern Illinois indicate that Native Americans burned forests in the region nearly every year, with most areas burned on a two or three year cycle. This repeated burning stabilized the prairies and open woodlands that historically dominated the region. As settlers rapidly colonized the area, fires were suppressed; however, settlements eventually adopted a tradition of localized burning of woodlots to enhance forage quality for livestock, improve visibility for hunting, and reduce the amount of flammable material in the understory. Currently, most wildfires in Illinois are caused by carelessly tended brushpile fires, garden fires, campfires, and other flame sources (e.g., welding/grinding machinery, hot vehicle undercarriages, cigarettes, etc.) (IDNR 2012). Lightning strikes or other natural causes account for very few wildfires in Illinois (FFS 1999). Drought conditions have the potential to increase the frequency and severity of wildfires in Illinois (IDNR 2012).

Although wildfires often cause increased tree mortality and can result in increases in snag density, which may improve roosting habitat available to Indiana and northern long-eared bats, severe wildfires can cause extreme tree mortality and result in unsuitable habitat for both species of bats.

Trigger

A wildfire that physically impacts the summer mitigation project would trigger corrective action if immediately following (same season) the wildfire, the mitigation metrics (e.g., tree density, snag size-class density metrics, understory composition, etc.) are >25% below the target values.

Response

Within one year of the end of a wildfire triggering corrective action, one or more of the following restoration actions will be taken, depending on the mitigation metric(s) affected by the wildfire:

- Tree planting in areas where the tree density is >25% below the mitigation metric target value,
- Tree girdling in areas where the snag density is >25% below the mitigation metric target value (this will be done on a size-class specific basis), and
- Non-native woody invasive species control in areas where the native understory composition is >25% below the mitigation metric target value.

Fires determined to be caused by arson will constitute an unforeseen circumstance. Additionally, more than three wildfires triggering corrective action during the 43-year ITP Term will be considered unforeseen circumstances based on the historic pattern of wildfire frequency and severity in Illinois (FFS 2000a). Response actions for such unforeseen circumstances will be consistent with existing ITP obligations.

8.2.2.6.3 Flood

Flooding is a major, recurrent disturbance in Illinois (State of Illinois 2010). Illinois has the largest inland system of river, lakes, and streams in the U.S., and consequently flooding is a common occurrence in the state, particularly during the spring and summer months (FEMA 2011). Flood damage is often exacerbated by snow melt and spring rains which create excessive stormwater runoff (State of Illinois 2010). The paving-over of permeable soils and the fact the most stormwater drainage systems are only designed for 10-year storm events increases both rural and urban runoff problems. Although measures have been taken in many jurisdictions to control the flood stages of rivers by constructing levees, flood gates, installing inlet control values, etc., these measures are still needed in many areas and can be prone to failure under severe flooding conditions, especially if not maintained.

Between 1957 and 2009, Illinois experienced 35 federally declared flood disasters (State of Illinois 2010). Between 2006 and 2011 alone, Illinois experienced seven federally declared flood disasters. Since 1981, 99 of Illinois' 102 counties have been federally declared as major disaster areas due to flooding. Most of the counties in recent flood disaster declarations have an extensive history of repetitive flooding. History supports the assumption that all counties in Illinois are susceptible to some type of flooding; on average, 10% of the area within Illinois is within a 100-year floodplain. During the Great Midwest Flood of 1993, Illinois suffered widespread flood devastation; the 2008 flood event caused the most damage in the state's recorded history (FEMA 2011). The National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA) maintains a database of all storm events, including flooding, by county.

Trigger

Negative impacts of flooding on the summer habitat mitigation project would trigger corrective action if immediately following (same season) a flood event documented by the NCDC the mitigation metrics (e.g., tree density, snag size-class density metrics, understory composition, etc.) are >25% below the target values.

Response

Within one year of the end of a flood event triggering corrective action, one or more of the following restoration actions will be taken, depending on the mitigation metric(s) affected by the flooding:

- Tree planting in areas where the tree density is >25% below the mitigation metric target value,
- Tree girdling in areas where the snag density is >25% below the mitigation metric target value (this will be done on a size-class specific basis), and

Non-native woody invasive species control in areas where the native understory composition is >25% below the mitigation metric target value.

8.2.2.6.4 Tornadoes

Tornadoes are a frequent severe weather event throughout Illinois (State of Illinois 2010). All of Illinois is susceptible to tornadoes; counties in the north, south, east, west, and central areas of the state have been hit by tornadoes. The greatest frequency of tornadoes in Illinois occurs in a wide band from Madison and St. Clair counties northeastward to Lake and Cook counties. Tornadoes are more likely to occur between 3:00pm and 7:00pm during April, May, and June; however, tornadoes may occur at any time and during any month in Illinois. Officially, there have been 2, 047 tornadoes in Illinois from 1950 to 2009 and the state has averaged 37 tornadoes per year. Counties in Illinois ranged from 0.05 to 1.69 tornadoes per year on average between 1950 and 2009. Data for the 59-year period between 1950 and 2009 indicate that nearly 74% of the tornadoes in Illinois were rated as weak tornadoes (EF0/EF1 on the Enhanced Fujita damage-based scale), 24% were rated as strong tornadoes (EF2/EF3), and 2% were rated as violent tornadoes (EF4/EF5). Weak tornadoes in Illinois are typically 100 yards (91 m) wide with a path length of one to two miles (1.6 to 3.2 km), strong tornadoes are usually ¼ to ½ mile (0.4 to 0.8 km) wide with a path length of up to 20 miles (38 km), and violent tornadoes are typically close to one mile (1.6 km) wide with a path length greater than 20 miles (38 km). Between 1957 and 2009, Illinois experienced 17 federally declared tornado disasters (State of Illinois 2010). The NCDC includes tornadoes in its database of all storm events by county.

Trigger

A tornado that physically impacts the summer mitigation project would trigger corrective action if immediately following (same season) a tornado documented by the NCDC in the vicinity of the summer mitigation area the mitigation metrics (e.g., tree density, snag size-class density metrics, understory composition, etc.) are >25% below the target values.

Response

Within one year of the end of a tornado triggering corrective action, one or more of the following restoration actions will be taken, depending on the mitigation metric(s) affected by the tornado:

- Tree planting in areas where the tree density is >25% below the mitigation metric target value,
- Tree girdling in areas where the snag density is >25% below the mitigation metric target value (this will be done on a size-class specific basis), and
- Non-native woody invasive species control in areas where the native understory composition is >25% below the mitigation metric target value.

More than six tornados triggering corrective action during the 43-year ITP Term will be considered unforeseen circumstances based on the historic pattern of tornadoes in Illinois (State of Illinois 2010). Response actions for such unforeseen circumstances will be consistent with existing ITP obligations.

8.3 Permit Renewal and Amendments

8.3.1 Permit Extension/Renewal

When the ITP expires or when all authorized take has occurred, PTWF will no longer be protected from take that may occur as a result of the operation of Pioneer Trail (provided that the Indiana bat and/or northern long-eared bat are still listed at the expiration of the permit). At that time, PTWF may apply for an extension or renewal of the ITP. If a written request for ITP renewal is on file with the issuing USFWS office at least 30 days prior to the permit's expiration, the permit will remain valid while the renewal is being processed, provided the existing permit is renewable (50 CFR 13.22). The renewal request must (USFWS and NOAA 1996):

- Be in writing;
- Reference the permit number;
- Certify that the statements and information in the original application are still correct or include a list of changes;
- Provide specific information concerning what take has occurred under the existing permit and what portions of the Project are still to be completed. Additional information that may be provided if appropriate, includes conservation measures to be added to, or eliminated from, the HCP; and
- Request renewal.

The permit becomes invalid after the expiration date if the permittee fails to file a renewal request 30 days prior to permit expiration. Extension or renewal of the permit constitutes extension of the HCP and this agreement for the agreed-upon time, subject to any modifications that the Service may require at the time of extension.

8.3.2 Amendments

PTWF may request an amendment to this HCP by submitting a signed letter to the Service referencing the ITP permit number along with a $25 fee. The amendment request shall explain the specific amendment requested and provide the basis for same, along with appropriate supporting documentation. The Service shall process the amendment request in the same manner as the original HCP; provided, however, that additional NEPA review or modifications to the IA shall be necessary only if and to the extent that the amendment involves an issue or action that was not addressed in the original NEPA analysis or IA, respectively. If the circumstances necessitating the amendment were addressed in the original documents then only amendment of the ITP itself shall be necessary.

8.4 Enforcement

The provisions of this HCP are enforceable under the terms and conditions set forth in the IA and the ITP issued by the Service.

8.5 Suspension/Revocation

The Service may suspend or revoke all or part of the privileges authorized by the ITP if the permittee does not comply with the conditions of the permit or with applicable laws and regulations governing the permitted activity. Suspension or revocation of the ITP, in whole or in part, by the Service shall be in accordance with 50 CFR 13.27-29, as may be amended over time, and with the IA.

9. List of Preparers

This document was prepared in consultation with the USFWS. The following companies and key individuals contributed to its preparation.

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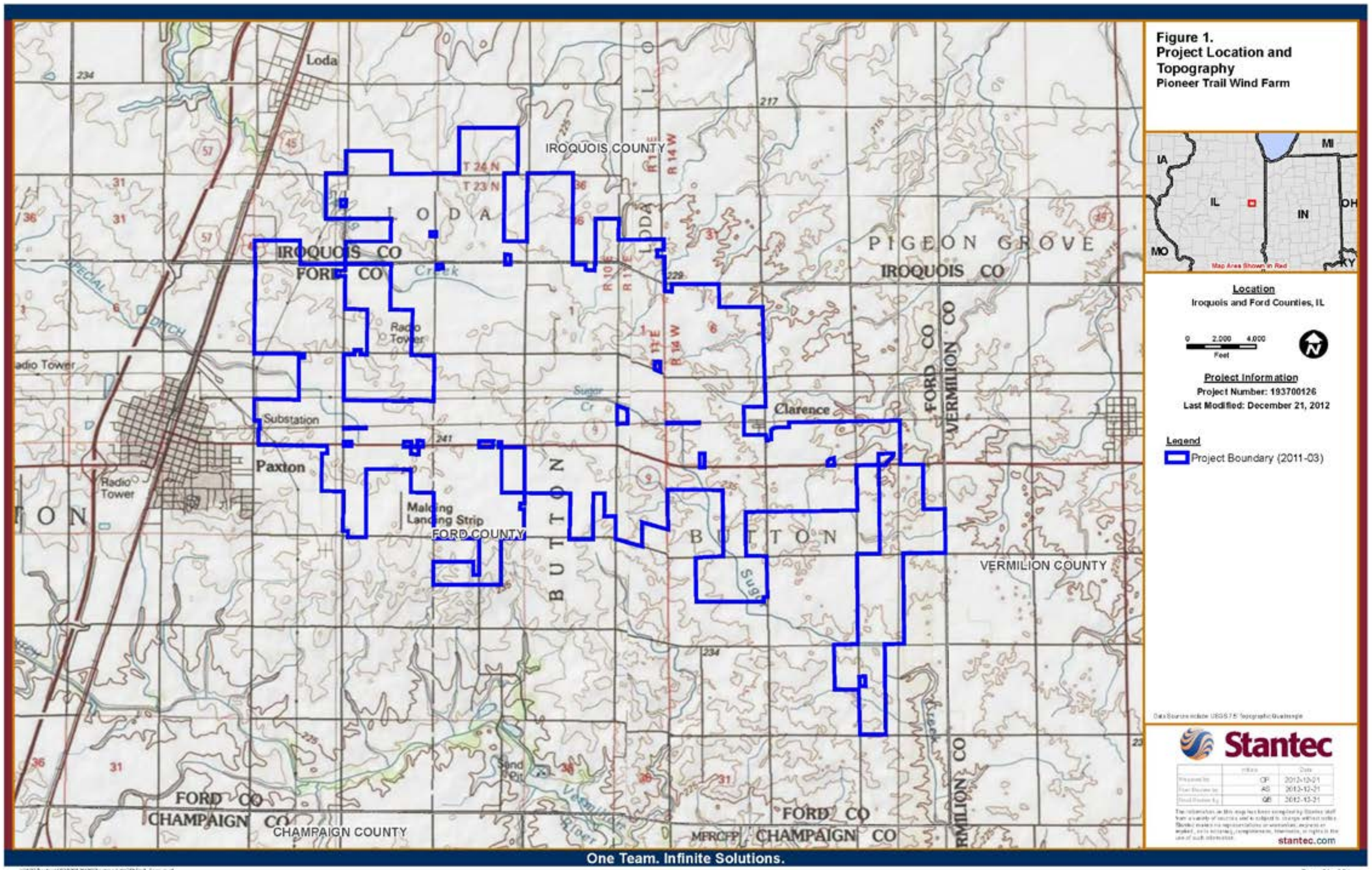

