

**2016 Post-Construction Bat  
Mortality Monitoring Report  
Pioneer Trail Wind Farm**

**Ford and Iroquois Counties, Illinois**

**Project #193703901**




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### CERTIFICATION

Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate and complete in all material respects.

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**2016 POST-CONSTRUCTION BAT MORTALITY MONITORING REPORT  
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## **1.0 Introduction**

### **1.1 PROJECT DESCRIPTION**

The Pioneer Trail Wind Farm (Project or Pioneer Trail) developed by Pioneer Trail Wind Farm, LLC (PTWF), is located in Ford and Iroquois counties, just east of the towns of Paxton and Loda, Illinois. The Project consists of 94 1.6 megawatt (MW) wind turbine generators, operations and maintenance building, access roads, collector line system, and substation for a total capacity of approximately 150 MWs (Figure 1). The Project became operational in January 2012. The Project is located on lands leased from private landowners, who continue their existing use of the land. Land use in the area is predominantly agricultural.

Pioneer Trail is located within the range of both the federally and Illinois endangered Indiana bat (*Myotis sodalis*) and the federally and Illinois threatened northern long-eared bat (*Myotis septentrionalis*). PTWF developed a Habitat Conservation Plan (HCP) in accordance with the requirements set forth under section 10(a)(1)(B) of the Endangered Species Act of 1973 (ESA), as amended, and applicable U.S. Fish and Wildlife Service (USFWS) guidance documents, in support of its application for an incidental take permit (ITP) for these species under section 10(a)(1)(B) of the ESA. On June 26, 2015 the USFWS issued ITP No. TE66598B-0 to PTWF for the Project. On the basis of the HCP and certain additional information submitted to the Illinois Department of Natural Resources (IDNR), the IDNR issued an Incidental Take Authorization (ITA) to PTWF for the Project on October 8, 2015. The federal ITP and state ITA for the Project set a take limit of 129 Indiana bats and 86 northern long-eared bats over the course of the 43-year permit term, or an estimated 3 Indiana bats and 2 northern long-eared bats per year.

### **1.2 PURPOSE AND OBJECTIVES OF THE STUDY**

The HCP for the Project outlines the following measures required as a condition of the federal ITP and state ITA:

- Avoidance measures to avoid take of listed species;
- Minimization measures to minimize take of listed species, as well as all bats;
- Mitigation to mitigate for unavoidable take of listed species;
- Post-construction monitoring protocols to measure effectiveness of avoidance and minimization measures; and
- Adaptive management to adjust minimization measures as necessary.

The HCP and federal ITP require PTWF to perform post-construction monitoring during the fall season curtailment window (August 15 through October 15) for the first two years of operation

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post-ITP issuance, and every five years thereafter. The state ITA also requires PTWF to perform mortality monitoring in the first two years following ITA issuance during the fall curtailment window, plus an extended period prior to the curtailment window beginning on July 15. Due to the timing of the state ITA issuance (near the end of the fall 2015 season), PTWF conducted fall monitoring only from August 15 through October 15 in 2015, the first year of operation post-ITP issuance. PTWF first conducted extended fall monitoring July 15 – August 14) in 2016, and will do the same in 2017. Fall season monitoring will then be repeated every 5 years beginning in 2021. Spring season monitoring (April 1 through May 15) will also occur in 2021 (year 7 of operation post-ITP issuance, year 6 post-ITA issuance) and every 10 years thereafter, unless the results of spring monitoring indicate that it must be conducted every 5 years as well, as set forth in the HCP.

The HCP requires annual reporting to the USFWS of the results of the post-construction monitoring conducted at the Project. The state ITA requires that these results also be reported to the IDNR within 60 days of survey completion. This Post-Construction Bat Mortality Monitoring Report has been prepared to satisfy those requirements.

The primary objectives of the post-construction study were to:

1. Determine overall bat fatality rates from the Project;
2. Estimate Indiana and northern long-eared bat mortality at the species level to ensure compliance with the federal ITP and state ITA; and
3. Evaluate the circumstances under which fatalities occur.

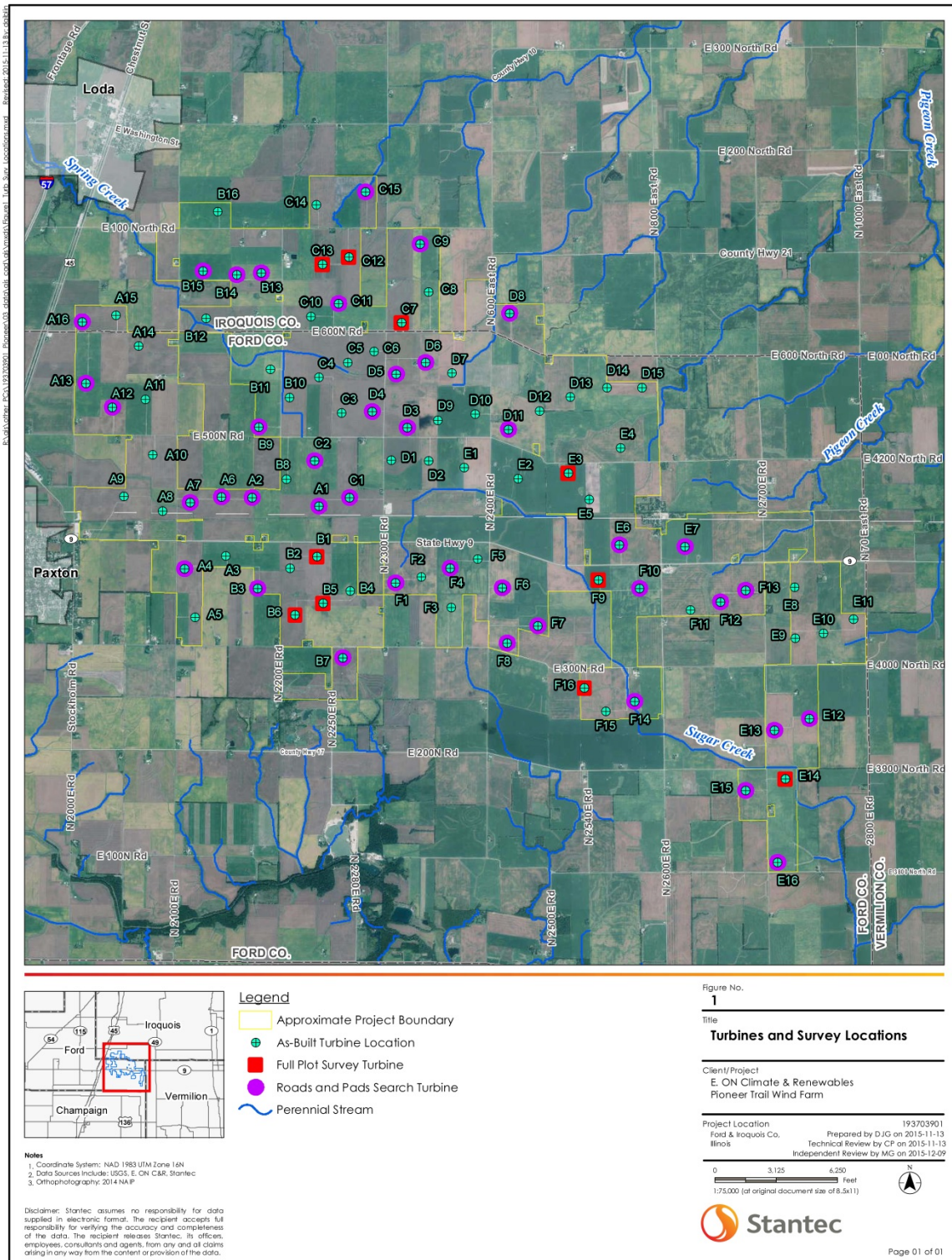
The study included the following components:

1. Standardized carcass searches to systematically search plots at all turbines for bat casualties attributable to the turbines;
2. Searcher efficiency trials to estimate the percentage of bat casualties that were found by the searcher(s); and
3. Carcass removal trials to estimate the persistence time of carcasses on-site before they were removed by scavengers.

