

**Post-Construction Monitoring Study for the  
Headwaters Wind Farm  
Randolph County, Indiana**

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**Year 3 Final Report  
April 1 – October 15, 2021**



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## **EXECUTIVE SUMMARY**

Headwaters Wind Farm, LLC (Headwaters) is operating the Headwaters Wind Farm (Project) in Randolph County, Indiana. The Project became operational in 2014 and consists of 100 2.0-megawatt (MW) Vestas V110 wind turbines with a 95-meter (m; 312 foot [ft]) hub height and a 55-m (180 ft) blade length. This report details the post-construction monitoring (PCM) study conducted in 2021, as the third year of monitoring consistent with Section 5.4.1 of the Project's Habitat Conservation Plan (HCP) and Incidental Take Permit (ITP; TE85617C-0) for Indiana and northern long-eared bats (the Covered Species).

The PCM was completed in accordance with the study plan, which was approved by US Fish and Wildlife Service in spring 2021. The study plan was designed to target a probability of detection,  $g$ , of 0.25. The overall goal of this PCM study was to generate reliable fatality estimates for the Covered Species and to evaluate compliance with the incidental take authorization granted under the Project's ITP. More specifically, the objectives of this study were to: 1) estimate take of the Covered Species using the Evidence of Absence (EoA) framework, as outlined in the HCP; 2) provide the necessary data to determine if adaptive management was required; and 3) determine estimated cumulative bat fatality rates for the Covered Species throughout the study.

Standardized carcass searches were completed for bat carcasses at two plot types: full plots and road and pad plots, and were conducted by two types of searchers: technician and dog-handler team (consisting of one dog trained to detect carcasses and one handler). The frequency of searches varied between the spring, summer and fall, with more searches occurring when take of Covered Species was considered more likely to occur. Searcher efficiency and carcass persistence trials were also conducted during each season to correct for detection and scavenger bias.

Five federally listed endangered Indiana bats were recorded at the Project during the study period. No northern long-eared bats were found at the Project. Two evening bats, a state-endangered species, were found at the Project during the fall. Five-hundred-seven bats in total were found during the study. The most commonly found bat species were eastern red bat (40.6%), silver-haired bat (30.8%), hoary bat (16.6%), and big brown bat (8.9%). Species composition recorded at the Project was similar to previous studies at the Project, as well as other wind facilities in Indiana. Sixty-five bird carcasses were recorded; no federally or state-listed birds were found.

Using all data collected to date (2019, 2020, and 2021 studies), the EoA model estimated the mean annual fatality rate at the Project was 9.53 Indiana bats and 0.64 northern long-eared bats. The probability [ $\Pr(\lambda > \tau)$ ] that the annual take rate was greater than the expected annual take rate was 0.45 for Indiana bat and 0.05 for northern long-eared bat. The cumulative take estimates through 2021 for the Project were 27 Indiana bat fatalities and zero northern long-eared bat fatalities. The estimated levels of Indiana bat and northern long-eared bat take were below levels authorized within the ITP and adaptive management is not required to reduce Covered Species mortality.

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### **REPORT REFERENCE**

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## INTRODUCTION

Headwaters Wind Farm, LLC (Headwaters), a subsidiary of EDP Renewables North America (EDPR), is operating the Headwaters Wind Farm (Project) in Randolph County, Indiana. Headwaters obtained an Incidental Take Permit (ITP; TE85617C-0; dated June 4, 2019) from the US Fish and Wildlife Service (USFWS) for the federally listed, endangered Indiana bat (*Myotis sodalis*; USFWS 1967), and the federally listed, threatened northern long-eared bat (*M. septentrionalis*; USFWS 2015; hereafter referred to as Covered Species). This report presents the results of the third year of compliance monitoring conducted under the HCP and ITP to determine if the level of take is in compliance with the authorized take and to evaluate the need for adaptive management measures.

Western EcoSystems Technology, Inc. (WEST), used Project-specific data from previous post-construction monitoring (PCM) studies at the Project (see Rodriguez et al. 2020, 2021) to develop a study plan that targeted a *g* of 0.25 to meet the monitoring commitments in the HCP. The objectives of this study were to estimate take of the Covered Species using the Evidence of Absence (EoA) framework as outlined in the HCP, and provide the necessary data to determine if adaptive management is triggered. This report presents the results of the third year of monitoring conducted at the Project from April 1 through October 15, 2021.