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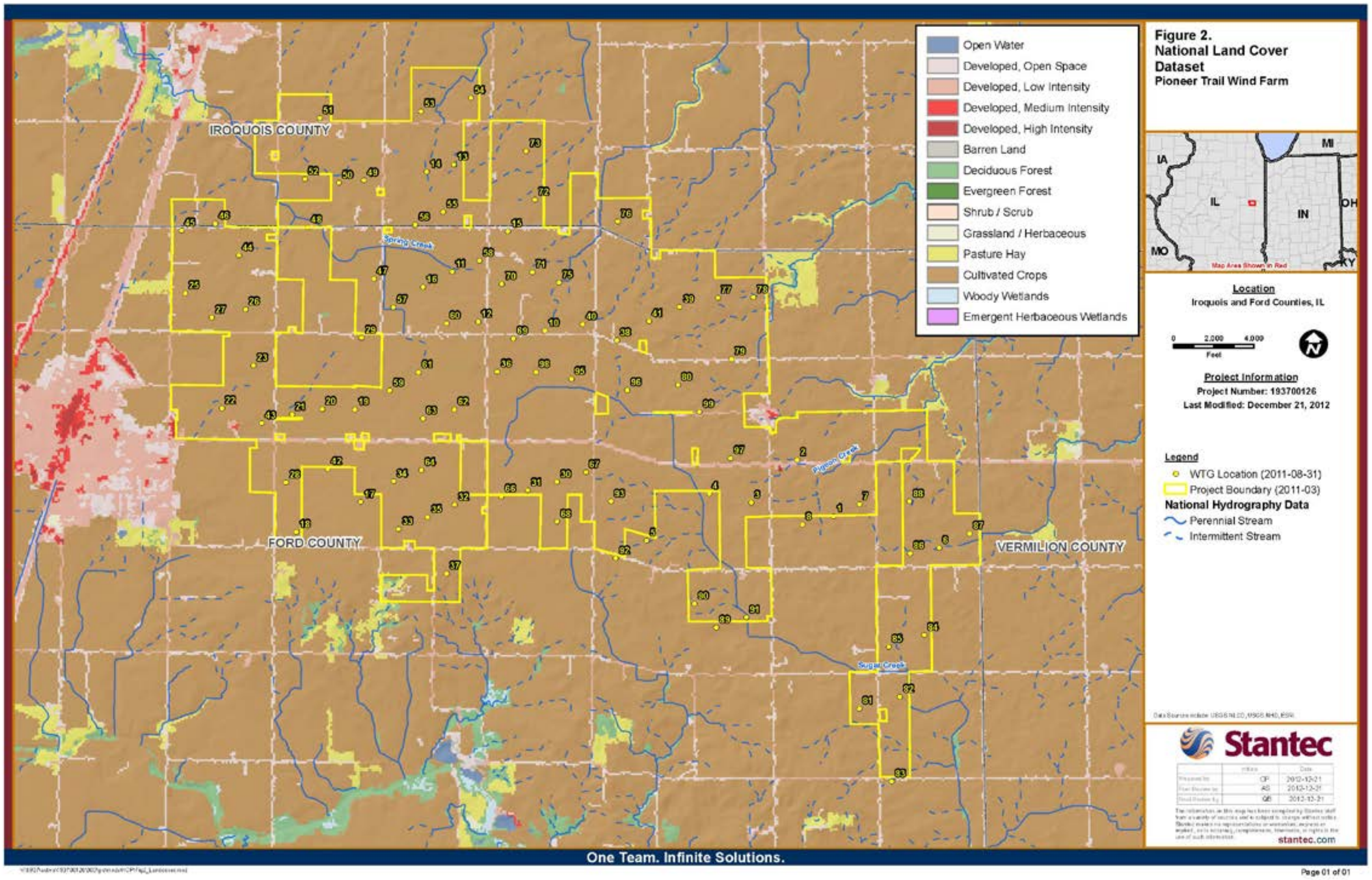

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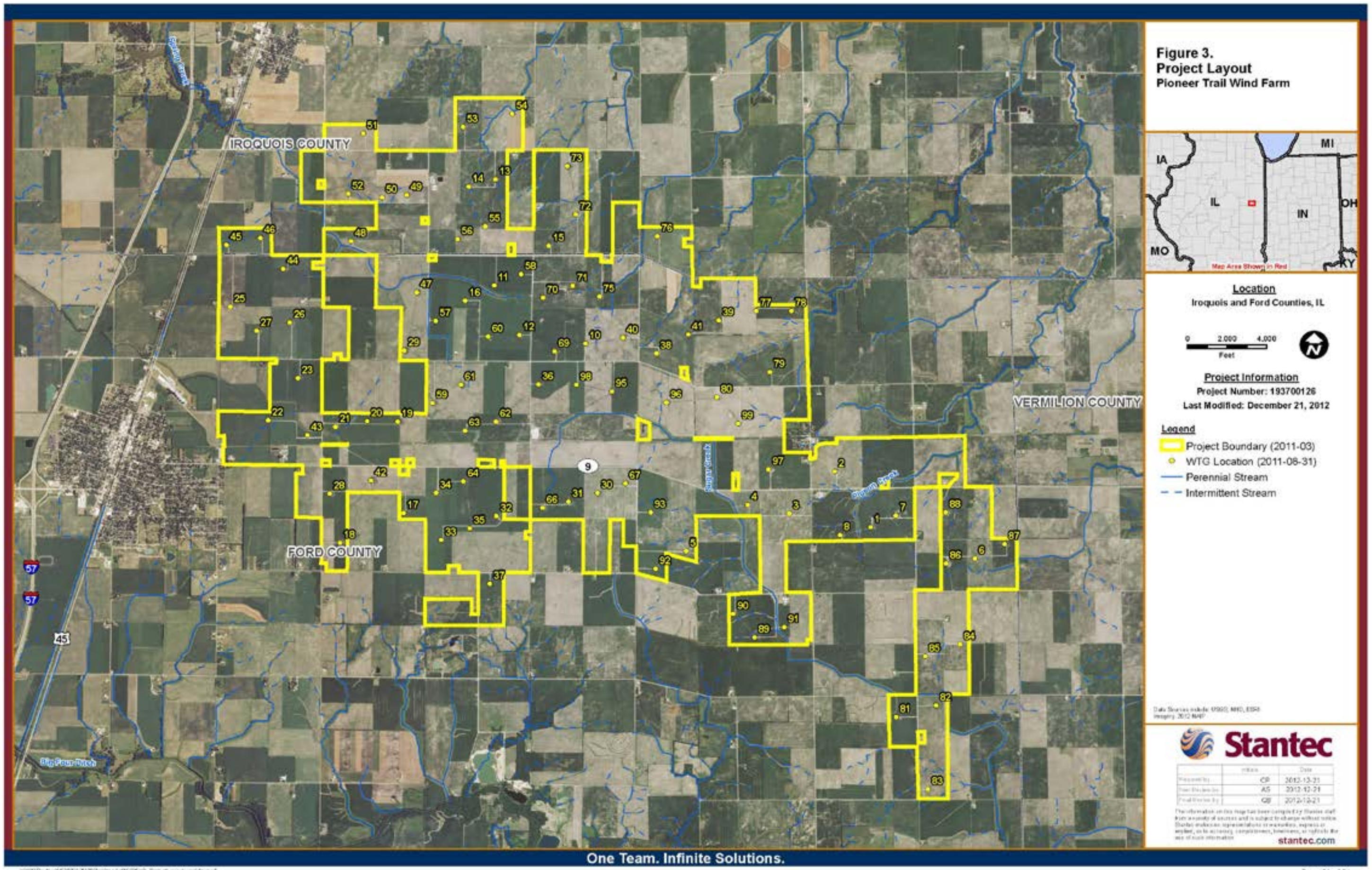

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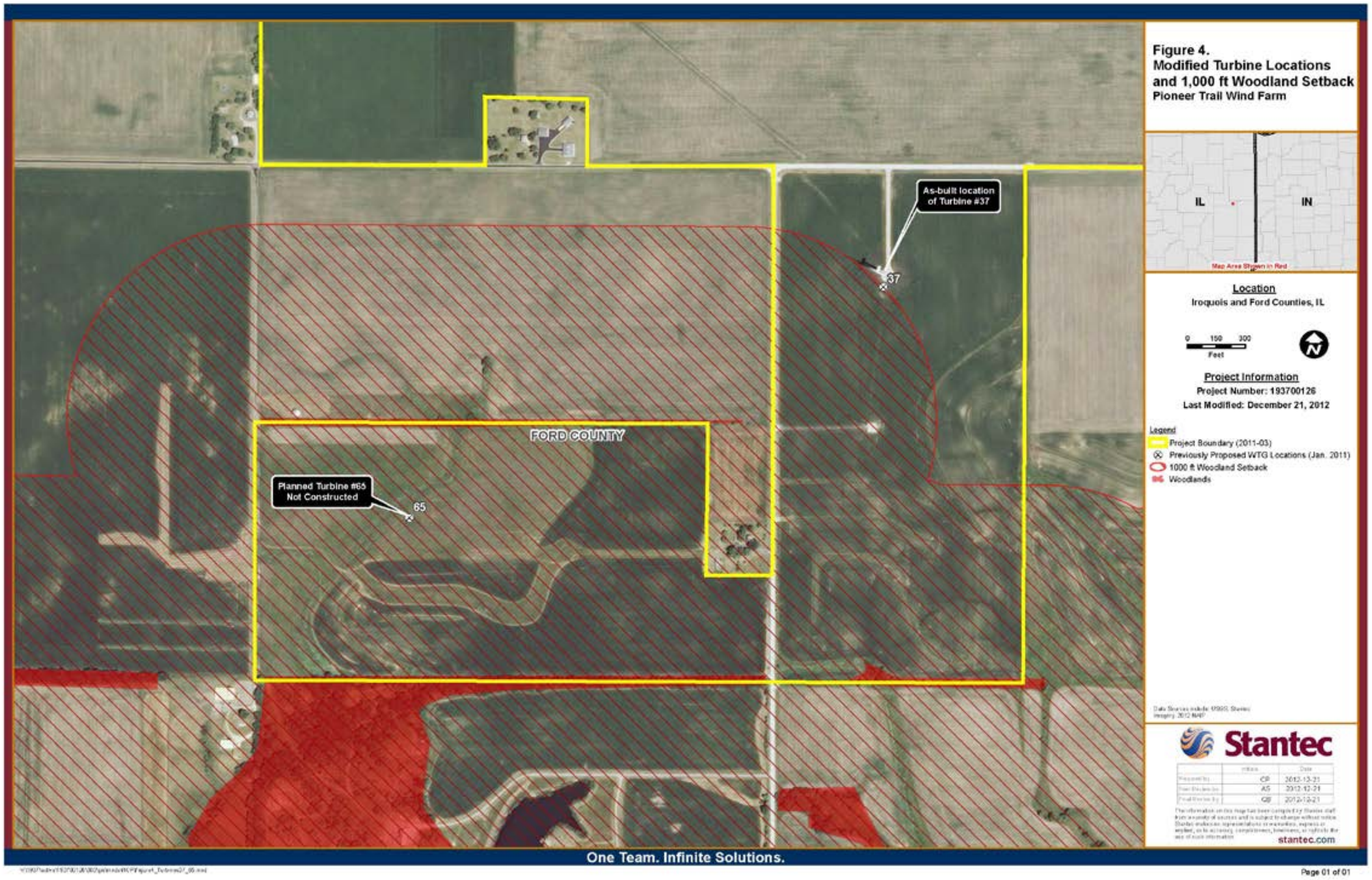

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APPENDIX A

Bat Screening Analysis and Pre-Construction Bat Survey, Pioneer Trail Wind Farm Iroquois and Ford Counties, Illinois

BAT SCREENING ANALYSIS AND PRE-CONSTRUCTION BAT SURVEY

PIONEER TRAIL WIND FARM
IROQUOIS AND FORD COUNTIES, ILLINOIS

Project No. 193700126
January 2011

PREPARED FOR:

E.ON Climate and Renewables
c/o ARCADIS U.S., Inc.
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1.0 INTRODUCTION

Wind energy is one of the fastest growing sources of renewable energy in the United States (AWEA 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 Wind Turbine Generator (WTG) blades. An important step in the process of siting and developing potential wind energy sites is to evaluate wildlife use for the project area. Stantec (formerly NRC) was retained to perform a bat screening analysis and one activity season of pre-construction bat activity surveys at the Pioneer Trail Wind Farm.