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## **2.0 Methods**

### **2.1 MORTALITY STUDY**

Carcass searches were conducted during the following time periods:

1. Extended State ITA Monitoring Period – July 15 to August 14. This extended monitoring period was required by the IDNR as a condition of the state ITA. Turbine curtailment is not in effect during this period.
2. Federal ITP Monitoring Period – August 15 to October 15. This was identified in the Project's HCP as the period of risk for Indiana and northern long-eared bats, and is the monitoring period required by the federal ITP. It represents the period of turbine curtailment under both the federal ITP and the state ITA.

This was the second year of Project operation under the federal ITP, but because the state ITA was not issued until late in 2015, it was the first year that the Project operated at a cut-in speed of 5.0 m/s during the federal ITP monitoring period. In previous fall seasons prior to ITA issuance, PTWF operated the Project with a cut-in speed of 6.9 m/s during the federal ITP monitoring period to avoid take of both the Indiana and northern long-eared bat.

#### **2.1.1 Sample Size**

Post-construction monitoring was conducted at 50 of the 94 turbines (53%). This sample size optimizes field survey effort while maximizing expected confidence in the data and associated results. This approach meets 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.

#### **2.1.2 Search Plot Size**

At 80% of the surveyed turbines (n=40), only the turbine pads and roads out to 328 feet (100 meters[m]) from the turbine were searched. This method targets the areas with the highest searcher efficiency while greatly reducing the financial and logistical constraints associated with clearing and searching large study plots, enabling much broader coverage of the facility. At the remaining 20% of turbines (n=10), 262-foot x 262-foot (80-m x 80-m) plots were cleared and searched using a full-coverage transect approach. Each 80-m x 80-m plot was centered on a turbine location, and vegetation was periodically mowed and cleared as needed to improve searcher efficiency.

Previous studies have indicated that the majority of bat carcasses typically fall within 100 feet (30 m) of the turbine or within 50% of the maximum height of the turbine (Kerns and Kerlinger 2004, Arnett et al. 2005, Arnett et al. 2008, Young et al. 2009, Jain et al. 2007, Piorkowski and O'Connell 2010, USFWS 2012). The plot size used for this study exceeds one-half the maximum turbine rotor



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height of the Project turbines (246 feet [75 m]). The subset of full-coverage plots provided a reference for estimating the number of fatalities which may have fallen outside of the search area at the roads and pads search turbines. This mixed sampling approach is consistent with other post-construction monitoring studies being conducted (e.g., Good et al. 2011) and will enable comparison of study results.

#### **2.1.3 Search Schedule**

The search interval for all turbines was once weekly during the respective monitoring periods. An individual turbine was searched on the same day each week when conditions allowed. Within a day, the turbine search schedule and order were randomized, so that each turbine's search plot was sampled at differing periods during the day. A weekly search interval for fatality monitoring was deemed adequate by Kunz et al. (2007) and studies have demonstrated that a weekly search interval provides effective mortality monitoring and adequately estimates impacts from wind energy facilities (Gruver et al. 2009, Young et al. 2009), such that the added effort associated with more frequent intervals is not warranted.

#### **2.1.4 Carcass Searches**

Carcass searches were conducted by biologists, operating under applicable state and federal permits and experienced and/or trained in fatality search methods, including proper handling and reporting of carcasses. The biologist was familiar with and able to accurately identify the bat species likely to be found in the project area, and photos of any unknown bat discovered were sent to an expert for positive identification, and the carcasses were retained on-site. Bird carcasses were identified in the field. Digital photographs and location information of all bird carcasses were taken and used for confirming identification when necessary. Carcasses (birds and bats) were photographed from several angles to provide the best chance of photographic identification. During searches, the biologist walked at a rate of approximately 2 miles per hour (45 to 60 m per minute) while searching 10 feet (3 m) on either side of each transect.

For each carcass found, the following data were recorded (a sample data form is included in Appendix A):

- 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;

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- Condition (intact, scavenged); and
- Any notes on presumed cause of death.

A digital photograph of each detected carcass was taken before the carcass was handled and removed. Representative digital photographs are included in Appendix B. All bat carcasses were labeled with a unique number, bagged, and stored frozen (with a copy of the original data sheet) at the Project Operations and Maintenance Building. Bat carcasses were collected and retained under the Illinois DNR Permit Number NH15.5951, and listed species (Indiana bat and northern long-eared bats) under Illinois DNR Permit Type S, Permit Number 15-052 (up to 3 of each listed species). Raw data for all bat carcasses found are included in Appendix C.

Bat carcasses found in non-search areas and any bird carcasses found were coded as incidental finds, and documented as much as possible in a similar fashion to those found in standardized searches. Bird carcasses were not collected, but left in place after data collection. Maintenance personnel were informed of the standardized searches, and were trained in collision event reporting protocol in the case of an incidental find. Incidental finds are not 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.

#### **2.1.5 Species Identification**

Preliminary bird and bat species identifications were made in the field by qualified staff. When carcass condition allowed, data collected also included the sex, age, and reproductive condition of the carcass. For bat carcasses, forearm length was recorded to facilitate identification. Any unknown bat, or potential Indiana or northern long-eared bat, was identified by a Stantec bat biologist. In addition to the carcass, photographs and data collected for each carcass were used to verify the species identification.

## **2.2 SEARCHER EFFICIENCY TRIALS**

Searcher efficiency trials were used to estimate the probability of bat carcass detection by the biologist. One searcher efficiency trial was conducted during the monitoring period, as only one biologist and one season are included in this monitoring study. The biologist did not know when during the monitoring period the trial was being conducted, at which turbines trial carcasses were placed, or the location or number of trial carcasses placed in any given search plot. Commercially-available brown mouse carcasses were used as trial carcasses to represent bats.

All searcher efficiency trial carcasses were randomly placed by the field lead within the search plots prior to the carcass searches for that day. The number of trial carcasses found by the biologist during the mortality searches in each plot was recorded and compared to the total number of trial carcasses placed in the plot and not scavenged prior to the mortality search. A sample data form is included in Appendix A.