## STUDY AREA

The primary land cover type within 100 meters (m; 328 feet [ft]) of the turbines (i.e., within the area defined in the HCP) is cultivated crops, which covers 87.7% of the Permit Area, followed by developed (5.5%), and patches of deciduous forest (5.1%; Table 1, Figure 1; National Land Cover Database 2019). The Project became fully operational in 2014, and consists of 100 2.0-megawatt (MW) Vestas V110 wind turbines that have a 95-meter (m; 311 foot [ft]) hub height and a 55-m (180 ft) blade length. All turbines are within the migratory range of Indiana bat and northern-long eared bat, and the following minimization and mitigation activities were set forth in the HCP (Section 5.2.2; Headwaters ITP 2019):

- Headwaters committed to feathering blades on nights when temperatures were above 10 degrees (°) Celsius (C; 50 °Fahrenheit [F]) for spring, summer (summer risk turbines), and fall seasons.<sup>1</sup>
- Spring (April 1 – May 15)
  - Feathering of all wind turbine blades below a wind cut-in speed of 3.5 m per second (m/s; 11.5 ft/s) from a half hour before sunset to a half hour after sunrise.
- Summer (May 16 – July 31)

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<sup>1</sup> In practice, the Project feathered on all nights, regardless of temperature.

- Feathering of wind turbine blades below a wind cut-in speed of 5.0 m/s (16.4 ft/s) at 10 turbines *with* summer risk to Covered Species from a half hour before sunset to a half hour after sunrise.
- Feathering of wind turbine blades below a wind cut-in speed of 3.0 m/s (9.8 ft/s) at 90 turbines *without* summer risk to Covered Species from a half hour before sunset to a half hour after sunrise.
- Fall (August 1 – October 15)
  - Feathering of all wind turbine blades below a wind cut-in speed of 5.0 m/s from a half hour before sunset to a half hour after sunrise.

**Table 1. Land cover types and percent composition at the Headwaters Wind Farm Permit Area, in Randolph County, Indiana.**

<b>Habitat</b>	<b>Acres</b>	<b>% Composition</b>
Cultivated Crops	25,668	87.7
Developed*	1,602	5.5
Deciduous Forest	1,488	5.1
Hay/Pasture	320	1.1
Woody Wetlands	113	0.4
Herbaceous	55	0.2
Open Water	10	< 0.1
Emergent Herbaceous Wetlands	6	< 0.1
Mixed Forest	3	< 0.1
Evergreen Forest	2	< 0.1
Barren Land	1	< 0.1
<b>Total**</b>	<b>29,269</b>	<b>100</b>

\* Developed areas include high-, medium-, and low-intensity developed areas, as well as developed open space.

\*\* Sums may not equal total values shown due to rounding.