1.1. Background Information Regarding Bat Mortality at Wind Farms

Commercial wind facilities have been found to affect many bat species (Arnett et al. 2008). These impacts may include displacement of individuals, fragmentation of habitat, and direct mortality from collisions with or proximity to WTG blades (Kunz et al. 2007a). Whether bats are attracted to WTGs and the exact mechanisms by which WTGs cause mortality are unclear (reviewed in Kunz et al. 2007b); however, several hypotheses have recently been put forth and tested, including the role of land cover and environmental conditions in attracting bats to WTG sites, behavioral factors that might make WTGs attractive to bats, pressure changes from rotating blades causing "barotrauma", or direct impact of unsuspecting migrant bats (Baerwald et al. 2008; Horn et al. 2008; Johnson et al. 2004; Kerns et al. 2005; reviewed in Kunz et al. 2007b). Determining the effects of wind farms on bats is of critical importance to the future conservation of these poorly understood mammals.

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

The primary bat species affected by wind facilities are believed to be migratory, foliage- and tree-roosting species that mostly emit low frequency calls (Johnson et al. 2004; reviewed by 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 mortality has been reported for 11 of the 45 bat species known to occur north of Mexico. Of the 11 species, nearly 75% were the migratory, foliage roosting Hoary Bat (*Lasiurus cinereus*), Eastern Red Bat (*Lasiurus borealis*), and Silver-haired Bat (*Lasionycteris noctivagans*) (Kunz 2007a).

Prior to September 2009, no mortality of species listed as threatened or endangered under the federal Endangered Species Act had been reported, including the Indiana Bat (*Myotis sodalis*) (Arnett et al. 2008). In September 2009, the first documented take of an endangered Indiana Bat at a wind facility occurred at BP Wind Energy's Fowler Ridge wind farm located in Benton County, Indiana.

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

Although the number of bat fatalities recorded at wind facilities varies regionally, reports of mortality have been highest along forested ridgetops in the eastern U.S. and lowest in open landscapes of Midwestern and western states (Kunz et al. 2007b). However, it is difficult to make direct comparisons among projects due to differences in study length, metrics used for searches and calculations for compensating bias (Arnett et al. 2008). In the Midwestern U.S., bat fatalities range from 0.2 to 8.7 bats killed/megawatt generated, but higher fatality rates (up to 53.3 fatalities/MW generated) have been reported in the eastern U.S. (Arnett et al. 2008).

1.2. Project Description

The Pioneer Trail Wind Farm is a state-of-the art wind energy project located in Iroquois and Ford counties, Illinois just east of the towns of Paxton and Loda, Illinois, in Sections 26 and 33 – 36, T24N, R10E; Section 31, T24N, R14W; Sections 1 – 4, and 10 – 16, T23N, R10E; Sections 5 – 9 and 16 – 18, T55N, R31W; Sections 1 and 12 – 13 T23N, R11E (Figure 1).

Currently, the wind project is proposed to be a 150 megawatt farm with 1.6 megawatt wind turbine generators (WTGs) and associated access roads and collector line system. Steel reinforced concrete foundations will be constructed to anchor each WTG. A pad mount transformer will be installed at the base of each WTG and will collect electricity generated by each turbine through cables routed down the inside of the tower.

An underground power collection system will be trenched in between the pad mount transformers and a collector substation. This power collection system will consist of a series of underground cables ranging from approximately 2 to 5 inches in outside diameter. In addition to the WTGs and power collection system, the Pioneer Trail Wind Farm project would construct service roads allowing access to the turbines during and after construction.

The site is located immediately east of the town of Paxton, Illinois. Land use throughout much of the project area is dominated by agriculture (i.e. rowcrops and pasture); however, several creeks and unnamed drainageways are found throughout the project limits (Figure 2). Forest cover is minimal throughout the project area (Figure 3).

1.3. Purpose and Objectives

The purpose of this report is to identify and summarize general bat activity within the project area, based on review of existing literature and data collected during surveys. The process used to evaluate the project area generally follows recommended project siting guidelines of the U.S. Fish and Wildlife Service (2010).

The objectives of the pre-construction bat activity surveys have been developed to provide a scientific pre-permitting/pre-construction bat survey of sufficient duration and focus to address the potential impact concerns through collection of site-specific baseline data. The survey objective is to characterize general bat activity by collecting site-specific baseline data on bat species activity, richness, frequency, and behavior in order to:

1. Estimate the spatial and temporal extent of bat use of the project area;
2. Determine the spatial and temporal extent of rare bat species use of the project area.

This report includes the results of literature and database reviews and observations made during pre-construction field surveys.

2.0 METHODS

2.1. Bat Screening Analysis and Baseline Data Collection

Information on the ecology and distribution of bats is sparse for the entire upper Midwestern United States, including Illinois (Schwartz and Schwartz 1986; Kurta 2000; Laubach et al. 2004). Therefore, the bat screening analysis relied on what little information currently exists, which included a review of publicly available literature and bat resources. Illinois Gap Analysis Program (GAP) landcover data were used to provide information on available habitat and sensitive environmental areas that may influence bat abundance, distribution, or movement within or near the project area. Each of these screening level components is described in more detail below.

2.1.1. Bat Data Acquisition and Analysis

A literature and database review was used to identify bat species known to occur within or in close proximity to the project area, including review of distribution and ecological information provided by Bat Conservation International (BCI; www.batcon.org). BCI is the foremost bat conservation association in the world. Headquartered in Austin (TX) and founded in 1982, BCI currently has a membership of over 14,000 individuals, spread across 70 countries. They have been involved in cutting edge research and educational products on the subject of bat ecology and conservation. BCI provides not only accessible information on bat ecology, but also provides recommendations on how to monitor and conserve them on a global scale. In addition, literature resources, such as Schwartz and Schwartz (1986), Harvey et al. (1999), Kurta (2000) and Laubach et al. (2004) were reviewed for general ecology and distribution information regarding species found in Illinois.

2.1.2. Spatial Data Acquisition and Landcover Analysis

In addition to bat data acquisition, aerial photograph interpretation via a Geographic Information System (GIS) was used to locate and evaluate land features within the project area. Spatial data layers used in the GIS included base orthophotography, the 24K hydrology layer, USGS 24K topography, and Illinois GAP Landcover data. A desktop review of maps and GIS data was performed to evaluate the physical attributes of the project area, as well as the sensitive environmental areas within or near the project area that may influence bat movement and concentration patterns. Examples of physical attributes that could influence bat use include project size, topography, weather, infrastructure, and environmental corridors. Examples of sensitive environmental areas include State or County Natural Areas, State Wildlife Areas, and National Wildlife Refuges.

2.1.3. Indiana Bat Habitat Assessment

A desktop analysis was conducted to determine the presence of potential Indiana bat habitat within the project area. Suitable Indiana bat summer habitat is considered to have the following characteristics within a 0.5 mile radius of permanent water (USFWS Rock Island Field Office guidance 2010):

- Forest cover of 15% or greater
- One or more of the following tree species: shagbark and shellbark hickory that may be dead or alive, and dead bitternut hickory, American elm, slippery elm, eastern cottonwood, silver maple, white oak, red oak, post oak, and shingle oak with slabs or plates of loose bark
- Potential roost trees with 10% or more peeling or loose bark

Aerial photography and ArcMap GIS data were used to evaluate habitat suitability within the entire project area. A 0.5-mile radius plot was drawn centered on a permanent water source (e.g., perennial and intermittent streams, farm ponds, etc) to determine if the area met the 15% forest cover requirement within 0.5 mile of permanent water. For the purposes of this analysis, it was assumed that all waterways identified as “blue line” streams on USGS 1:24,000 scale topographic maps contained water for the majority of the year; however, the presence of water was not field verified. The area of the woodland tracts located within the 0.5 mile buffer was measured to determine the percent cover of woodland.

No walking surveys or field verification were conducted as part of this determination. Therefore, habitat suitability was based on the presence of 15% or greater forest cover within 0.5 mile of permanent water.

2.2. Pre-Construction Bat Activity Surveys

2.2.1. Acoustic Data Capture

Pre-construction bat activity surveys at the project site incorporated both stationary (i.e. passive) and mobile (i.e. active) echolocation detectors, which have been proven to be an acceptable methodology for bat/wind farm screening (e.g., Kunz et al. 2007a; Redell et al. 2006). These detectors record the real-time ultrasonic calls emitted by echolocating bats. The data produced by these detectors are sonograms of the bat calls recorded by the unit’s receiver. In many cases, bat calls can be identified to species group, and tallied. In addition, the number of “bat passes”, or times in which a bat was recorded by the receiver, can be determined, which yields a rough estimate of activity or bat use of the area being sampled. Bat activity surveys were conducted at the site from 15 April through 4 November 2010. Surveys were divided among time periods, or seasons, generally recognized as appropriate for pre-construction screening level surveys at wind farms (Table 1).

Table 1. Timing and frequency of bat surveys conducted at the Pioneer Trail Wind Farm (Iroquois and Ford counties, Illinois)

Screening Survey Period	2010																											
	April				May				June				July				August				September				October			
Spring Migration		x	x	x	x	x																						
Summer											x	x																
Fall Migration															x			x	x	x		x	x	x			x	

Seasonal stationary detector survey periods (yellow shading)
x Mobile field survey visits

2.2.1.1. Stationary Survey

Stationary detectors were used to determine species presence and relative activity levels at varying heights. One Remote Bat Acoustic Technology System (ReBAT™; Pandion Systems, Inc., Gainesville, Florida) array was deployed on one 60-meter tall meteorological (MET) tower located within the project area (Figure 2).

Two receivers were deployed on the tower at different heights in a vertical transect to capture information about bat species flying at variable altitudes. Based on accepted methodology, receivers were placed at 16.5 ft (5 m) and 190 ft (58 m; within the rotor swept zone). Acoustic receivers were protected from the elements in weather-resistant aluminum housing units that are raised and lowered on a pulley system attached to the tower. To avoid microphone damage from precipitation, the microphones were positioned within the protective aluminum housing pointing straight down. A plastic reflector plate was attached to the aluminum housing at a 45° angle to allow for maximum bat detectability.

The array was programmed to record bat acoustic data nightly from one hour before sunset to one hour after sunrise. Recordings were triggered based on frequency (kHz) and decibel (dB). Recorded sound files were 1.7 seconds in duration. Data from the acoustic receivers were transmitted to a custom-built computer located at the base of the tower. The data were transmitted via cellular signal to Pandion Systems, Inc. for storage and then transmitted to Stantec staff for analysis. The entire system was powered through a series of batteries and solar panels. All critical components were secured and stored in weatherproof housing at the base of the tower.

2.2.1.2. Mobile Survey

Surveys with mobile hand-held Anabat detectors (Titley Electronics, Australia) were used to supplement stationary surveys. Landcover analysis was used to select transect locations. Transects were ground-truthed on-site to ensure the selected locations were appropriate for mobile bat surveys. Six mobile transects were selected along roads within the project area (Figure 2). Survey routes were selected in a variety of habitat types to adequately represent the project area (e.g., agricultural fields, woodlots, wetlands or stream corridors). Transects were driven at a slow rate of speed (<5 mph) by surveyors while holding the mobile bat echolocation detector outside of the vehicle. Hand-held units have a limited range and only detect bats in the lower altitudes. However, by conducting mobile surveys, the chances of detecting a species or species group not captured by detectors on the MET tower are increased because the surveyor could follow a bat as it was calling and record long call sequences suitable for call identification.

A total of 15 mobile surveys were conducted (spring-5, summer-2, fall-8), with emphasis placed on the critical fall migration period (Table 1). This information was used for comparison with data from stationary detectors on the MET tower to determine variation in bat activity based on location within the project area.

2.2.2. Acoustic Data Analysis

2.2.2.1. Stationary Survey

Qualitative analysis of echolocation calls recorded by the ReBAT™ unit was performed on all operational detector nights using SCAN'R (Binary Acoustic Technology 2007) filtering software to remove noise files. Stantec staff further filtered the files using the Sonobat Batch Scrubber 3 (Sonobat, Arcata, CA).