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**2.3 CARCASS REMOVAL TRIALS**

Carcass removal trials were conducted to estimate the average length of time bat carcasses remained in the search plots (i.e., were available to find) before being removed by scavengers. The carcass removal trial was conducted following the searcher efficiency trial. Mouse carcasses used during the searcher efficiency trials were left in place and their locations were discretely marked. The biologist monitored the trial carcasses over a period of up to 30 days. During each carcass removal trial, carcasses were checked every day for the first week, and then on days 10, 14, 21 and 30, when possible.

The condition of each carcass was recorded during each trial check. The conditions recorded were defined as follows:

- Intact – complete carcass with no body parts missing.
- Scavenged – carcass with some evidence or signs of scavenging.
- Fur spot – no carcass, but fur spot remaining.
- Missing – no carcass or fur remaining.

A sample data form is included in Appendix A. Any carcasses remaining at the end of the 30-day trial period were removed from the field.

**2.4 STATISTICAL METHODS FOR MORTALITY ESTIMATES**

In an effort to make results comparable with other post-construction mortality studies, the methods used to calculate the mortality estimates largely followed the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). The estimate of the total number of turbine-related casualties was based on three components: (1) observed number of casualties, (2) searcher efficiency, and (3) carcass removal rates. The 90% confidence intervals were calculated using bootstrapping methods (Erickson et al. 2003 and Manly 1997 as presented in Young et al. 2009).

**2.4.1 Mean Observed Number of Casualties (c)**

The estimated mean observed number of casualties (c) per turbine per monitoring period was calculated as:

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

where n is the number of turbines searched, and c<sub>j</sub> is the number of casualties found during mortality searches. Incidental carcass finds (those found outside of the searched areas or at times other than during mortality searches) were not included in this calculation, or in the estimated

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fatality rate. Mean number of observed casualties was calculated separately for each search type (roads and pads, full plots) and for both the federal ITP monitoring period and the extended state ITA monitoring period.

**2.4.2 Estimation of Searcher Efficiency Rate (p)**

Searcher efficiency (p) represents the average probability that a carcass was detected by the biologist. The searcher efficiency rate was calculated by dividing the number of trial carcasses observers found by the total number which remained available during the trial (non-scavenged). Searcher efficiency was calculated separately for each search type (roads and pads, full plots), but was assumed to remain the same between the federal ITP monitoring period and the extended state ITA monitoring period.

**2.4.3 Estimation of Carcass Removal Rate (t)**

Carcass removal rates were estimated to adjust the observed number of casualties to account for scavenger activity at the site. Mean carcass removal time (t) represents the average length of time a trial carcass remained at the site before it was removed by scavengers. Mean carcass removal time was 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<sub>c</sub> is the number of carcasses remaining at day 30. 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 were collected, yielding censored observations at 30 days. Carcass removal rates were calculated separately for each search type (i.e., roads and pads, full plots) but was assumed to remain the same between the federal ITP monitoring period and the extended state ITA monitoring period.

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

Searcher efficiency and carcass removal rates were combined to represent the overall probability (π) that a casualty incurred at a turbine was reflected in the mortality search results. This probability was calculated as:

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

where I is the interval between searches.

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The estimation of the probability of carcass availability and detection was calculated separately for each search type (roads and pads, full plots), and then averaged for the study using a weighted average as:

$$\pi = (0.8 * \pi_{RP}) + (0.2 * \pi_{FP})$$

### 2.4.5 Area Adjustment (A)

Approximation of A, the adjustment for areas which were not searched, was calculated following methods and data collected during post-construction monitoring studies at Fowler Ridge Wind Farm in Indiana (Good et al. 2011). For this study, A was calculated to represent the adjustment for the proportion of carcasses which likely fell outside of the area searched at surveyed turbines. The value for A was approximated using the following equation:

$$A = \frac{\frac{C_{RP}}{\pi_{RP} * S_{RP}} + \frac{C_{FP}}{\pi_{FP} * S_{FP}}}{\frac{C_{RP}}{\pi_{RP}} + \frac{C_{FP}}{\pi_{FP}}} * A_{FP}$$

where  $C_{RP}$  is the number of observed casualties on roads and pads,  $C_{FP}$  is the number of observed casualties on full plots,  $\pi_{RP}$  is the probability of carcass availability and detection on roads and pads,  $\pi_{FP}$  is the probability of carcass availability and detection 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 were searched at 80% of the study turbines and full plot searches were conducted at the remaining 20% of the study turbines.

The value for  $A_{FP}$  used was equal to the correction factor calculated for the Fowler study ( $A_{FP}=1.305$ ) as the Fowler study estimated that 23.4% of fatalities fall outside of the 262-foot x 262-foot (80-m x 80-m) square plots. This number was calculated separately for the federal ITP monitoring period and the extended state ITA monitoring period due to the differences in cut-in speeds between the two periods, which may influence the distribution of carcasses around the turbine.

### 2.4.6 Estimation of Facility-Related Mortality (m)

Mortality estimates were calculated using the estimator proposed by Erickson et al. (2003), as modified by Young et al. (2009). The estimated mean number of bat casualties/turbine/monitoring period (m) was calculated by dividing the mean observed number of bat casualties/turbine/monitoring period (c) by  $\pi$ , an estimate of the probability a carcass was not removed by scavengers and was detected by the biologist, and then multiplying by A, the adjustment for the area within which bats may have fallen but which was not searched.

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$$m = A * \frac{C}{\pi}$$

Where A is the area adjustment, C is the number of carcasses found per turbine, and π is the probability of carcass detection and availability (weighted average of π<sub>RP</sub> and π<sub>FP</sub> based on 80% of searches being roads and pads and 20% of searches being full plots). This number was calculated separately for the federal ITP monitoring period and the extended state ITA monitoring period.

### 3.0 Results

#### 3.1 SUMMARY OF SEARCHES

A total of 650 carcass searches were conducted over 13 weeks in the fall. Due to schedule, weather and turbine maintenance activities, the average time between searches was 6.9 days. A total of 42 individual bat carcasses were found during standardized carcass searches, 22 during the extended state ITA monitoring period (July 15 – August 14) and 20 during the federal ITP monitoring period (August 15 – October 15). Two additional bat carcasses were found incidentally, either outside of the search plot areas, killed prior to the start of fall monitoring (determined by carcass condition the first week of searches) or on a non-scheduled search day during carcass removal checks. In total, 44 bat carcasses were found during the study period.

##### 3.1.1 Species Composition

A summary of all bat carcasses found during standardized post-construction searches is shown in Table 1. Of the 42 bat carcasses found during standardized searches, 23 were eastern red bats (*Lasiurus borealis*; 54.8%), 13 were hoary bats (*Lasiurus cinereus*; 31.0%), 4 were silver-haired bats (*Lasionycteris noctivagans*; 9.5%), and 2 were big brown bats (*Eptesicus fuscus*; 4.7%). No bat species listed as threatened or endangered under the ESA, or by the State of Illinois were found during the searches.

**Table 1.** Summary of all bat carcasses found during the 2016 standardized post-construction searches (July 15 through October 15) at the Pioneer Trail Wind Farm, Ford and Iroquois counties, Illinois.