Data from National Land Cover Database. 2019



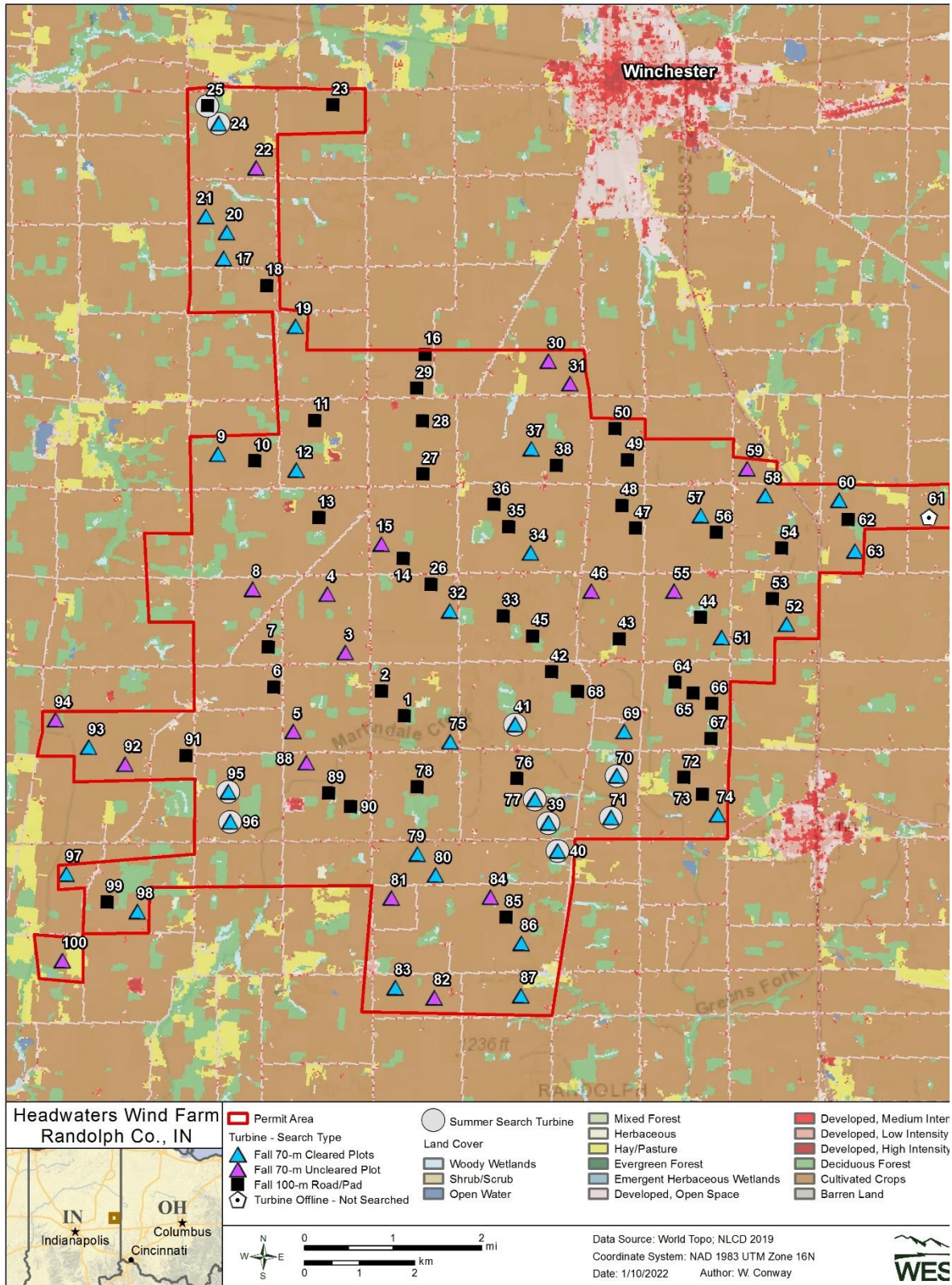


Figure 1. Turbine locations by search type and surrounding land cover at the Headwaters Wind Farm in Randolph County, Indiana. All fall turbines were searched in spring as road and pad plots, with the exception of turbine 6, which was offline.

## METHODS

WEST used Project-specific data from previous PCM studies at the Project (see Rodriguez et al. 2020, 2021) to develop a study plan that targeted a *g* of 0.25 to meet the monitoring commitments in the HCP. WEST submitted a study plan to EDPR on January 28, 2021, and received approval from the USFWS on June 30, 2021 (M. Reed, USFWS, pers. comm.).

### Standardized Carcass Searches

#### *Number of Turbines Sampled, Search Frequency, and Plot Size*

Technicians and dog-handler teams conducted standardized carcass searches (carcass searches) from April 1 – October 15, 2021. Search effort varied by season, and was designed to maximize effort when the greatest number of Covered Species were expected to occur (Table 2).

**Table 2. Search effort by season and plot type at the Headwaters Wind Farm in Randolph County, Indiana.**

Season	Plot Type	Search Interval	Number of Turbines	Search Team
Spring (April 1–May 15)	100-m road and pad	14 days	98 <sup>1,2</sup>	Technician
Summer (May 16–July 31)	100-m road and pad	7 days	1	Technician
	70-m cleared (full) plots	7 days	9	Dog-handler Team
Fall (August 1–October 15)	100-m road and pad	7 days	46 <sup>2</sup>	Technician
	70-m cleared (full) plot	7 days	35 <sup>2</sup>	Dog-handler Team
	70-m uncleared (full) plot	7 days	18 <sup>2</sup>	Dog-handler Team

<sup>1</sup>Turbine 6 was inaccessible and unsearched during the spring, but was searched during fall season.

<sup>2</sup>Turbine 61 was offline (non-operational) for the entire season, bringing the total number of turbines searched in the fall to 99.

During the spring (April 1 – May 15), technicians searched the gravel road and pad areas under 98 turbines to a distance of 100 m from the turbine every other week (Table 2, Figure 2). Turbine 61 was non-operational for the entire 2021 study season, and was not searched. Turbine 6 was inaccessible due to construction and was not searched. Additionally, construction taking place at the nearby Riverstart Solar Project led to all turbines not operating from April 26 – May 19. However, carcass searches continued as normal during this period.

During the summer (May 16 – July 31), dog-handler teams searched nine turbines with summer risk as cleared plots, where crops were regularly mowed within a 70-m (230-ft) radius (Figure 3), and technicians searched one road and pad plot to a distance of 100 m from the turbine once a week. Turbine 71, a summer risk cleared plot turbine, experienced a blade failure on July 3, 2021, and was non-operational and not searched for the remainder of the summer season.