2.2.2.2. Mobile Survey

To analyze sound files recorded with Anabat detectors, a rough "activity filter" was created in AnalookW Software v. 3.7i (Titley Electronics, Australia). This filter was designed to eliminate non-bat noise. The filter parameters were mainly the settings of the default filter, with slight modifications: minFc=12, maxFmean=90, minFmean=12, smooth=80 and bodyover=1000 microseconds. Files retained by the filter were visually inspected to confirm that the associated sound was produced by a bat. Files containing confirmed bat calls were then analyzed by applying slight modifications to the existing activity filter that divided call sequences into either a "low frequency species" category (highstart=yes, smooth=12, maxFmin=34) or a "high frequency species" category (highstart=yes, smooth=12, minFmin=35). Bat passes were considered any file with equal to or greater than one call or pulse. The total number of bat files, and the number that met the criteria in each frequency category were summed.

2.2.2.3. Call Classification

Data collected were analyzed by trained Stantec staff using SonoBat v. 2.9.5 and 3.0.5 acoustic analysis software (stationary data) and AnalookW Software v. 3.7i (Titley Electronics, Australia) (mobile data). Bat activity was measured by the number of "bat passes", or times in which a bat was recorded by the receiver, which yields a rough estimate of activity or bat use of the area being sampled. A "pass" was defined as any file with ≥ 2 echolocation pulses. Bat pass data represent levels of activity rather than numbers of individuals because individuals cannot be distinguished by their calls. The total number of bat passes divided by the number of detector nights (i.e. one detector for one night = one detector night) was used as an index of bat activity.

Bat calls were classified as either high frequency (≥ 34 kHz) bats (e.g., Eastern Red Bat *(Lasiurus borealis),* Little Brown Bat *(Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), Indiana Bat (*Myotis sodalis*), Tri-colored Bat (*Perimyotis subflavus*) and Evening Bat (*Nycticeius humeralis*)), or low frequency (<34 kHz) bats (e.g. Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*) and Hoary Bat (*Lasiurus cinereus*)).

The Sonobat Batch Scrubber 3 rejects calls less than 2 msec and those with weak signals. As a result, some poor quality, unclassifiable calls will get filtered (scrubbed) out. These unclassifiable calls are the weakest calls and are not classifiable as high or low frequency or suitable for species identification. However, in order to accurately represent total bat activity at the site, the number of unclassifiable calls that were scrubbed out (i.e. false negatives) was estimated and added to the total classifiable calls to produce an adjusted total bat activity number.

The number of unclassifiable calls was estimated by analyzing the scrubbed files of a random sample of 25% of the survey nights distributed among the three seasons (i.e. spring, summer, and fall). The scrubbed files for each of the sample nights were visually inspected to determine the number of false negative calls. A correction factor was then calculated by dividing the total number of false negatives in the random sample by the total number of bat calls (false negatives + positives) in the random sample. The total number of classifiable bat passes for the activity season was then multiplied by the correction factor to produce the estimated total unclassifiable bat passes for the activity season.

2.2.2.4. Species Identification

Where possible, attempts were made to identify bat species or species groups (e.g. *Myotis*) utilizing high quality bat passes and comparing those calls with the species' known call parameters and with known calls found in established call libraries. Although each bat species has specific call characteristics, there is considerable overlap among call parameters between species. In addition, bats can vary their calls based on habitat conditions (e.g. open vs. cluttered environments). Due to the known overlap in echolocation call characteristics occurring among some sympatric species (i.e. closely related species occurring in the same geographic area) (Barclay 1999), a portion of the acoustic data was classified to species groups rather than to individual species. Classification to species or species group was possible only for calls with a low signal-to-noise ratio and minimal echo. If the species or species group could not be determined because of call quality, or if calls were assignable to more than three species due to overlap in echolocation call parameters, the call was categorized as "unknown."

3.0 RESULTS

3.1. Bat Screening Analysis and Baseline Data Collection

3.1.1. Project Specific Landcover Characteristics

Landcover within the project area is highly agricultural (i.e. rowcrop and pastureland), with drainageways scattered across the site. Illinois GAP landcover data indicate a total of six land cover categories within the project area, including various types of row and close grown crops, grasses (i.e. pasture), upland forest, forested wetland, open water and developed land (Table 2; Figure 3). Of these, cropland comprises 95.6% of the project area, with the next most abundant landcover type being grassland (3.8%). Forest, forested wetland, and open water collectively comprise <0.1% of the landcover within the project area (Table 2; Figure 3).

Table 2. Landcover type and amount within the proposed project area determined through analysis of Illinois GAP Landcover Data

Landcover	Total Acres	Percent of Total
Agriculture (Rowcrop)	12081.3	95.6
Grassland (Pasture)	477.9	3.8
Developed	75.9	0.6
Upland Forest	3.6	0.03
Open Water	1.6	0.01
Forested Wetland	0.9	<0.01

A series of unnamed streams are present throughout the project area (Figure 2). Three named streams are also present: Spring Creek in the northwestern and north central portion of the project area; Sugar Creek in the south central portion; and, Pigeon Creek located in the southeastern portion of the site (Figure 2). In general, woodlots are absent in the project area and the few wooded riparian areas that are present tend to be small and/or narrow.

Several bat species native to Illinois prefer woodlands for feeding or roosting at some time during the year. In addition, many species of bats feed along wooded stream corridors or over water. Several of the more common species, such as the Little Brown Bat and Big Brown Bat, are known to roost in attics or the peaks of other large buildings. Natural habitat features or resource areas that typically attract bats are limited within the project area. However, large outbuildings associated with agricultural settings may provide suitable roosting locations for some of the more common bat species.

3.1.2. Designated Natural Resource Areas

Two designated natural resource areas occur within the project area (Figure 3), neither of which would provide significant bat habitat:

- Clarence Railroad Prairie – Located in the southeastern portion of the project area. Six acres designated as restored or natural prairie.
- Clarence West Railroad Prairie – Located in the south central portion of the project area. Five acres designated as restored or natural prairie.

Five natural areas are located within four miles of the project area:

- Herschel Workman – Located one mile east of the project area, this 141 acre property with six acres of timber is managed by the Illinois Department of Natural Resources (DNR).
- Loda Cemetery Prairie – Located approximately 1.5 miles northwest of the project area. This area is 12.4 acres of native prairie managed by The Nature Conservancy (TNC).
- Prospect Cemetery Prairie – Five acres of native prairie located approximately 1.5 miles west of the project area, managed by the Paxton Township Cemetery Association.
- Patton Woods – Located approximately three miles south of the project area. This area is 14 acres of dry oak hickory forest containing mature oaks and hickories. It is managed by the Champaign County Forest Preserve District.
- Middle Fork River Forest – A 1702 acre area located approximately four miles south of the project area composed of old hardwood timber, reforested lowlands, ponds, and four miles of the Middle Fork River managed by Champaign County Forest Preserve District.

3.1.3. Bat Species Potentially Present and Species of Concern

A total of 12 species of bats occur in Illinois. Nine species, all members of the family Vespertilionidae, have geographic distributions that include Iroquois and Ford counties (Schwartz and Schwartz 1986; Harvey et al. 1999; Batcon.org 2010) (Table 3). Of these, only the Indiana Bat is listed as threatened or endangered (Illinois-state and federally endangered). The Indiana Bat is also considered a Species in Greatest Need of Conservation by the Illinois DNR (IDNR 2010). Currently, a petition has been submitted to the USFWS requesting that the Northern Myotis be listed under the Endangered Species Act and a separate request has been submitted for a status review of the Little Brown Bat. At present, these species are not yet listed; however, it may be prudent to consider these species during the project planning process.

Indiana bat maternity colonies are historically known from Ford County (USFWS 2007). Recent records include a July 2010 survey that identified an Indiana Bat maternity colony on the Middle Fork of the Vermilion River in Ford and Champaign counties (Illinois DNR correspondence dated 6 December 2010). Maternity colonies are also known from Vermillion County, located adjacent to Ford County to the southeast (USFWS 2007). No records of Indiana Bats are known from Iroquois County (USFWS 2007). The closest known hibernaculum is Blackball Mine located in LaSalle County, Illinois approximately 120 miles to the northwest of the site (USFWS 2007).

All nine bat species use woodland habitat for feeding or roosting at some time during the year. In addition, many species of bats feed along stream corridors or over water. A limited number of narrow, linear tracts of woodland associated with stream corridors are found within the project area and may, at times, serve as habitat for these species. While these areas may provide potentially suitable foraging habitat for bats, review of landcover data indicate that overall forest cover in the project area is minimal (Table 2; Figure 3).

Illinois GAP data were used to identify those areas that may provide Indiana Bat habitat. GAP predicted areas are based on specific modeling criteria that produce a geographic range extent for the species. In addition, GAP data identify those areas with GIS features or conditions to which the species is likely to be associated. These areas are identified as possible habitat.

Illinois GAP data indicate approximately 7,383 acres of possible Indiana Bat habitat in Iroquois County, and no areas of possible Indiana Bat habitat in Ford County. No GAP indicated possible or predicted Indiana Bat habitat is found within the project area.

Approximately 4.5 acres of total forest cover (upland forest and forested wetland) is found within the project area (Table 2; Figure 3). Results of the desktop Indiana Bat habitat assessment indicate that no woodland tracts within the project area meet the minimum forest cover requirement of >15% for suitable Indiana Bat summer habitat; therefore, no suitable summer habitat is present within the project area. However, suitable summer habitat may be present in the larger woodland tracts located south and west of the project area (see Section 3.1.2). While suitable summer habitat may not be present in the project area, due to the site's location within the known geographic range of the Indiana Bat, the potential does exist for Indiana Bats to migrate through the project area.

Although the desktop assessment indicates that no suitable Indiana Bat habitat is present within the current project boundary, habitat impacts are not the only potential impacts to Indiana Bats posed by a wind facility. Although it may be possible to avoid impacts to Indiana Bat habitat altogether, the presence of the turbines, even in open, non-forested areas, may pose a risk of bat mortality due to rotor strikes and barotrauma.

Table 3. Abundance, call frequency group and winter habits of Illinois bat species with potential to occur in Iroquois and Ford counties, Illinois.

Scientific Name	Common Name	Abundance[1]	Frequency Group[2]	Winter Habits
Myotis lucifugus	Little Brown Bat	Common	High	Short Distance Migrants (<300 km)
Myotis sodalis	Indiana Bat	Rare (Federal and State Endangered) Species in Greatest Need ofConservation[3]	High	Short Distance Migrants (<300 km)
Myotis septentrionalis	Northern Long-eared Bat	Common	High	Short Distance Migrants (<300 km)
Lasionycteris noctivagans	Silver-haired Bat	Limited Distribution/Uncommon	Low	Long Distance Migrants (>500 km)
Perimyotis subflavus	Tri-colored Bat	Common	High	Short Distance Migrants (<300 km)
Eptesicus fuscus	Big Brown Bat	Common	Low	Short Distance Migrants (<300 km)
Lasiurus borealis	Eastern Red Bat	Common	High	Long Distance Migrants (>500 km)
Lasiurus cinereus	Hoary Bat	Limited Distribution/Uncommon	Low	Long Distance Migrants (>500 km)
Nycticeius humeralis	Evening Bat	Limited Distribution/Uncommon	High	Probably Long Distance Migrant

[1] http://m.extension.illinois.edu/wildlife/directory_show.cfm?species=bat

[2] Low frequency bats are considered to be those using calls in which the highest minimum frequency is 34 kHz, while high frequency bats are considered to be those using calls in which the lowest minimum frequency is ≥ 34 kHz.

[3] IDNR 2010.

3.2. Pre-Construction Bat Activity Surveys

The ReBAT™ unit was operational between 17 April and 4 November, for a total of 402 detector nights (one detector for one night = one detector night; therefore, there are two detector nights for each night that both detectors are operational). Bats were recorded on 145 of 201 (72.1%) survey nights at the tower. A summary of ReBAT™ operational data by season is shown in Table 4.

Table 4. Summary of ReBAT™ operational data by season at the Pioneer Trail Wind Farm (Iroquois and Ford counties, Illinois, 2010)

	No. Survey Nights	No. Detector Nights[1]	No. Survey Nights Bats Recorded	% of Survey Nights Bats Recorded
Spring	29	58	16	55.1
Summer	61	122	47	77.0
Fall	111	222	82	73.9
Total	**201**	**402**	**145**	**72.1**

[1]One detector for one night = one detector night

A total of 1026 classifiable bat passes (mean = 2.6 passes/night) were recorded by the stationary detectors during the activity season (Table 5). It is estimated that 243 unclassifiable passes were removed during the filtering process. Therefore, the adjusted total bat passes for the 2010 activity season at the Pioneer Trail Wind Farm is 1269 (mean = 3.2 passes/night) (Table 5). Bat activity by month is shown in Figure 4. August had the most activity followed closely by July and September.