Species	Extended State ITA Monitoring Period (July 15 – August 14)	Federal ITP Monitoring Period (August 15 – October 15)	Total	Percent of All Bats Found
Eastern Red Bat	10	13	23	54.8%
Hoary Bat	10	3	13	31.0%
Silver-Haired Bat	0	4	4	9.5%
Big Brown Bat	2	0	2	4.7%
<b>Total</b>	<b>22</b>	<b>20</b>	<b>42</b>	<b>100%</b>

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Eastern red bats and hoary bats were found during both the extended state ITA monitoring period (July 15 – August 14) as well as during the Federal ITP monitoring period (August 15 – October 15); however, 10 of the 13 hoary bat carcasses (76.9%) were found prior to August 15 (Table 1). Big brown bats were found only during the extended state ITA monitoring period (on July 25 and August 8), and silver-haired bats were found only during the federal ITP monitoring period (on September 6, 12 [2 carcasses], and 13).

**3.1.2 Age and Sex**

A summary of the age and sex of all bat carcasses found during the standardized post-construction monitoring is shown in Table 2. Of the 42 bat carcasses found, there were 4 adult females (3 found prior to August 15), 4 females of unknown age (1 found prior to August 15), 7 adult males (3 found prior to August 15), 4 males of unknown age (1 found prior to August 15), 5 adults of unknown sex (4 found prior to August 15), and 18 bats of unknown age and unknown sex (10 found prior to August 15; Table 2).

**Table 2.** Sex and age of all bat carcasses found during the 2016 standardized post-construction searches (July 15 through October 15) at the Pioneer Trail Wind Farm, Ford and Iroquois counties, Illinois. Ages include adults (A), juveniles (J) and unknown (U). The percentage found during the extended state ITA monitoring period is in parenthesis following the total number found.

	Species	Female			Male			Unknown		
		A	J	U	A	J	U	A	J	U
Extended State ITA Monitoring Period (July 15 – August 14)	Eastern Red Bat	2	0	1	2	0	0	0	0	5
	Hoary Bat	1	0	0	0	0	0	4	0	5
	Silver-Haired Bat	0	0	0	0	0	0	0	0	0
	Big Brown Bat	0	0	0	1	0	1	0	0	0
Federal ITP Monitoring Period (August 15 – October 15)	Eastern Red Bat	0	0	3	2	0	3	0	0	5
	Hoary Bat	1	0	0	0	0	0	0	0	2
	Silver-Haired Bat	0	0	0	2	0	0	1	0	1
	Big Brown Bat	0	0	0	0	0	0	0	0	0
	<b>Total</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>7</b>	<b>0</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>18</b>

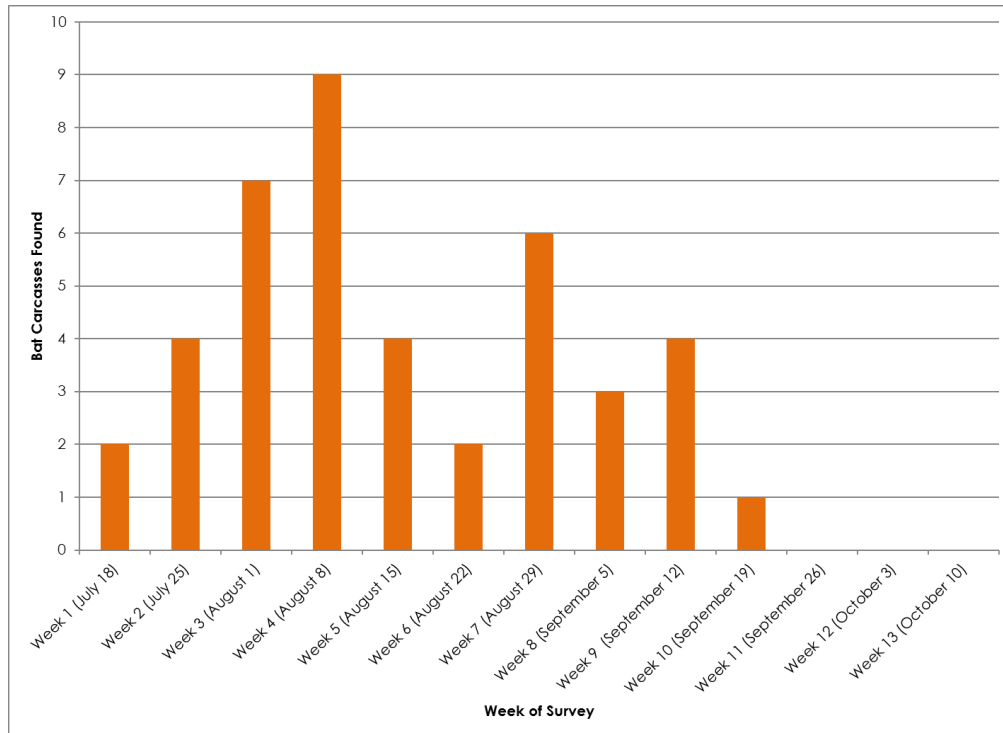
**3.1.3 Temporal Patterns**

Bat carcasses were found in 10 of the 13 survey weeks in 2016 (Figure 2). The fourth week (week of August 8) had the greatest number of bat carcasses (9) found in a single week, followed by the third week (week of August 1) with seven carcasses, both of which occurred prior to curtailment going into effect on the night of August 15. During the last three weeks of surveys no carcasses were found. All other weeks had between one and six bat carcasses found.



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**Figure 2.** Bat carcasses found by week during the 2016 standardized post-construction searches (July 15 through October 15) at the Pioneer Trail Wind Farm, Ford and Iroquois counties, Illinois. Turbines were curtailed at 3.5 m/s for weeks 1 through 4 and at 5.0 m/s for weeks 5 through 13.



**3.1.4 Spatial Patterns**

Bat carcasses were found at a total of 27 of 50 (54%) of the monitored turbines during the 2016 survey period. The greatest number of carcasses found at a single turbine (4) were at turbines B1 (full plot) and F4 (road and pad; Figure 1).

Over the entire monitoring period (July 15 – October 15, 28 bats were found at the road and pad turbines, and 14 bats were found at the full plot turbines. During the federal ITP monitoring period, when turbines were curtailed at 5.0 m/s, 17 bats were found at the road and pad turbines, and 3 bats were found at the full plot turbines, whereas for the extended state ITA monitoring period (July 15 – August 14), 11 bats were found at the road and pad turbines, and 11 bats were found at the full plot turbines.

**3.2 SEARCHER EFFICIENCY TRIALS**

A total of 30 mouse carcasses were placed for searcher efficiency trials during the monitoring period. Overall, the searcher efficiency ranged from 80% at full plots to 70% on roads and pads

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(Table 3). It was assumed that searcher efficiency did not differ between the federal ITP monitoring period and the extended state ITA monitoring period, as the same searcher and plots were used.

**Table 3.** Searcher efficiency by search type for the 2016 post-construction searches (July 15 to October 15) at the Pioneer Trail Wind Farm Ford and Iroquois counties, Illinois.