**Figure 2. Representative photograph of conditions within a 100-meter road and pad plot.**



**Figure 3. Representative photograph of vegetation conditions within a 70-meter cleared plot. Pictured is dog-handler team member, “Bella”.**

All turbines were searched once per week during the fall (August 1 – October 15; Table 2), with the exception of turbines 61 and 71. As previously noted, Turbine 61 was non-operational for the entire 2021 study season and was not searched. Blade repairs at Turbine 71 kept it non-operational for the nearly the entire fall season (until October 5), and it was not searched except for a single search at the end of the season, on October 11, 2021, after it became operational again. A technician searched 46 turbines as road and pad plots to a distance of 100 m from the turbine during the fall, while dog-handler teams searched 35 turbines as cleared plots with a 70-m radius (Figure 2) and 18 turbines as uncleared plots with a 70-m radius (Figure 3).

During the summer and fall study periods, vegetation at cleared plots was mowed and maintained by EDPB within 10 to 15 centimeters (four to six inches) in height to enhance detectability of carcasses (Figure 3). Ground cover at uncleared plots consisted of soybeans (*Glycine max*; Figure 4) or alfalfa (*Medicago sativa*). A cross pattern, approximately 1.5-m (4.9-ft) wide, was mowed into the uncleared soybean plots to assist with plot access.



**Figure 4. Representative photograph of vegetation conditions in a 70-meter uncleared plot. Pictured is dog-handler team member, “Bella”.**

### *Search Methods*

WEST used two types of search methods: a technician, or human only visual search, and a dog-handler team or olfactory search where the team consisted of one technician/handler and one dog. All technicians were trained to follow the Project’s study plan, including proper handling and reporting of carcasses.

### Road and Pad Searches - Technician

Technicians walked transects spaced five m (16 ft) apart at a rate of approximately 45–60 m per minute (min; 148–197 ft/min) on all gravel road and pad areas within 100 m of the turbine. Technicians scanned the area for fatalities on both sides of the transects out to approximately 2.5 m (8.2 ft) to ensure full visual coverage of each search area. Technician searches were only conducted for road and pad plot types.

### Full Plot Searches – Dog-Handler Team

Dog-handler teams searched cleared and uncleared plots for bat carcasses. Prior to each search, the dog handler determined the survey start point and the number of transects needed to cover the plot after taking into account wind speed and direction, as well vegetation density (when applicable). The handlers oriented the dog to start searches perpendicular to the wind to maximize scent detection. Both wind speed and vegetation density can affect dispersal of the target odor (bat carcass) across the search area. To maximize detection rates during an olfactory search, transect width varied with vegetation density, ranging from five to 10 m (16 to 33 ft) apart in densely vegetated areas, to 10–15 m (33–49 ft) in shorter vegetation.

### Dog-Handler Team Evaluation

Detection dogs were considered candidates for conducting carcass searches at the Project if they met certain temperament, obedience, and carcass-detection requirements. Characteristics that are sought after in a detection dog are comparatively high-energy, with a high toy or food drive, and successful completion of WEST's detection dog scent training protocol. Prior to conducting searches at the Project, handlers trained their detection dogs on the scent of bat carcasses using techniques derived from search and rescue training and drug detection programs (Kay 2012, Helfers 2017). Dogs were initially trained on dehydrated bat carcasses as the target odor. Once the dog had achieved a passing grade of 80% or higher in a scent recognition test consisting of 10 blind trial lineups using bat carcasses, the dog and handler were evaluated in the field to measure performance under conditions representative of the actual survey area. The detection dog coordinator conducts a 2-day field evaluation for dog-handler teams. Teams were required to achieve a searcher efficiency (SEEF) of 75% or greater for 15–30 bats during field evaluation trials, the teams are approved to conduct carcass searches. Because the objective of this study was to document bat fatalities, the dogs were not explicitly trained on the scent of native bird carcasses; however, all detection dogs alerted on birds in the field, and handlers rewarded bird carcass finds, allowing the detection dogs to include bird carcass odors into their list of known target odors. Breeds of detection dog used at the Project included Border collie, Labrador retriever, and Labrador retriever mix.

### *Search Data Collection*

For each scheduled search, technicians recorded the date, start and end times, observer, turbine number, type of search, and if any fatalities were found. When a fatality was found, technicians placed a flag near it and continued the search. After searching the entire plot, the technician returned to each fatality and recorded the date and time found, observer, species, sex and age of the carcass (when possible), turbine number, distance and azimuth from turbine, location of the

carcass as latitude and longitude coordinates, habitat surrounding carcass, estimated time of death (ETOD) (e.g., less than one day, two days), and condition of carcass (e.g., intact, scavenged, dismembered).

The condition of each carcass found was recorded using the following categories:

- Intact—a carcass that was found in entirely in one piece, was not badly decomposed, and showed no sign of being fed upon by a predator or scavenger.
- Scavenged—a carcass that showed signs of being fed upon by a predator or scavenger, but was otherwise complete; or a portion(s) of a carcass in one location (e.g., wings, skeletal remains, portion of a carcass), or a carcass that was heavily infested by insects.
- Dismembered—all portions of a single carcass found in multiple pieces that were distributed more than 1.0 m (3.3 ft) apart from one another due to scavenging or other reasons.
- Injured—a bat or bird found alive, but impaired in some way.