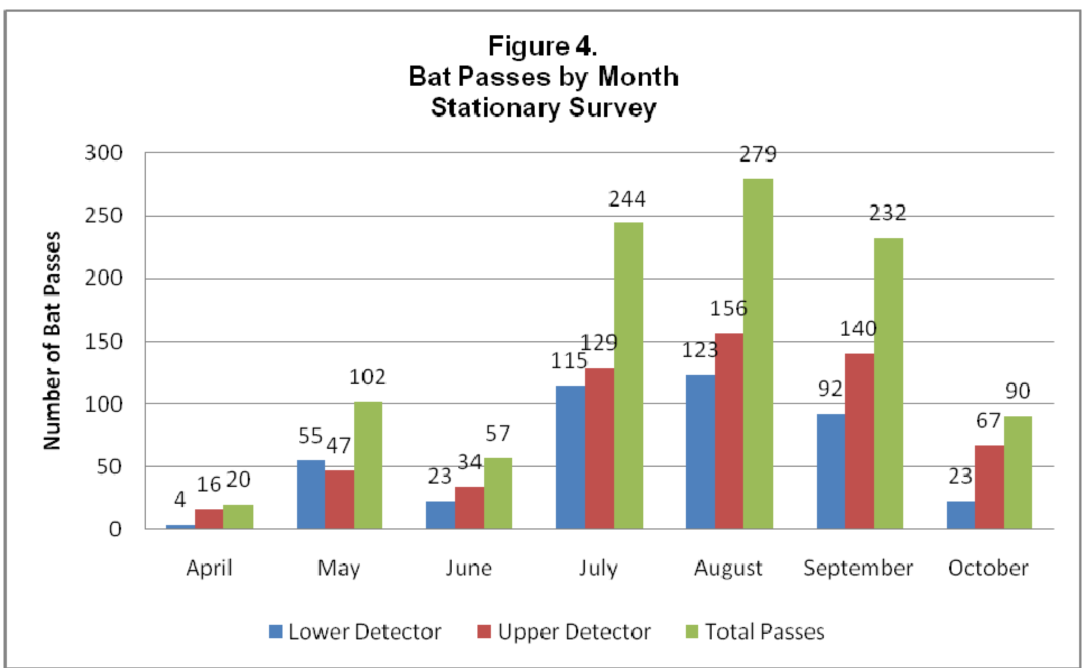


Table 5. Summary of bat passes (mean per night) by detector height, season and frequency group for stationary pre-construction surveys at the Pioneer Trail Wind Farm (Iroquois and Ford counties, Illinois, 2010).

	5 Meter	58 Meter	Total
Spring			
Low Freq. Bat Passes	18 (0.6)	41 (1.4)	59 (1.0)
High Freq. Bat Passes	10 (0.3)	3 (0.1)	13 (0.2)
Total Passes (Spring)*	**29 (1.0)**	**45 (1.6)**	**74 (1.3)**
Summer			
Low Freq. Bat Passes	77 (1.3)	83 (1.4)	160 (1.3)
High Freq. Bat Passes	15 (0.2)	10 (0.2)	25 (0.2)
Total Passes (Summer)*	**97 (1.6)**	**96 (1.6)**	**193 (1.6)**
Fall			
Low Freq. Bat Passes	244 (2.2)	376 (3.4)	620 (2.8)
High Freq. Bat Passes	44 (0.4)	56 (0.5)	100 (0.5)
Total Passes (Fall)*	**309 (2.8)**	**450 (4.1)**	**759 (3.4)**
Total Low Frequency Passes for Activity Season	**339 (1.7)**	**500 (2.5)**	**839 (2.1)**
Total High Frequency Passes for Activity Season	**69 (0.3)**	**69 (0.3)**	**138 (0.3)**
Total Classifiable Passes for Activity Season*	**435 (2.2)**	**591 (2.9)**	**1026 (2.6)**
Est. Total Unclassifiable Passes for Activity Season	**243**		
Adjusted Total Passes for Activity Season	**1269 (3.2)**		

*Some recorded bat sound files contained both low and high frequency species or were too poor quality to characterize the call by frequency group. Therefore, the sum of bat passes for these groups may not equal the "Total Passes" recorded.

During the 90 mobile surveys (15 surveys of 6 transects), 58 definitive bat passes (mean = 0.6 passes/transect/night) were recorded (Table 6). Among the transects, Transect 4, located in the southwest corner of the project area (Figure 2), recorded the highest number of total bat passes at 28 (mean = 1.9/night) (Table 6). Transects 1 and 3, located in the northwestern portion of the project area (Figure 2), recorded the lowest total number of bat passes at only 2 each (mean = 0.1/night) (Table 6).

Table 6. Bat passes (mean per transect per survey night) by season for mobile pre-construction surveys at Pioneer Trail (Iroquois and Ford counties, Illinois, 2010).

	Transect 1	Transect 2	Transect 3	Transect 4	Transect 5	Transect 6
Low Frequency Bat Passes	0 (0.0)	3 (0.2)	2 (0.1)	14 (0.9)	4 (0.3)	4 (0.3)
High Frequency Bat Passes	2 (0.1)	2 (0.1)	0 (0.0)	9 (0.6)	10 (0.7)	3 (0.2)
Total Passes	2 (0.1)	5 (0.1)	2 (0.1)	28 (1.9)	14 (0.9)	7 (0.5)
Total Passes for Activity Season*	**58 (0.6)**					

*Some recorded bat sound files contained both low and high frequency species. Therefore, the sum of bat passes for these groups may not equal the "Total Passes" recorded.

3.2.1. Bat Species and Frequency Groups Detected During Surveys

Using classifiable calls and files that contained high quality bat passes, a species list was developed for the project area. Approximately 73.5% of the 1026 classifiable calls recorded during the stationary survey and 72.4% of the 58 calls recorded during the mobile surveys were identifiable to species or species group (e.g. Big Brown Bat/Silver-haired Bat, *Myotis* sp.). Five bat species were confirmed to be present at the site:

- Big Brown Bat
- Silver-haired Bat
- Eastern Red Bat
- Hoary Bat
- Tri-colored Bat

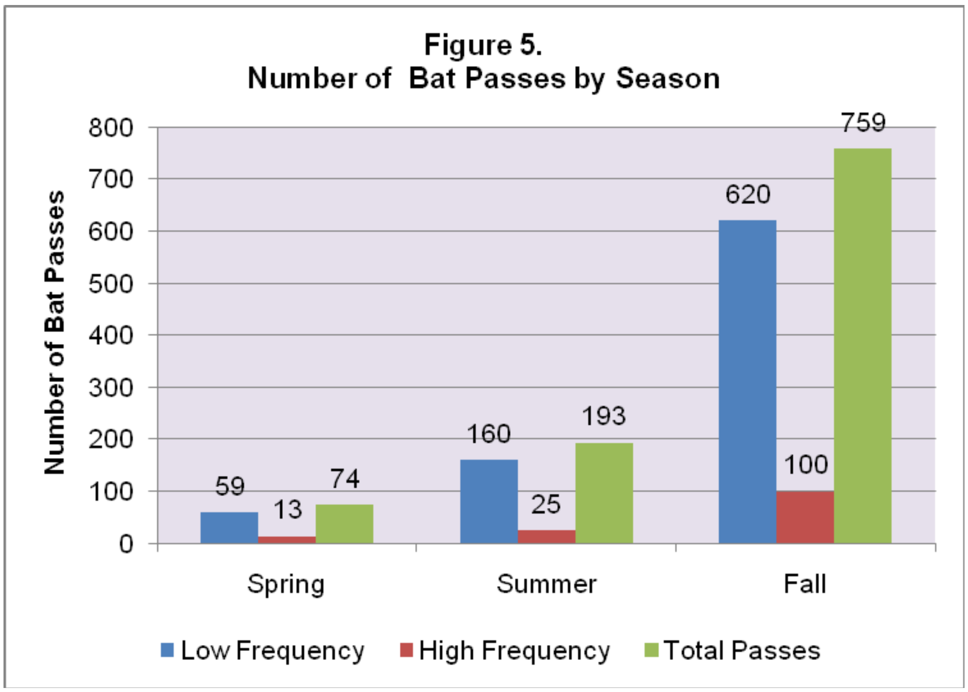
None of the species confirmed in the project area are listed as state or federally threatened or endangered. Six confirmed *Myotis* calls were recorded by the 5 m receiver during the stationary survey. A single call was recorded on 3 July, 27 July, 11 August and 14 August, and two calls were recorded on 11 October. All six calls exhibit characteristics found in both Little Brown Bat and Indiana Bat calls; however, due to the overlap in call characteristics between the two species, positive identification to species is not possible. Based on the detection zone of the receivers, bats recorded by the 5 m detector are not within the rotor swept zone (>38.75 m). Three confirmed *Myotis* calls were recorded during mobile surveys: one along Transect 5 on 20 August and two along Transect 4 on 25 August. *Myotis* calls represent 7% of the identifiable calls recorded during the mobile survey, but only 0.8% of the identifiable calls recorded during the stationary survey.

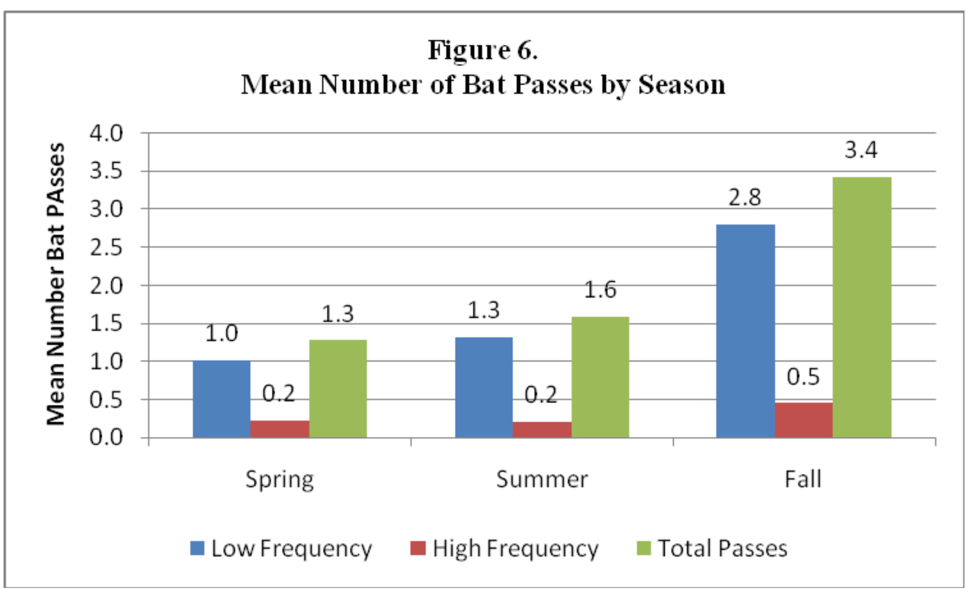
Three additional possible *Myotis* calls were recorded during stationary surveys: one on 27 July and one on 31 July, both at the upper detector, and one at the lower detector on 15 September. All three calls exhibit characteristics found in *Myotis* calls, but are also consistent with Red Bat calls; therefore, positive identification is not possible.

Both low and high frequency bat species were recorded during stationary and mobile surveys. During stationary surveys, specifically when all receiver heights and time periods are considered together, on average, low frequency species were recorded more often than high frequency species (mean = 2.1 and 0.3 passes/night, respectively); with the total number of passes per species group greater for the low frequency species (839 passes) vs. high frequency species (138 passes) (Table 5). During mobile surveys, passes from low frequency and high frequency species were recorded in nearly equal numbers (27 and 26 total passes; mean = 1.8 and 1.7 bats/night, respectively).

3.2.2. Seasonal Distribution of Bat Activity

A summary of bat activity by season at the Pioneer Trail Wind Farm site is shown in Figures 5 and 6 and a discussion by season is presented below.





3.2.2.1. Spring (15 April – 15 May)

The total number of bat passes at the stationary detector during the spring season (74) was the lowest among the three seasons (74; mean = 1.3 passes/night) (Table 5). Low frequency species were recorded more often than high frequency species during both stationary and mobile surveys (Tables 5, 6 and 7). Total bat passes recorded during spring mobile surveys were the highest of the three seasons (27), but only slightly above the fall surveys (25) (Table 7).

Table 7. Bat passes (mean/transect/survey night) by season for mobile pre-construction bat surveys at the Pioneer Trail Wind Farm (Iroquois and Ford Counties, Illinois, 2010).