	Full Plots	Roads and Pads
# Carcasses Placed	10	20
# Carcasses Found	8	14
<b>Mean Searcher Efficiency (90% CI)</b>	<b>0.8</b> (0.6, 1.0)	<b>0.7</b> (0.6, 0.9)

### 3.3 CARCASS REMOVAL TRIALS

Mouse carcasses used in the searcher efficiency trials were left for up to 30 days, and checked on days 1-7, 10, 14, 21, and 30 of the trial. Thirty (30) mouse carcasses were used during the monitoring period, 10 at full plot turbines, and 20 at roads and pads turbines. Carcasses persisted for an average of 3.0 days at roads and pads turbines and an average of 8.2 days at full plot turbines (Table 4). It was assumed that carcass persistence did not differ between the federal ITP monitoring period and the extended state ITA monitoring period.

**Table 4.** Carcass removal by plot type during the 2016 post-construction searches (July 15 to October 15) at the Pioneer Trail Wind Farm, Ford and Iroquois counties, Illinois.

	Full Plots	Roads and Pads
# Carcasses Placed	10	20
# Carcasses Scavenged within 30 days	8	20
<b>Mean Carcass Persistence time in days (90% CI)</b>	<b>8.2</b> (3.2, 17.6)	<b>3.0</b> (1.8, 4.2)

### 3.4 ADJUSTED MORTALITY ESTIMATES

Mortality rate estimates were calculated based upon the carcasses found during the mortality searches, and did not include any incidental finds. Observed bat mortality estimates were

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adjusted to account for searcher efficiency, carcass removal, and an area adjustment using the methods described in Section 2.4<sup>1</sup>. Results are summarized in Table 5.

**Table 5.** Bat mortality estimates for the 2016 standardized post-construction searches at the Pioneer Trail Wind Farm, Ford and Iroquois counties, Illinois.

	Extended State ITA Monitoring July 15 – August 14 (3.5 m/s cut-in)		Federal ITP Monitoring August 15 – October 15 (5.0 m/s cut-in)	
	Full Plots	Roads and Pads	Full Plots	Roads and Pads
(c) Observed bats/turbine/season	1.1	0.275	0.3	0.425
(π) Probability of Carcass Availability and Detection (90% CI)	0.6 (0.3, 0.8)	0.3 (0.2, 0.4)	0.6 (0.3, 0.8)	0.3 (0.2, 0.4)
(A) Area Adjustment	3.3		2.1	
(m) Estimated bats/turbine/monitoring period	4.6 (2.9, 7.3)		2.6 (1.5, 4.3)	
Estimated bats/MW/monitoring period	2.9 (1.8, 4.6)		1.6 (0.9, 2.7)	
Estimated bats/facility/monitoring period	432.4 (272.6, 686.2)		244.4 (141.0, 404.2)	
Estimated Indiana bats/facility/monitoring period <sup>1</sup>	NA		0.4 (0.2, 0.6)	
Estimated northern long-eared bats/facility/monitoring period <sup>1</sup>	NA		0.2 (0.1, 0.3)	

<sup>1</sup>Calculated based upon percentage of Indiana and northern long-eared bats to all bat carcasses found (0.16% and 0.08%, respectively), based upon research done at Fowler Ridge Wind Farm (Western Ecosystems Technology, Inc. 2013). Assumed to not be applicable (NA) for the extended state ITA monitoring period since that is prior to the established period of risk in the HCP for both species.

### 3.5 INCIDENTAL FINDS

A total of two incidental bat carcasses were found during the 2016 standardized post-construction searches. Incidental bat finds included one hoary bat found at a full plot during scavenger

<sup>1</sup>

$$A = \frac{\frac{C_{RP}}{\pi_{RP} * S_{RP}} + \frac{C_{FP}}{\pi_{FP} * S_{FP}}}{\frac{C_{RP}}{\pi_{RP}} + \frac{C_{FP}}{\pi_{FP}}} * A_{FP}; A = \frac{\frac{17}{0.3 * 0.8} + \frac{3}{0.6 * 0.2}}{\frac{17}{0.3} + \frac{3}{0.6}} * 1.305 = 2.1 \text{ for the federal ITP monitoring period}$$

$$A = \frac{\frac{11}{0.3 * 0.8} + \frac{11}{0.6 * 0.2}}{\frac{11}{0.3} + \frac{11}{0.6}} * 1.305 = 3.3 \text{ for the extended state ITA monitoring period}$$

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removal trials, and one eastern red bat found at a road and pad plot before the fall season of standardized post-construction surveys began.

No bird carcasses were found during the 2016 post-construction searches.

## 4.0 Summary and Conclusions

### 4.1 COMPARISON TO PREVIOUS STUDIES

Post-construction monitoring has been conducted in previous years at the Project. While the surveys differed in level of effort (search interval, search area) and bias correction factors (searcher efficiency, carcass persistence, area adjustments), all surveys had overall fatality estimates corrected for these differences, allowing for comparison of results. In addition, the Project operated under different cut-in speed adjustments between years based on the TAL, federal ITP or state ITA requirements.

Because 2016 was the first year that monitoring took place from July 15 to August 14, the following comparisons shown in Table 6 are only for the time period from August 15 to October 15. For the first three years of Project operations the turbines operated under the terms of a TAL, with a cut-in speed of 6.9 m/s. In 2015, the Project operated under the terms of the TAL for the majority of the season, until October 9, when the state ITA was issued and the Project began operations under the federal ITP at 5.0 m/s. The Project operated at 5.0 m/s for the entire 2016 monitoring period. The mean bat fatality estimate ranged from 71.4 to 256.6 bats during the fall period when operating at 6.9 m/s, compared to 244.4 bats during the 2016 fall season, when the project was operating at a cut-in speed of 5.0 m/s (Table 6).

**Table 6.** Bat mortality estimates by year for the fall migratory period (August 15 – October 15) at the Pioneer Trail Wind Farm, Ford and Iroquois counties, Illinois (ARCADIS 2013, 2014, Stantec Consulting Services 2015).

	Year and Cut-in Speed			
	2012 <sup>1</sup> (6.9 m/s)	2013 <sup>1</sup> (6.9 m/s)	2015 (6.9 m/s until October 9, then 5.0 m/s)	2016 (5.0 m/s)
(m) Estimated bats/turbine	0.76	2.73	1.1	2.6
Estimated bats/MW	0.48	1.71	0.7	1.6
Estimated bats/facility	71.4	256.6	103.4	244.4

<sup>1</sup>The estimated bats/facility was adjusted for these years, as the published reports had only multiplied the bats/turbine rate by the number of turbines sampled (50) rather than the facility size of 94 turbines

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**4.2 SUMMARY**

- A total of 650 carcass searches were conducted over 13 weeks from July 15 to October 15.
- A total of 42 bat carcasses were found during standardized searches, with an additional 2 incidental carcasses found. Of these 42 carcasses, 22 were found during the extended ITA monitoring period (July 15 – August 14) and 20 were found during the federal ITP monitoring period (August 15 – October 15).
- No bird or bat species listed as threatened or endangered under the ESA or by the State of Illinois were found during the study.
- Bat species found during standardized searches included eastern red bats (23), hoary bats (13), silver-haired bats (4) and big brown bats (2). In addition, one hoary bat and one eastern red bat were found incidentally.
- No bird carcasses were found during the searches.
- Estimated bat mortality between July 15 and August 14 was 432.4 bats (90% CI: 272.6 to 686.2), compared to an estimated bat mortality between August 15 and October 15 of 244.4 bats (90% CI: 141.0 to 404.2). Turbines operated at a cut-in speed of 3.5 m/s for the period from July 15 to August 14, and at a cut-in speed of 5.0 m/s starting on August 15.
- No Indiana bat carcasses were found during the 2016 study. Estimated mortality of the federally and state endangered Indiana bat was 0.4 Indiana bat during the federal ITP monitoring period.
- No northern long-eared bat carcasses were found during the 2016 study. Estimated mortality of the federally and state threatened northern long-eared bat was 0.2 northern long-eared bat during the federal ITP monitoring period.