For bird carcasses, the following category was also used:

- Feather spot—Ten or more feathers (excluding down), or two or more primary feathers at found at one location, indicating predation or scavenging of a bird carcass.

Technicians took digital photographs of each fatality, including any visible injuries, and surrounding habitat. No bird carcasses were collected, but a marker was placed next to each bird carcass to avoid duplicate counting. Technicians placed each bat carcass in a resealable plastic bag that was labeled with a unique carcass identification number, turbine number, and date, and stored the bags in a freezer on site. Leather gloves covered in nitrile or latex gloves were used to handle all carcasses to eliminate possible transmission of rabies or other zoonotic diseases, and to reduce possible human scent bias on any carcasses used later in bias trials. Bat carcasses were collected under the Project's ITP (TE85617C-0), WEST's Federal Native Endangered and Threatened Species Recovery Permit (TE234121-9), and WEST's Indiana Special Purpose Salvage Permit (2137). Live, injured bats were recorded and considered fatalities for analysis purposes when observed in search areas, and were handled in accordance with permit conditions (left in place).

Carcasses found in non-search areas (e.g., outside of a plot boundary) or outside of the scheduled study period were recorded as incidental discoveries and documented following the same protocol as carcasses found during standard searches. All Covered Species (see HCP Sections 3.2 and 3.3), including any found incidentally, were included in statistical analysis for Evidence of Absence (EoA; see Evidence of Absence section below).

### *Carcass Identification and Agency Notification*

Field identification of bird carcasses by technicians was verified through photographs by WEST biologists experienced in identification of birds and their feathers. A federally permitted bat biologist (TE33467D-0) identified all bat carcasses via photographs within 24 hours. Tissue samples were collected from scavenged or decomposed carcasses that could not be positively identified and had the potential to be a Covered Species. Tissue samples were submitted to an USFWS-approved laboratory, the Northern Arizona University School of Forestry and Center for Microbial Genetics and Genomics, or the East Stroudsburg University Wildlife Genetics Institute for identification. Bat carcasses that were heavily scavenged but did not have potential to be a Covered Species (i.e., fur was present on the wing, or the forearms measured more than 41 millimeters [1.6 inch] long) were identified to the closest genus or group possible and were not sent off for further identification.

The USFWS and the Indiana Department of Natural Resources (IDNR) were notified within 24 hours of positive identification any species listed as endangered or threatened under the Endangered Species Act of 1973, or any state-listed threatened or endangered species (see IDNR 2020). All listed species were delivered to USFWS as instructed by the agency. A permitted bat biologist (TE33467D-0) verified the identifications of all bat carcasses throughout the surveys. Carcass samples were delivered to USFWS in January 21, 2022.

### **Bias Trials**

#### *Searcher Efficiency Trials*

The objective of the SEEF trials was to collect data to estimate the probability that searchers detected bat carcasses. One hundred and sixty carcasses were distributed throughout the spring, summer, and fall seasons and across all plot types (road and pad plots, uncleared plots, and cleared plots). This effort accounted for any biases associated with changes in conditions, such as vegetation, topography, weather (e.g., rain and/or cloud cover, muddy plots), and searcher variability that could have affected SEEF.

SEEF trials commenced with the start of carcass searches and were conducted in the same areas where carcass searches occurred. Multiple trials were conducted in each season to measure potential changes in plot conditions on SEEF over time. Technicians and dog-handler teams conducting searches did not know when SEEF trials were being conducted or the location of the trial carcasses. Trial carcasses consisted of big brown bats (*Eptesicus fuscus*) provided by Indiana State University, as well as eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), and silver haired bats (*Lasionycteris noctivagans*) that had previously been found on site.

Prior to placement, each SEEF carcass was discreetly marked with a black zip-tie around the upper forelimb so it could be identified as a trial carcass. Carcasses were dropped from waist-height or higher and allowed to land in a random posture. For technician search trials, the trial administrator placed carcasses prior to the technician searching the plot, either the night before, or the morning of searches depending on work schedules. For dog-handler team trials,

the trial administrator dropped SEEF carcasses the night before the next search to allow time for a scent pool to form; a meandering path was taken to and from the placement site to eliminate a direct scent trail.

Searchers had one chance to locate SEEF carcasses during the first search after carcass placement. The number and location of SEEF carcasses found during a search were recorded. Immediately after each trial, the trial administrator coordinated availability checks to determine the total number of SEEF carcasses available for detection during each search. This included checks for any SEEF carcasses not recorded as found during the search, to determine availability. Ninety SEEF carcasses were left in place and used for carcass persistence trials (CPT).