	Spring	**Summer**	**Fall**
Low Frequency Bat Passes	16 (0.5)	2 (0.2)	9 (0.2)
High Frequency Bat Passes	6 (0.2)	4 (0.3)	16 (0.3)
Total Passes	27 (0.9)	6 (0.5)	25 (0.5)
Total Passes for Activity Season*	**58 (0.6)**		

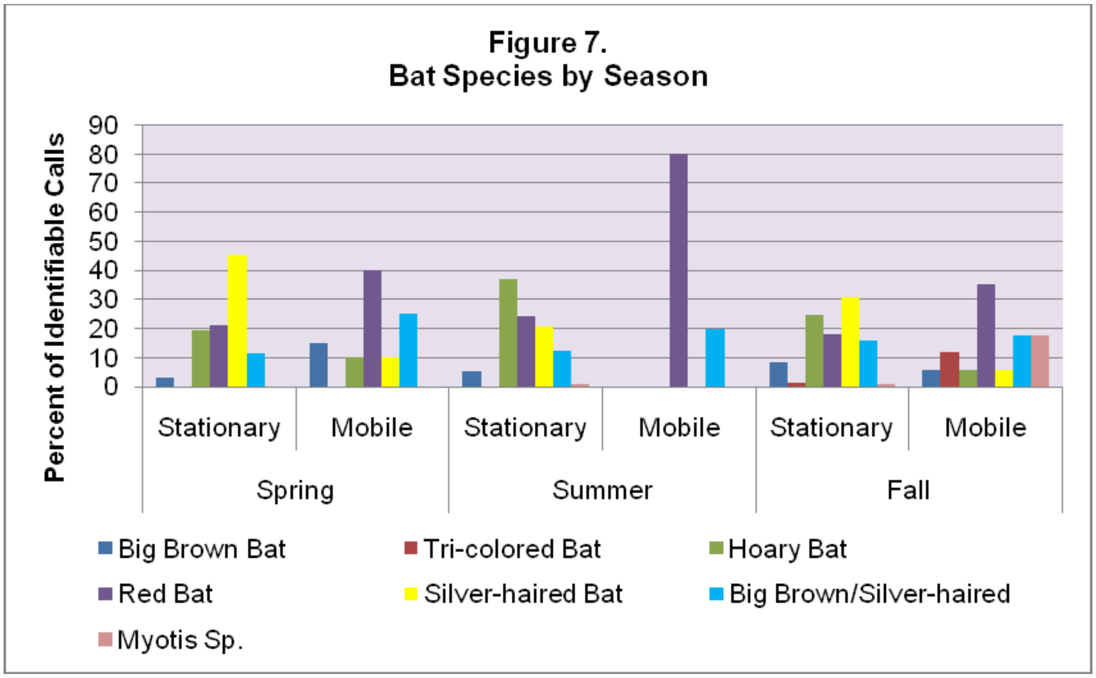
*Some recorded bat sound files contained both low and high frequency species. Therefore, the sum of bat passes for these groups may not equal the "Total Passes" recorded.

The approximate distribution of the classifiable bat passes recorded at the stationary unit, during the spring season, where species identification was possible is shown below and in Figure 7:

- Silver-haired Bat 45%
- Red Bat 21%
- Hoary Bat 19%
- Big Brown Bat/Silver-haired Bat group 11%
- Big Brown Bat 3%

The approximate distribution of identifiable bat passes recorded during spring mobile surveys where species identification was possible is shown below and in Figure 7:

- Red Bat 40%
- Big Brown Bat/Silver-haired Bat group 25%
- Big Brown Bat 15%
- Hoary Bat 10%
- Silver-haired Bat 10%



3.2.2.2. Summer (16 May – 15 July)

The total number of bat passes at the stationary detector during the summer season (193) increased over what was observed during the spring season (74); and the average number of passes/night increased from 1.3 to 1.6 (Table 5). Low frequency species were recorded at the stationary detector more often than high frequency species (Table 5; Figure 5). Bat activity recorded during summer mobile surveys was significantly lower than spring (5 total passes vs. 20 total passes), with twice as many high frequency bats recorded as low frequency bats (Table 7).

The approximate distribution of the classifiable bat passes recorded at the stationary unit, during the summer season, where species identification was possible is shown below and in Figure 7:

- Hoary Bat 37%
- Red Bat 24%
- Silver-haired Bat 21%
- Big Brown Bat/Silver-haired Bat group 13%
- Big Brown Bat 5%
- *Myotis* sp. <1%

The approximate distribution of identifiable bat passes recorded during summer mobile surveys where species identification was possible is shown below and in Figure 7:

- Red Bat 80%
- Big Brown Bat/Silver-haired Bat group 20%

3.2.2.3. Fall (16 July – 31 October)

The total number of bat passes at the stationary detector during the fall season (759) was the highest among the three seasons. The average number of passes/night (3.4) was over two times the average number of passes/night recorded in the spring or summer (1.3 and 1.6 respectively) (Figures 5 and 6). Low frequency species were recorded at the stationary detector six times more often than high frequency species (Table 5). Total bat passes recorded during fall mobile surveys (25) were nearly equal to what was recorded in the spring (27) and four times that recorded in the summer (6) (Table 7).

The approximate distribution of the classifiable bat passes recorded at the stationary unit, during the fall season, where species identification was possible is shown below and in Figure 7:

- Silver-haired Bat 31%
- Hoary Bat 25%
- Red Bat 18%
- Big Brown Bat/Silver-haired Bat group 16%
- Big Brown Bat 8%
- Tri-colored Bat 1%
- *Myotis* sp. <1%

The approximate distribution of identifiable detections recorded during mobile surveys where species identification was possible is shown below and in Figure 7:

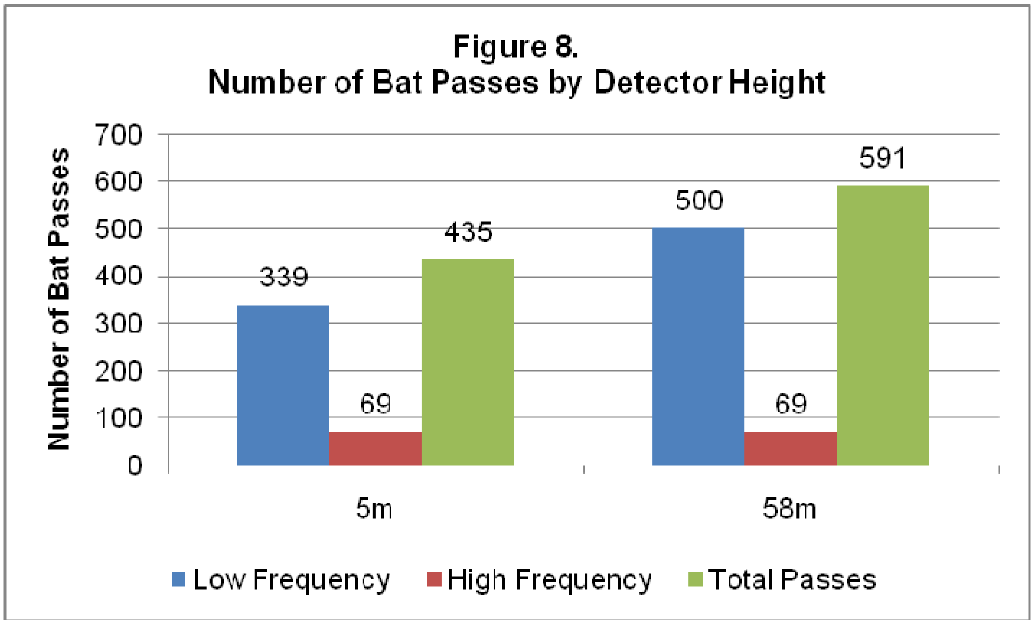
- Red Bat 35%
- Big Brown Bat/Silver-haired Bat group 18%
- *Myotis* sp. 18%
- Tri-colored Bat 12%
- Silver-haired Bat 6%
- Hoary Bat 6%
- Big Brown Bat 6%

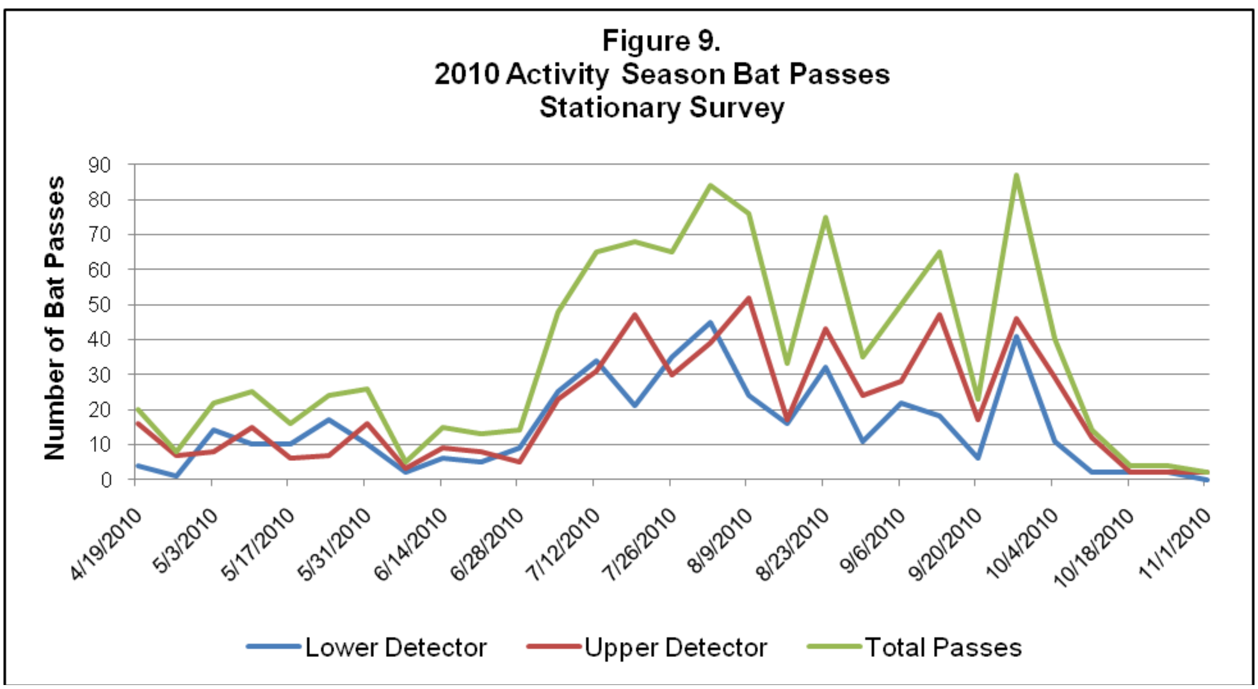
3.2.3. Vertical Distribution of Bat Activity – Stationary Survey

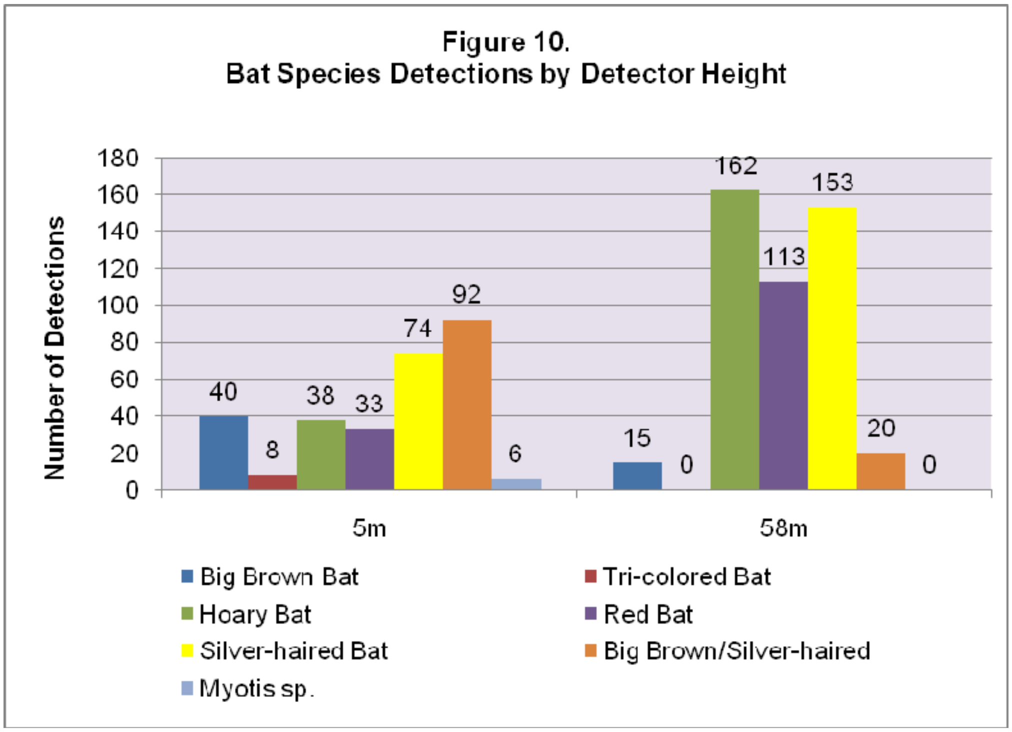
More total bat calls were recorded at the 58 m height (rotor-swept zone) (591 total passes; mean = 2.9 passes/night) than at the 5 m height (435 total passes; mean = 2.2 passes/night) (Table 5; Figure 8). Bat passes at the 58 m height outnumbered those at the 5 m height off and on from the beginning of the study period (17 April) through 16 July, at which time, bat passes at the 58 m height outnumbered those at the 5 m height and continued to do so until the end of the survey (4 November) (Figure 9). The increase in activity at the 58 m height from the mid-July through October coincides with the fall migration period.