**4.3 CONCLUSIONS**

Estimated Indiana bat and northern long-eared bat fatalities were below the annual take limits set forth in both the federal ITP and state ITA. For this Project, the USFWS considers Indiana bats and northern long-eared bats to be at risk during fall migration, which was defined in the Project HCP as August 15 through October 15.

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## **5.0 Literature Cited**

- ARCADIS. 2013. Fall 2012 and spring 2013 avian and bat post-construction mortality monitoring report, Pioneer Trail Wind Farm. Prepared for E.ON Climate & Renewables, North America. ARCADIS U.S., Inc. Milwaukee, Wisconsin. 14 August.
- ARCADIS. 2014. Fall 2013 and spring 2014 avian and bat post-construction mortality monitoring report, Pioneer Trail Wind Farm. Prepared for E.ON Climate & Renewables, North America. ARCADIS U.S., Inc. Milwaukee, Wisconsin. July.
- Arnett, E.B., W.P. Erickson, J. Kerns, and J. Horn. 2005. Relationships Between Bats and Wind Turbines in Pennsylvania and West Virginia: An Assessment of Fatality Search Protocols, Patterns of Fatality, and Behavioral Interactions with Wind Turbines. Final Report prepared for the Bats and Wind Energy Cooperative. Bat Conservation International, Austin, Texas. June 2005.
- Arnett, E.B., W.K. Brown, W.P. Erickson, J.K. Fiedler, B.L. Hamilton, T.H. Henry, A. Jain, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T.J. O'Connell, M.D. Piorkowski, and R.D. Tankersley. 2008. Patterns of bat fatalities at wind energy facilities in North America. *Journal of Wildlife Management* 72: 61-78.
- Erickson, W.P., Gritski, B., and K. Kronner. 2003. Nine Canyon Wind Power Project Avian and Bat Monitoring Report, August 2003. Technical report submitted to energy Northwest and the Nine Canyon Technical Advisory Committee.
- Jain, A., P. Kerlinger, R. Curry, and L. Slobodnik. 2007. Annual Report for the Maple Ridge Wind Power Project: Post-Construction Bird and Bat Fatality Study – 2006. Final report. Prepared for PPM Energy and Horizon Energy and Technical Advisory Committee (TAC) for the Maple Ridge Project Study.
- Good, R. E., Erickson, W., Merrill, A., Simon, S., Murray, K., Bay, K., & Fritchman, C. 2011. Bat monitoring studies at the Fowler Ridge Wind Energy Facility, Benton County, Indiana, April 13–October 15, 2010. Prepared for Fowler Ridge Wind Farm, by Western EcoSystems Technology, Inc. Cheyenne, WY, USA.
- Gruver, J., K. Bay, and W. Erickson. 2009. Post-construction bat and bird fatality study, Blue Sky Green Field Wind Resource Area, Fond du Lac County, Wisconsin. Interim Report prepared for We Energies, Milwaukee, Wisconsin.
- Kerns, J., and P. Kerlinger. 2004. A Study of Bird and Bat Collisions at the Mountaineer Wind Energy Center, Tucker County, West Virginia: Annual Report for 2003. Prepared for FPL Energy and the Mountaineer Wind Energy Center Technical Review Committee. Technical report prepared by Curry and Kerlinger, LLC. February 14, 2004. 39 pp. <http://www.wvhighlands.org/Birds/MountaineerFinalAvianRpt-%203-15-04PKJK.pdf>

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- Kunz, T.H., E.B. Arnett, B.M. Cooper, W.P. Erickson, R.P. Larkin, T. Mabee, M.L. Morrison, M.D. Strickland, and J.M. Szewczak. 2007. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. *Journal of Wildlife Management* 71:2449-2486.
- Manly, B.F.J. 1997. *Randomization, Bootstrap, and Monte Carlo Methods in Biology*. Second edition. Chapman and Hall, New York. 399 pp.
- Piorkowski, M.D., and T. J. O'Connell. 2010. Spatial Pattern of Summer Bat Mortality from Collisions with Wind Turbines in Mixed-grass Prairie. *Am. Midl. Nat.* 164:260-269.
- Stantec Consulting Services Inc. 2015. 2015 Post-construction Bat Mortality Monitoring Report Pioneer Trail Wind Farm, Ford and Iroquois Counties, Illinois. Prepared for Pioneer Trail Wind Farm, LLC. December 9, 2015.
- US Fish and Wildlife Service (USFWS). 2012. *Land-based Wind Energy Guidelines*. March 2012. 71 pp.
- Western Ecosystems Technology, Inc. 2013. *Fowler Ridge Wind Farm, Benton County, Indiana: Indiana Bat Habitat Conservation Plan*. Prepared for Fowler Ridge Wind Farm LLC, Fowler Ridge II Wind Farm LLC, Fowler Ridge III Wind Farm LLC, Fowler Ridge IV Wind Farm LLC. November 2013.
- Young, D. P., Erickson, W.P., Bay, K., Nomani, S., and W. Tidhar. 2009. *Mount Storm Wind Energy Facility, Phase I Post-Construction Avian and Bat Monitoring, July-October 2008*. Prepared for NedPower Mount Storm, LLC, by Western EcoSystems Technology, Inc. 40pp.



# APPENDIX A

## Sample Data Sheets



TURBINE NO. <sup>1</sup>	PLOT TYPE <sup>2</sup>	CARCASS NO. <sup>3</sup>	FROM TURBINE		ON ROAD/PAD?	GPS COORDINATES	SPECIES (scientific name, spell out) <sup>4</sup>	FOREARM LENGTH OF BAT (mm)	AGE <sup>5</sup>	SEX <sup>6</sup>	CAUSE OF DEATH <sup>7</sup>	CONDITION <sup>8</sup>	CHECK IF COMMENTS (write on back) <sup>9</sup>
			DISTANCE (m)	AZIMUTH (DEGREES)									
												/	
												/	
												/	
												/	
												/	
												/	
												/	
												/	
												/	

<sup>1</sup> TURBINE – ENTER NUMBER OF TURBINE. ALSO SEARCH THE TURBINE PAD AND ACCESS ROAD IN ADDITION TO THE STUDY PLOT.

<sup>2</sup> PLOT TYPE – R=ROADS AND PADS, F=FULL PLOT

<sup>3</sup> CARCASS NO. – NUMBER CARCASSES IN THE ORDER THEY ARE FOUND.

<sup>4</sup> SPECIES – IF UNKNOWN, SPECIFY UNKNOWN BAT OR UNKNOWN BIRD.