#### *Carcass Persistence Trials*

The objective of CPT was to estimate the average probability a bat carcass remained available to be found during the search interval. Carcasses could be removed by scavenging or rendered undetectable by typical farming activities (e.g., agricultural tilling that could bury the trial carcass). Fifteen trial carcasses were placed in each plot type each season to incorporate the effects of varying weather, climatic conditions and scavenger densities on carcass persistence (CP). No more than two trial carcasses were placed on a plot to avoid potential over-seeding and attracting scavengers. Estimates of bat CP were used to adjust the total number of carcasses found for those removed from the search area.

Technicians monitored the trial carcasses over a 30-day period according to the following schedule, as closely as possible. Carcasses were checked daily for the first four days, then on day 7, 10, 14, 20, and 30. Trial carcasses were monitored until the carcass was completely removed or the trial period ended. Following the 30-day period, any evidence of the carcasses that remained was removed from the search plot. Dog-handler teams determined when carcasses were removed from the cleared and uncleared plots, while technicians verified the status of carcasses on road and pad plots.

#### **Search Area Mapping**

The boundaries of all plots were mapped using aerial imagery for road and pad plots and applying a 70-m buffer beyond the turbine tower base for full plots. Plot boundaries were used to verify if carcasses were found inside the search areas, and to inform the distribution of carcasses around turbines to estimate the number of carcasses that fell inside or outside of search areas.

#### **Quality Assurance and Quality Control**

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, technicians were responsible for inspecting data forms for completeness, accuracy, and legibility. Potentially erroneous data were identified using a series of database queries. Irregular codes or data suspected as questionable were discussed with the technician and/or Project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes and measures were implemented. A Microsoft® SQL



database was developed to store, organize, and retrieve survey data. All data forms and electronic data files were retained for reference.

## **Statistical Analysis**

The EoA modeling framework (Dalthorp et al. 2017) was used to estimate take of Covered Species. Inputs used to estimate take included the number of Covered Species' carcasses found, the search schedule, searcher efficiency trial results, a fitted carcass persistence distribution, an area adjustment, and pre-defined expectations of carcass arrival in each season. EoA was used to estimate the site-wide and multi-year detection probability ( $g$ ) and associated mortality metrics for the Covered Species: cumulative take to date and the annual take rate. These metrics were compared to targets specified in the ITP to test whether the Project is in compliance and/or whether adaptive management is needed.

### *Searcher Efficiency Estimation*

EoA uses raw SEEF data (i.e., number of found and available trial carcasses) to inform overall probability of detection. However, to determine if SEEF data should be pooled, or separated by strata such as season and/or plot type, SEEF was modeled using logistic regression while accounting for the detection reduction factor  $k$  (Dalthorp et al. 2018). Models included plot type and season as potential covariates, and SEEF was modeled separately for technician and dog-handler teams to account for different modes of detection (i.e., technicians use visual cues, dogs use olfactory cues). For both sets of models, selection was completed using an information theoretic approach known as AICc, or corrected Akaike Information Criterion (Burnham and Anderson 2002). The best model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. SEEF values were input into the EoA software according to the model selection results.

The change in SEEF between successive searches was defined by a parameter called the detection reduction factor ( $k$ ) that can range from zero to one. When  $k$  is zero, it implies a carcass missed on the first search would never be found on subsequent searches. A  $k$  of one implies SEEF remains constant no matter how many times a carcass was missed. Huso et al. (2017) estimated a value of  $k = 0.67$  for bats, and this value was used to calculate bat fatality estimates using EoA, per the HCP.

### *Carcass Persistence Trial – Rate Estimation*

Data collected during carcass persistence (CP) trials were used to estimate the amount of time, in days, carcasses remained available to be located by the searcher. The average probability a carcass persisted through the search interval (i.e., the time between scheduled searches) was estimated using an interval-censored survival regression with four potential distributions: exponential, log-logistic, lognormal, and Weibull distributions (Kalbfleisch and Prentice 2002, Dalthorp et al. 2018). Potential covariates were fit to all parameters of the candidate distributions; the only covariates considered were season and plot type (road and pad, cleared plot, and uncleared plot), and persistence was modeled separately for technicians and dog-handler teams to account for different modes of detection. The best model was selected as the most parsimonious model within two AICc units of the model with the lowest AICc value. The parameter

estimates of the selected model ( $\alpha$  [shape] and  $\beta$  [scale], including the 95% Confidence Interval [CI] of  $\beta$ ) were used as inputs in the EoA Single Class Module.