Low frequency calls outnumbered high frequency calls at both the 5 m height and 58 m height (rotor-swept zone). At the 5 m height, low frequency calls were recorded approximately five times as often as high frequency calls, while at the 58 m height, low frequency calls were recorded approximately seven times as often (Table 5; Figure 8). The total number of bat passes on a single day ranged from 0 – 40, with the largest daily total recorded on 27 September, of which, 68% were recorded at the 5 m height.

Red Bats, Hoary Bats, Silver-haired Bats, and Big Brown Bats were all detected at both detector heights (Figure 10). Tri-colored Bats and *Myotis* sp. were only detected at the 5 m height. Silver-haired Bats were the most frequently recorded species at the 5 m height and Hoary Bats were recorded most frequently at the 58 m height. Within the rotor swept zone, the migratory, foliage roosting Red Bat, Hoary Bat and Silver-haired Bat were the most frequently recorded species, accounting for at least 72% of all detections, and 92% of all identifiable calls, at that height.







4.0 DISCUSSION

4.1. Summary and Conclusions

The Pioneer Trail project area is located in an agricultural setting dominated by farmsteads, livestock operations, pastures and fields used for rowcrop production. Natural habitat features, such as woodlands, woodlots and wooded riparian corridors that typically attract bats, are basically non-existent within the project area, and those that are present, are small and fragmented (Figure 2). However, larger blocks of woodland are found outside of the project area to the south and west, including Patton Woods, an area of mature oak and hickory woodland approximately three miles south of the project area, and Middle Fork River Forest, an area of old hardwood timber and reforested lowlands along the Middle Fork River approximately four miles south of the project area (Figure 3).

The majority of the bat species found in Illinois prefer to roost in woodlands and many species forage along wooded stream corridors or over water (Schwartz and Schwartz 1986; Harvey et al. 1999; Laubach et al. 2004). The Pioneer Trail project area provides limited roosting or foraging habitat in the form of woodland or open water. Limited information is available on how bats use agricultural areas in the Midwest; however, species such as the Big Brown and Little Brown Bat will roost, and even overwinter, in attics or large buildings. The farmsteads located in the project area, with their farmhouses and large outbuildings, likely provide suitable roosting locations for species such as these. Likewise, buildings in the towns of Paxton and Loda also likely provide suitable roosting and possibly overwintering sites for species such as the Big Brown and Little Brown Bat.

Bat activity at the stationary survey location (i.e. MET tower location), as measured by number of bat passes, was low when compared to some other wind farm sites in the Midwest. Table 7 provides a comparison of the bat activity at the Pioneer Trail site with activity at other wind farm sites surveyed by Stantec in Iowa, Illinois, Indiana and Wisconsin. The precise explanation for the lower activity is unknown and beyond the scope of this survey; however, landcover, specifically forest cover, in the project area likely plays a major role. Forest cover at the other Midwest sites ranges from 1.2 – 6%, while at Pioneer Trail forest cover comprises <0.01% of the landcover (Table 7).

Table 7. Comparison of bat activity at wind farms in the Midwest surveyed by Stantec.

Wind Farm Site Location	Total # Bat Passes (Mean/Night) Stationary Survey	Total # Bat Passes (Mean/Night) Mobile Survey	Land Use
Northeast Iowa	2313 (6.0)	105 (2.8)	83% Agricultural 2% Forest
Northwest Illinois	1905 (4.8)	196 (2.6)	>90% Agricultural >6% Forest
Central Indiana	1800 (4.5)	93 (1.0)	93% Agricultural 0.6% Forest
Southwest Illinois	1721 (5.1)	26 (0.3)	90% Agricultural 1.2% Forest
East Central Wisconsin	1647 (3.9)	95 (1.5)	88% Agricultural 2% Forest
Pioneer Trail Wind Farm	1269 (3.2)	58 (0.6)	96% Agricultural <0.01% Forest
Central Iowa	183 (0.4)	95 (4.5)	81% Agricultural 0.1% Forest

Based on geographic distribution, nine of the 12 bat species known to occur in Illinois have the potential to be found in the Pioneer Trail project area (Schwartz and Schwartz 1986; Harvey et al. 1999; Batcon.org). Five bat species, the Hoary Bat, Big Brown Bat, Eastern Red Bat, Silver-haired Bat and Tri-colored Bat, were confirmed to be present during the survey. Of the species confirmed in the project area, none are listed as threatened, endangered or as a Species in Greatest Need of Conservation by the Illinois DNR (Table 3).

In addition to the species listed above, calls of species within the genus *Myotis* were also recorded in the project area. Nine confirmed *Myotis* calls were recorded during the stationary and mobile surveys, representing only 0.7% of the total bat passes recorded at the site. Due to overlap in call characteristics between members of the genus *Myotis*, positive classification to species is not possible. However, based on habitat within the project area, it is likely that many of these calls are Little Brown Bats.

The Indiana Bat is known to occur in Ford County, with documented maternity colonies in the county (USFWS 2007). A habitat assessment conducted at the site indicates that no suitable Indiana Bat summer habitat is found within the project area, primarily due to the lack of sufficient forest cover. Nevertheless, habitat impacts are not the only potential impacts to Indiana Bats posed by a wind facility, and migratory risk could exist anywhere within the species' geographic range.

A total of 1269 stationary and 58 mobile bat passes, representing both low and high frequency species were recorded during the survey. On average, low frequency bats were recorded more often than high frequency bats at the stationary detectors. However, because low frequency sound attenuates less quickly than high frequency sound, the receivers may detect low frequency sounds at greater distances; therefore, it is possible that low frequency bats may not be more common in the area, but rather that their calls are being recorded more frequently. Along mobile transects high frequency bats were recorded almost equal to those of low frequency bats.

Bats were detected less often in the rotor-swept zone (i.e. 58 m height) during the summer season, but more often in the rotor-swept zone during the spring and the fall, corresponding to the spring and fall migration periods. Red Bats, Hoary Bats, Silver-haired Bats and Big Brown Bats were all recorded within the rotor-swept zone, with Red Bats, Hoary Bats and Silver-haired Bats being the most frequently recorded species, accounting for at least 72% of all detections, and 92% of all identifiable calls, at that height.

Post-construction and pre-construction data may not fully predict fatality risks (Cryan 2008). Although considerable variation exists in the data among projects, peaks in bat fatalities associated with numerous wind farms have been reported during late summer and fall (reviewed by Arnett et al., 2008). Bat activity at the Pioneer Trail site was highest during the fall, with a rise in activity at the 58 m height near the end of July through October, coinciding with the fall migration period.

4.1.1. Conclusions

4.1.1.1. Risk to Resident Bats

The results of this survey suggest that the Pioneer Trail Wind Farm site may present a relatively low risk to resident and foraging bats for the following reasons:

1. Natural habitat features, such as woodlands, woodlots and wooded riparian corridors that provide roosting and foraging habitat for bats, are basically non-existent within the project area, with <0.1% of the project area consisting of forest.
2. Due to the lack of forest cover, the project area rates as unsuitable Indiana Bat summer habitat.
3. Overall bat activity at the site, as measured by number of bat passes, was low when compared to other wind farm sites in the Midwest for which data are available (Table 7).

Accordingly, the survey results do not suggest a material risk of impact to Indiana Bats from the Pioneer Trail project. However, it should be noted that currently there are no published reports linking pre-construction activity rates to post-construction fatality rates, and therefore, it is not possible to accurately predict post-construction fatality rates.

4.1.1.2. Risk to Migrating Bats

Little is known about the migration patterns of bats, specifically how they disperse across the landscape during migration. Therefore, it is not possible to accurately predict an individual bat's route during migration. Based on this, migratory risk could exist anywhere within a species' geographic range, and the potential does exist for bats, including Indiana Bats, to migrate through the Pioneer Trail project area. However, the Pioneer Trail project area is located approximately 120 miles from Blackball Mine, the nearest known Indiana Bat hibernaculum. The results of this survey, with only nine confirmed *Myotis* calls, none of which could be positively identified as an Indiana Bat, do not suggest significant Indiana Bat migratory activity within the Pioneer Trail project area during the 2010 activity season.

4.2. Limitations of Pre-Construction Bat Activity Surveys

The results of the pre-construction bat activity survey should be viewed with the following limitations in mind:

1. Duration of the Survey – The survey included nightly passive survey events along a vertical transect in one location over the course of one activity season. Fifteen mobile surveys were conducted during this time as well. Because annual bat activity can vary due to weather, the results of this survey of one activity season may not be representative of the full range of bat activity in the project area.

2. Spatial Limitations of Vertical and Mobile Transects – Due to resource limitations, vertical transects, which survey bat activity at the height of the rotor-swept zone, were only conducted in one location. Although mobile surveys were conducted at more locations throughout the project area, it is unlikely that handheld units could detect bats at the height of the rotor swept zone. This pre-construction survey has only assessed bat activity in a small fraction of the overall rotor swept zones that will be occupied by WTGs.

The results of this survey should be used as baseline information regarding bat activity in the area and cannot be used to accurately predict what, if any, bat mortality would occur as a result of operation of the Pioneer Trail Wind Farm. A standard method of determining impacts to bats resulting from operation of a wind energy facility is to perform post-construction monitoring of bat species' presence, activity and mortality. If impacts are determined to be significant, then appropriate mitigation measures can be considered.