<sup>5</sup> AGE – IF IDENTIFIABLE: ADULT = A; JUVENILE = J; UNKNOWN = U

<sup>6</sup> SEX – IF IDENTIFIABLE: FEMALE = F; MALE = M, UNKNOWN = U

<sup>7</sup> CAUSE OF DEATH – COLLISION WITH TURBINE = T; PREDATION = P; UNKNOWN = U (ADD EXPLANATION IN COMMENTS IF NECESSARY).

<sup>8</sup> CONDITION – ENTER F=FRESH OR D=DECOMPOSED AND WHOLE =W; MOST OF BODY WITH SOME MISSING = M; PIECES = P (E.G., WING ONLY); FEATHER SPOT = F (EXAMPLE: F/W)

<sup>9</sup> COMMENTS – INCLUDING: REPRODUCTIVE CONDITION, IF IDENTIFIABLE: PREGNANT = P; LACTATING = L; POST-LACTATING = PL; NON-REPRODUCTIVE = NR; TESTES DESCENDED = T; UNKNOWN = U; B= BREEDING (BIRDS).

BAND COLOR/No. – IF BANDED, RECORD COLOR OF BAND (OR METAL), AND NUMBER.

OTHER COMMENTS. INCLUDE CARCASS NUMBER NEXT TO ALL COMMENTS.

**PHOTOS:** WHERE POSSIBLE, PHOTOGRAPH FOR BATS: BACK, BREAST, MUZZLE, TRAGUS, RULER BEHIND EAR, RULER NEXT TO FOREARM, FOOT, TOEHAIRS, CALCAR (IF EXPOSED).

FOR BIRDS: BACK, BREAST, HEAD, FEET, UNDERSIDE OF WINGS (FOR RAPTORS).

**ADDITIONAL COMMENTS (record carcass number next to associated comment; include any identifiers and bands, if present):**

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Carcass ID <sup>1</sup>	Placement				Species (scientific name)	Condition <sup>4</sup> When Checked, Checked By <sup>5</sup>											
	GPS Coordinates	Time (Military)	Turbine <sup>2</sup>	Placed By <sup>3</sup>		Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 10	Day 14	Day 20	Day 30	

<sup>1</sup> Carcass ID – Identification number marked inside carcass.

<sup>2</sup> Turbine – Turbine number where carcass placed.

<sup>3</sup> Placed By – Initials of the person who placed the carcass.

<sup>4</sup> Condition – Record the condition the carcass was in when checked. Intact = I, Signs of scavenging = S, Feather/Fur Spot = F, Missing or < 10 feathers = 0

<sup>5</sup> Checked by – Record the initials of the person who checked on the carcass.

**Comments:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

More data on back? Yes No



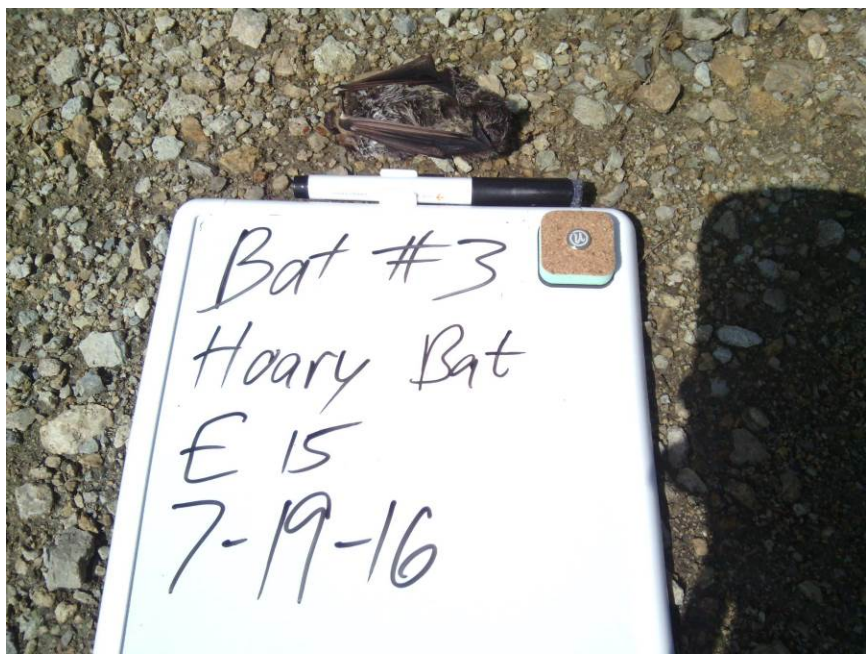






# APPENDIX B

## Representative Carcass Photos



**Photo 1. Representative hoary bat (*Lasiurus cinereus*) found at turbine E15 during road and pad surveys at the Pioneer Trail Wind Farm. (July 19, 2016)**



**Photo 2. Representative example of a red bat (*Lasiurus borealis*) and calipers found during road and pad surveys at turbine F4 at the Pioneer Trail Wind Farm. (July 25, 2016)**



**Photo 3. Big brown bat as found during full plot surveys at turbine B1 at the Pioneer Trail Wind Farm. (August 8, 2016)**



**Photo 4. Representative example of a silver-haired bat (*Lasionycteris noctivagans*) found during surveys at turbine D4 at the Pioneer Trail Wind Farm. (September 12, 2016)**