#### *Area Adjustment*

The search area adjustment accounted for unsearched areas beneath turbines, and was calculated as a probability that ranged from zero to one. The area adjustment was estimated as the product of the searched area around each turbine and a carcass-density distribution. A truncated weighted maximum likelihood (TWL) modeling approach (Khokan et al. 2013) was used to estimate the carcass-density distribution using site-specific fatality locations. The TWL approach uses weight based probability of detection and the proportion of area searched in each 1.0-m annulus around the turbine. Distributions considered were normal, gamma, Gompertz, Rayleigh and Weibull (parameterized according to R Development Core Team [2016] and Yee [2015]). The best model was selected using AICc. The proportion of area searched was calculated in a Geographic Information System as the amount of area searched divided by the total area searched at each 1.0-m annulus around the turbine.

#### *Carcasses Excluded from Area Adjustment Calculations*

Fatalities were excluded from the area adjustment calculation when the carcass was discovered outside of the spatial and temporal scope of the survey design. For example, carcasses found outside a designated plot were not included in the analysis because the area adjustment accounts for the carcass by adjusting for unsearched areas. Carcasses found prior to the start of surveys (e.g., a carcass found on a plot incidentally in the summer that was not searched until the fall) were also excluded because the carcass occurred outside of the study period. Note that carcasses found on a plot incidentally were included in the analysis if that plot had a scheduled search in the future, but within the same season. If a fatality of a Covered Species was found outside of the spatial or temporal scope of the survey design, it would still be excluded from the area adjustment estimate, but would be included in the EoA fatality estimate following Dalthorp et al. (2020).

#### *Indiana Bat and Northern Long-Eared Bat Take and Detection Probability Estimates*

##### Evidence of Absence

EoA was used to estimate the median cumulative take to-date ( $M^*$ ), mean annual take rate ( $\lambda$ ), and evaluate the probability that the estimated take rate ( $\lambda$ ) exceeded the expected take rate ( $\tau$ ) for Indiana bat and northern long-eared bat (i.e., Covered Species). Estimates were calculated using the EoA method (Dalthorp et al. 2017), using the Single Class, Multiple Class, and Multiple Years modules of EoA.

The probability of detection ( $g$ ) was estimated using the bias adjustments for SEEF, CP, and area searched, as well as the assumed seasonality of risk for the Covered Species. *Myotis* spp. carcass arrival at the Project is assumed to follow the arrival proportions of the Midwest Wind Energy Multi-Species HCP (USFWS 2016): 7% in spring, 36% in summer, and 57% in fall. Differences in the level of turbine operations within (e.g., turbines down for maintenance for extended periods within a season) and across seasons (e.g., reduced summer risk) were also accounted for, as described below.

The EoA Single Class Module was used to estimate the distribution of detection probability in each search stratum (i.e., each season-by-plot type combination). This resulted in alpha and beta parameters that defined the Beta distribution of detection probability in each stratum. The search area adjustment for each plot type was used as the “Spatial coverage (a)” parameter in the Single Class Module. The EoA Multiple Class Module was then used to combine detection probability distributions across plot types within seasons (cleared/uncleared full plots searched by the dog-handler teams and road and pad plots searched by technicians, with weights for each class defined by the within-season sampling fraction and the within-season relative turbine operations for each plot type. Relative turbine operation was included because some turbines operated for only a portion of a season; turbine operation for each plot type was calculated as the number of visits during which turbines were operating divided by the total number of visits. Values were re-scaled to sum to one within each season. The within-season sampling fractions and within-season operations for each plot type were multiplied and then re-scaled to sum to one across the plot types within each season. These values were used as weights to combine Beta (i.e.,  $\beta_a$  and  $\beta_b$ ) distribution parameters across plot types. Beta distribution parameters were set to  $B_a = 0.01$  and  $B_b = 1000$  for unsearched areas within each stratum.

The Multiple Class Module was then used to combine Beta distribution parameters across seasons, relying on the output for each season estimated using the methods described above. Seasonal arrival proportions and cross-season relative operations were combined to define the weights for combining Beta distribution parameters across season.

Cross-season relative turbine operations were calculated as the number of visits in each season, during which turbines were operating, divided by the total number of visits in each season. Values were re-scaled to sum to one across the three seasons. In addition, the summer turbine operations were discounted by 90% because only 10% of the Project turbines pose risk to Covered Species in the summer. Cross-season relative turbine operations and the arrival proportions were multiplied and then re-scaled to sum to one across seasons. These values defined the weights for combining the Beta distribution parameters across seasons.