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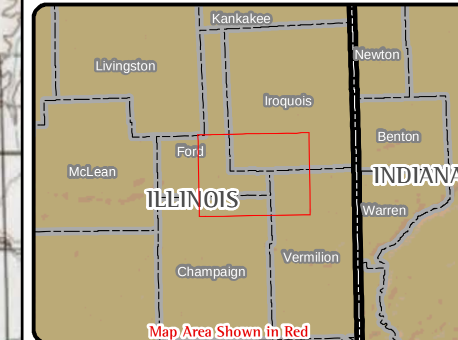
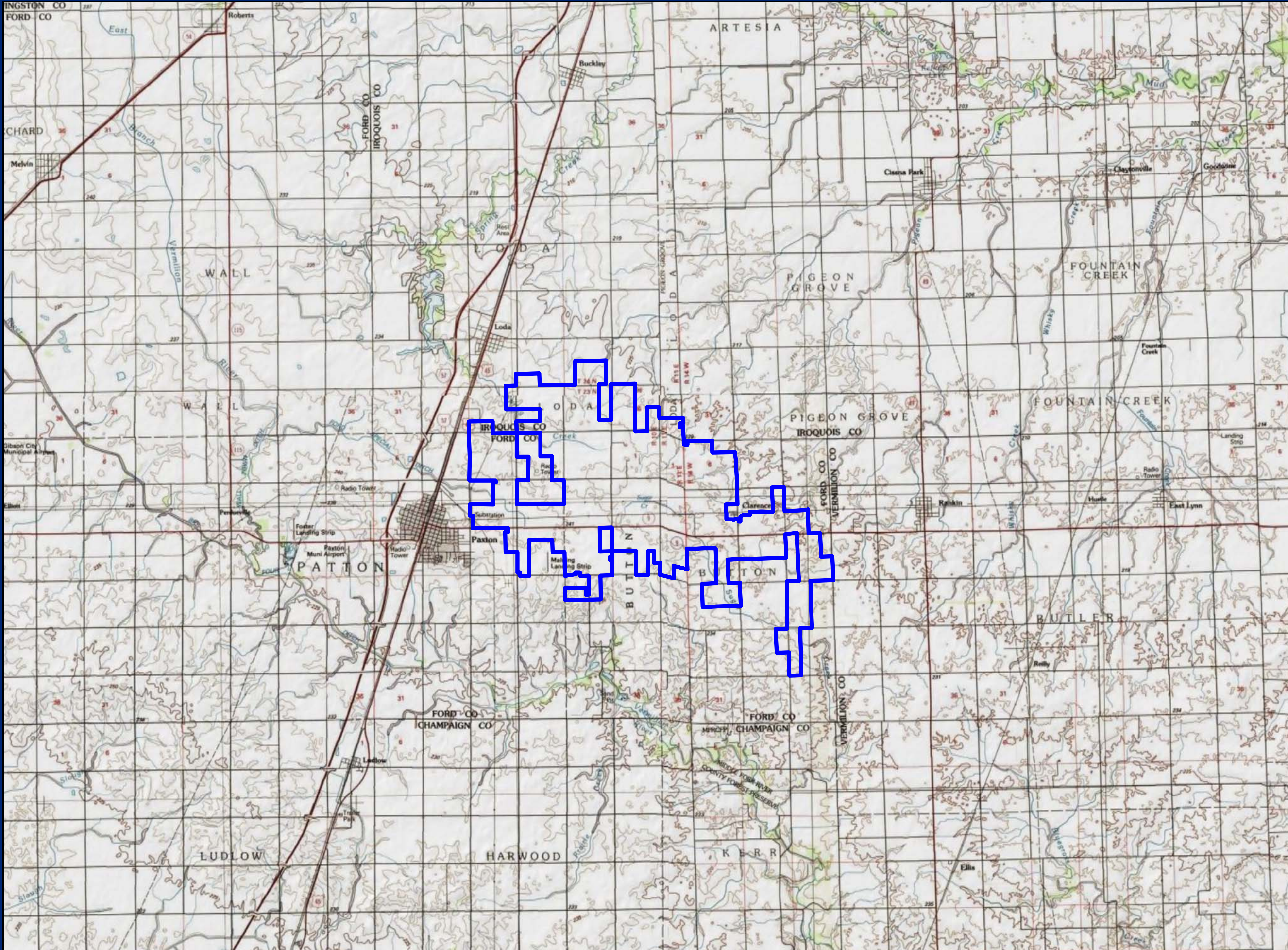
Figure 1.
Project Location and Topography
Pioneer Trail Wind Farm





Location

Iroquois and Ford Counties, IL

0 1 2 Miles

N

Project Information

Project Number : 0010-0034-01/193700126
Modified December 21, 2010

Legend

Project Boundary

Data Sources include USGS 30'x60' Topographic Quadrangles; Fairbury, Champaign, Watseka and Danville

NRC Natural Resources Consulting, Inc.

Stantec

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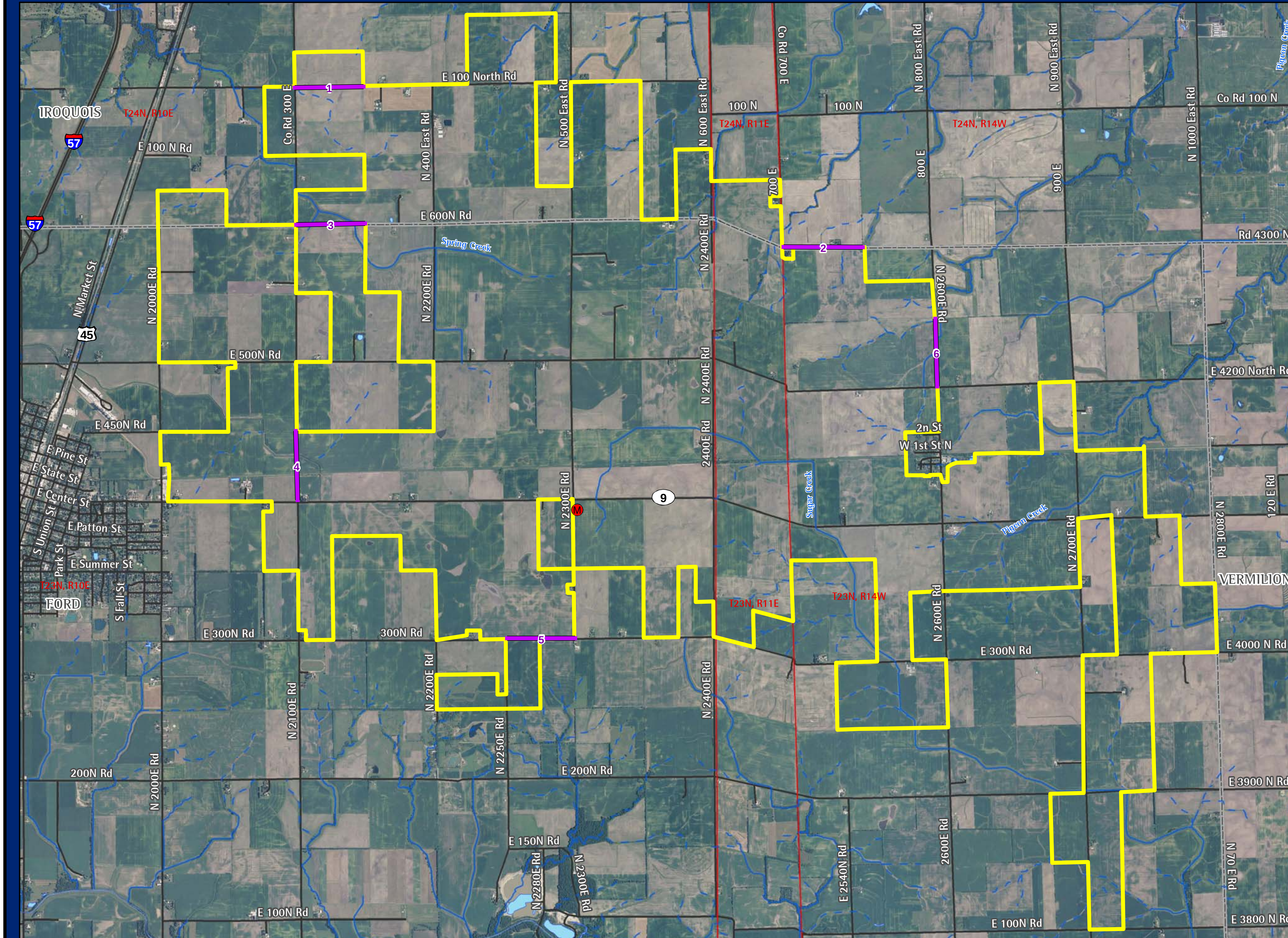

Figure 2.
Mobile Bat Survey Transects and Met Tower Locations
Pioneer Trail Wind Farm

Location

Iroquois and Ford Counties, IL

0 1,750 3,500 Feet

N

Project Information

Project Number : 0010-0034-01/193700126
Modified December 21, 2010

Legend

- Project Boundary
- Mobile Bat Transects
- County Line
- Township Line

National Hydrography Data

- Perennial Stream
- Intermittent Stream
- Waterbody

Data Sources include USCB, ESRI, USFWS and 2010 NAIP Orthophotography

NRC Natural Resources Consulting, Inc.
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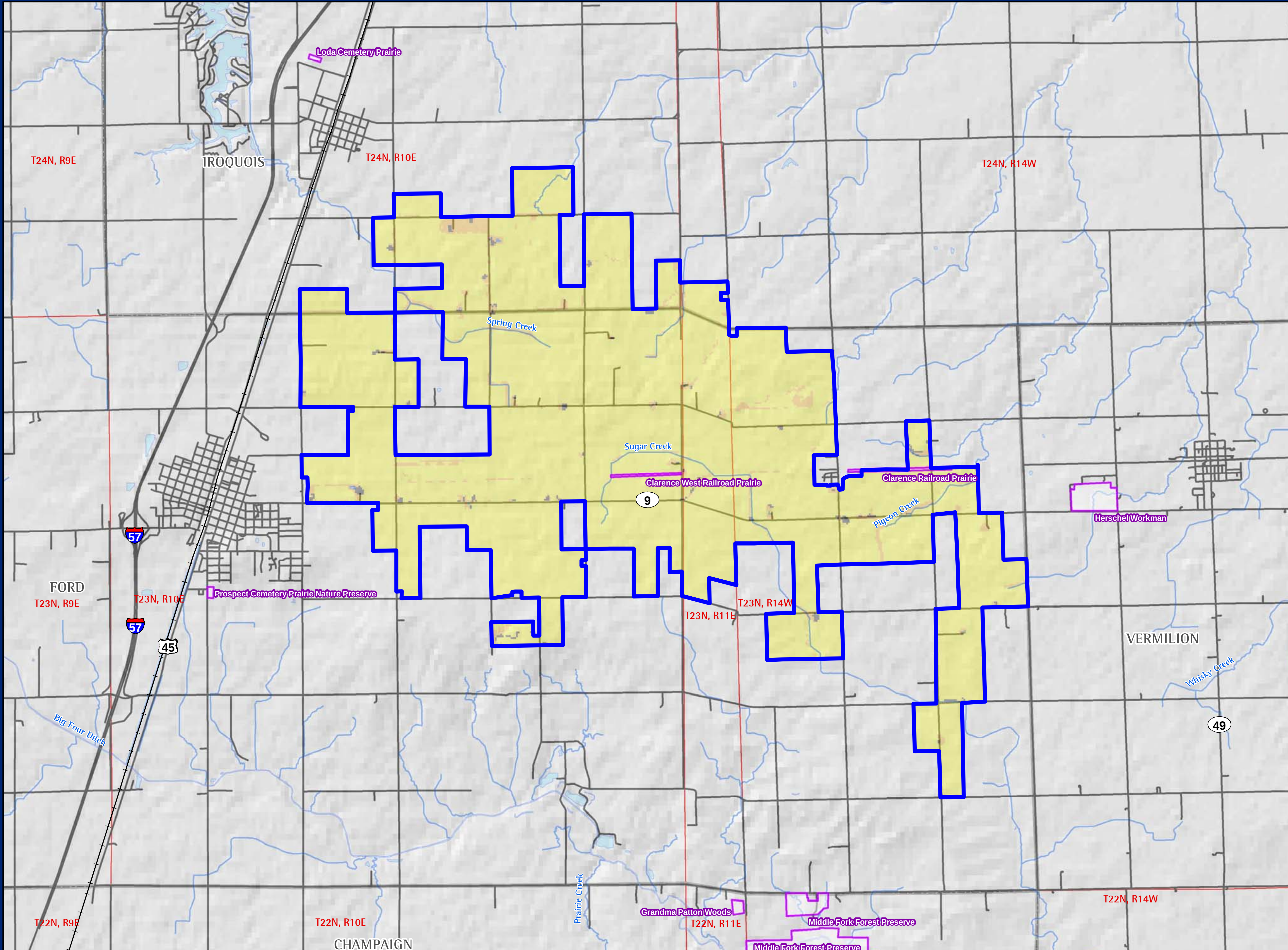
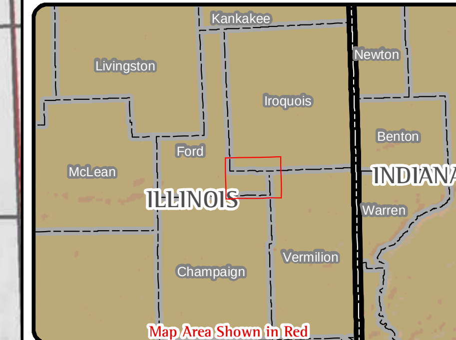
The information presented in this map document is advisory and is intended for reference purposes only.

Mobile_Bat_Survey_Transects20101206.mxd Map Created by D. Giblin



The information presented in this map document is advisory and is intended for reference purposes only.

Figure 3.
GAP Landcover Data
Pioneer Trail Wind Farm



Location

Iroquois and Ford Counties, IL

0 0.5 1 Miles

N

Project Information
Project Number : 0010-0034-01/193700126
Modified December 21, 2010

Legend

- Project Boundary
- Conservation Areas
- County Line
- Township Line
- Perennial Stream
- Waterbody

GAP Landcover Data

- Agriculture (12081.3 ac)
- Grassland (477.88 ac)
- Upland Forest (3.58 ac)
- Forested Wetland (0.92 ac)
- Open Water (1.55 ac)
- Developed (75.87 ac)

Data Sources include USGS, USFWS, USCB, ESRI and Ducks Unlimited

NRC Natural Resources Consulting, Inc.

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Paxton Landcover.mxd Map Created by S. Foster