# APPENDIX C

Raw Data

Date	Turbine No.	Search Type (Full or R/P)	On Road/ Pad? (Y or N)	Carcass Type (Bird or Bat)	Latitude	Longitude	Distance	Azimuth	Common Name	Species	Forearm Length (mm)	Age	Sex	Cause of Death	Condition	Incidental	Comments
8/1/2016	A12	R/P	Y	Bat	40.47752	-88.07195	22	180	Hoary Bat	<i>Lasiurus cinerus</i>	56	A	U	T	F/W	No	
8/1/2016	A2	R/P	Y	Bat	40.46524	-88.04592	8	4	Eastern Red Bat	<i>Lasiurus borealis</i>	41	A	M	T	F/W	No	
7/25/2016	A4	R/P	Y	Bat	40.45503	-88.05817	3	15	Big Brown Bat	<i>Eptesicus fuscus</i>	44	U	M	T	F/W	No	
7/26/2016	B1	Full	Y	Bat	40.45707	-88.03404	10	0	Eastern Red Bat	<i>Lasiurus borealis</i>	38	U	U	T	D/M	No	hair on tail membrane. Forearm may not be accurate because of decomposition.
8/1/2016	B1	Full	N	Bat	40.4654	-88.02828	15	0	Hoary Bat	<i>Lasiurus cinerus</i>	48	U	U	T	F/W	No	
8/8/2016	B1	Full	N	Bat	40.45693	-88.03403	12	180	Big Brown Bat	<i>Eptesicus fuscus</i>	48	A	M	T	F/W	No	
8/8/2016	B15	R/P	Y	Bat	40.49679	-88.05551	5	280	Eastern Red Bat	<i>Lasiurus borealis</i>	35	U	U	T	F/W	No	
8/9/2016	B5	Full	Y	Bat	40.45052	-88.03276	9	290	Eastern Red Bat	<i>Lasiurus borealis</i>	40	A	F	T	F/W	No	
8/1/2016	C1	R/P	Y	Bat	40.46541	-88.02828	11	270	Eastern Red Bat	<i>Lasiurus borealis</i>	41	A	F	T	F/W	No	
8/8/2016	C2	R/P	Y	Bat	40.47041	-88.0346	4	170	Hoary Bat	<i>Lasiurus cinerus</i>	51	U	U	T	F/W	No	
8/1/2016	D3	R/P	Y	Bat	40.47503	-88.01768	21	180	Hoary Bat	<i>Lasiurus cinerus</i>	51	A	U	T	F/W	No	
8/9/2016	E14	Full	N	Bat	40.42671	-87.94791	17	250	Eastern Red Bat	<i>Lasiurus borealis</i>	38	A	M	T	F/W	No	
8/9/2016	E14	Full	N	Bat	40.42664	-87.94773	10	175	Eastern Red Bat	<i>Lasiurus borealis</i>	41	U	U	T	F/W	No	
7/18/2016	E15	R/P	Y	Bat	40.42509	-87.95484	8	15	Hoary Bat	<i>Lasiurus cinerus</i>	55	A	F	T	F/W	No	
7/18/2016	E16	R/P	Y	Bat	40.41512	-87.94906	4	290	Hoary Bat	<i>Lasiurus cinerus</i>	49	A	U	T	D/W	No	within the week
7/18/2016	E7	R/P	Y	Bat	40.45895	-87.96671	7	195	Hoary Bat	<i>Lasiurus cinerus</i>	56	A	U	T	D/W	Yes	At least 1 week dead. Full of maggots and fairly decomposed.
8/9/2016	F10	R/P	Y	Bat	40.45291	-87.97477	26	180	Hoary Bat	<i>Lasiurus cinerus</i>	55	A	U	T	F/W	No	
7/26/2016	F4	R/P	Y	Bat	40.45577	-88.00951	19	15	Eastern Red Bat	<i>Lasiurus borealis</i>	41	U	F	T	F/W	No	
8/1/2016	F6	R/P	Y	Bat	40.45308	-88.00036	40	270	Hoary Bat	<i>Lasiurus cinerus</i>	58	U	U	T	F/W	No	
7/26/2016	F7	R/P	Y	Bat	40.44778	-87.99336	5	85	Eastern Red Bat	<i>Lasiurus borealis</i>	41	U	U	T	F/W	No	



Date	Turbine No.	Search Type (Full or R/P)	On Road/ Pad? (Y or N)	Carcass Type (Bird or Bat)	Latitude	Longitude	Distance	Azimuth	Common Name	Species	Forearm Length (mm)	Age	Sex	Cause of Death	Condition	Incidental	Comments
8/9/2016	F8	R/P	Y	Bat	40.44527	-87.99897	7	270	Hoary Bat	<i>Lasiurus cinerus</i>	52	U	U	T	F/W	No	
8/1/2016	F9	Full	N	Bat	40.45424	-87.98253	16	270	Eastern Red Bat	<i>Lasiurus borealis</i>	39	U	U	T	F/W	No	
8/9/2016	F9	Full	N	Bat	40.45403	-87.98237	27	183	Hoary Bat	<i>Lasiurus cinerus</i>	NA	U	U	T	F/W	No	forearm was not measured because it was broken
8/16/2016	A7	R/P	Y	Bat	40.464444	-88.057194	9	20	Eastern Red Bat	<i>Lasiurus borealis</i>	43	U	F	T	F/W	No	
8/16/2016	D3	R/P	Y	Bat	40.475194	-88.017667	6	250	Eastern Red Bat	<i>Lasiurus borealis</i>	39	U	U	T	F/W	No	
8/16/2016	C12	Full	Y	Bat	40.498944	-88.028722	3	20	Eastern Red Bat	<i>Lasiurus borealis</i>	40	U	U	T	F/W	No	
8/16/2016	B5	Full	Y	Bat	40.4505	-88.032639	14	175	Eastern Red Bat	<i>Lasiurus borealis</i>	38	U	U	T	F/W	No	
8/22/2016	D4	R/P	Y	Bat	40.477417	-88.024056	5	90	Hoary Bat	<i>Lasiurus cinerus</i>	56	U	U	T	D/W	No	less than a week
8/23/2016	F4	R/P	Y	Bat	40.457028	-88.009028	62	0	Eastern Red Bat	<i>Lasiurus borealis</i>	40	A	M	T	F/W	No	
8/29/2016	B13	R/P	Y	Bat	40.496583	-88.044861	10	190	Hoary Bat	<i>Lasiurus cinerus</i>	55	A	F	T	F/W	No	
8/29/2016	C12	Full	N	Bat	40.499056	-88.028556	20	30	Eastern Red Bat	<i>Lasiurus borealis</i>	42	U	F	T	F/W	No	
8/29/2016	A7	R/P	Y	Bat	40.464611	-88.05725	20	0	Eastern Red Bat	<i>Lasiurus borealis</i>	39	U	F	T	F/W	No	
8/29/2016	F10	R/P	Y	Bat	40.453139	-87.974639	8	75	Eastern Red Bat	<i>Lasiurus borealis</i>	39	U	M	T	F/W	No	
8/29/2016	E3	Full	N	Bat	40.469028	-87.988139	13	180	Eastern Red Bat	<i>Lasiurus borealis</i>	37	U	U	T	F/W	No	
8/29/2016	F8	R/P	Y	Bat	40.445278	-87.998861	5	35	Hoary Bat	<i>Lasiurus cinerus</i>	50	U	U	T	F/W	No	
9/6/2016	F4	R/P	Y	Bat	40.455639	-88.0095	10	90	Eastern Red Bat	<i>Lasiurus borealis</i>	39	U	M	T	F/W	No	
9/6/2016	F10	R/P	Y	Bat	40.452861	-87.97475	30	180	Eastern Red Bat	<i>Lasiurus borealis</i>	41	U	M	T	F/W	No	
9/6/2016	F4	R/P	Y	Bat	40.455861	-88.010139	4	345	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	42	U	U	T	F/W	No	
9/12/2016	B1	Full	N	Bat	40.457005	-88.033563	31	100	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	41	A	M	T	F/W	No	killed last night
9/12/2016	D4	R/P	Y	Bat	40.477412	-88.024104	9	181	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	41	A	M	T	F/W	No	killed last night

Date	Turbine No.	Search Type (Full or R/P)	On Road/ Pad? (Y or N)	Carcass Type (Bird or Bat)	Latitude	Longitude	Distance	Azimuth	Common Name	Species	Forearm Length (mm)	Age	Sex	Cause of Death	Condition	Incidental	Comments
9/13/2016	C7	Full	Y	Bat	40.48981	-88.018901	6	170	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	42	A	U	T	F/W	No	killed in last two nights
9/13/2016	A16	R/P	Y	Bat	40.48952	-88.07745	4	10	Eastern Red Bat	<i>Lasiurus borealis</i>	38	U	U	T	D/P	No	
9/13/2016	B5	Full	Y	Bat	40.450862	-88.032404	52	15	Eastern Red Bat	<i>Lasiurus borealis</i>	37	U	U	T	F/W	Yes	
9/20/2016	D1 1	R/P	Y	Bat	40.475106	-87.999118	6	80	Eastern Red Bat	<i>Lasiurus borealis</i>	39	A	M	T	F/W	No	