Last, the Multiple Years Module was used to estimate the site-wide, cumulative detection probability from 2019 – 2021. The EoA Multiple Years Module requires the input  $p$ , which weights the years appropriately for combining Beta distribution parameters. The value for  $p$  was set to 0.88 for 2019 because the ITP was issued part way through summer, meaning about 88% of total risk was realized in 2019. In 2020, the Project was fully operational for all three seasons, so  $p$  was set to 1. In 2021, there were comparatively long periods of turbine down-time across the facility, which is why relative operations were taken into account for the Multiple Class Module. Likewise, 2021 relative operations define the  $p$  value by summing the total number of visits during which turbines were operating and dividing that number by the total number of visits. This value was recalculated for the Multiple Years Module because Turbine 61 was down for the entire monitoring period in 2021. Turbine 61 downtime was not included in the Multiple Class Module relative turbine operations calculation, but will be included for comparison to other years. The value for  $p$  in 2021 was 0.91.

The results from the Multiple Years Module (Ba and Bb parameters for the detection probability to date) were used to estimate  $M^*$ , the median cumulative fatality estimate to date, the mean annual take rate ( $\lambda$ ) and its 95% CI, and the probability that  $\lambda > \tau$ . See *Statistical Analysis* in the Results for how the compliance metrics were calculated using the EoA Graphical User Interface.

### Adaptive Management Triggers

The estimates from the EoA analysis were used to test two adaptive management triggers: a short-term test of whether the estimated take rate exceeded the expected take rate and a long-term test of whether permitted take had been met (Dalthorp and Huso 2015). Both the short- and long-term triggers were tested individually for Indiana bat and northern long-eared bat.

### Evidence of Absence Short-Term Trigger

The EoA short-term trigger is designed as an early warning signal that the project may be on the path to exceeding permitted take (T) by the end of the permit term. The short-term trigger is designed to determine if an adaptive management response is needed to prevent the cumulative take estimate from actuating a response to the long-term trigger test. The short-term trigger tests if the estimated annual take rate ( $\lambda$ ) exceeded the expected take rate ( $\tau = T \div \text{years in permit}$ ) at a confidence level of  $\alpha = 0.05$ , per the HCP. The Project short-term trigger is designed to evaluate a rolling window of six years of post-construction monitoring data. If, within any 6-year rolling window, the estimated take rate exceeds the expected take rate with 95% confidence, the short-term trigger would be met, indicating that the minimization plan in the HCP may need to be adjusted to ensure that the median cumulative take estimate ( $M^*$ ) remains within the permitted limit over the ITP term.

### Evidence of Absence Long-Term Trigger

The EoA long-term trigger is designed to test if the cumulative take to date is equal to or greater than the permitted take (T). Per the HCP, cumulative take to date ( $M^*$ ) was estimated at a confidence level of  $\alpha = 0.5$  (using the median, or 50<sup>th</sup> credible bound, of the posterior distribution of estimated mortality). If the cumulative take to date at  $\alpha = 0.5$  is less than the total permitted take ( $M^* < T$ ), then the Project is in compliance with the ITP. If the cumulative take to date at  $\alpha = 0.5$  is greater than or equal to the total permitted take ( $M^* \geq T$ ), then the take limit has been met and the Project must enact avoidance measures.

## **RESULTS**

### **Standardized Carcass Searches**

A total of 1,564 searches occurred across all seasons (Table 3). Fifty searches (less than 3%) were missed due to turbine maintenance, weather constraints, and/or safety hazards. Five-hundred-seven bat carcasses and 65 bird carcasses were found during surveys and incidentally (Appendix A).

**Table 3. Number of searches per plot type by season at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Season	Plot Type	Search Interval	Number of Searches
Spring (April 1 – May 15)	100-m road and pad	every 14 days	389
Summer (May 16 – July 31)	100-m road and pad	every 7 days	12
	70-m cleared plot	every 7 days	101
Fall (August 1 – October 15)	100-m road and pad	every 7 days	500
	70-m cleared plot	every 7 days	388
	70-m uncleared plot	every 7 days	174
<b>Overall</b>			<b>1,564</b>

m = meter

### Species Composition

#### Bats

Five-hundred-seven bat carcasses, comprising six identified species, were found throughout the study (Table 4, Appendix A). Five Indiana bat carcasses (federally listed as endangered; 1.0%) and two evening bat (*Nycticeius humeralis*; state-listed as endangered) carcasses (0.4%) were found (Table 5, Figure 5). The majority of bat carcasses found were eastern red bats (206 carcasses; 40.6%) and silver-haired bats (156 carcasses; 30.8%). Hoary bats, 16.5% (84 carcasses) and big brown bats, 8.9% (45 carcasses), were also found. Of the 507 total carcasses, 490 carcasses were included for area adjustment analysis (Table 4), with the majority (97.8%) of included bat carcasses being found in the fall (Table 6).

Eight heavily scavenged bats (e.g., wing membrane only, bones, or partial carcasses) were sent off for identification via deoxyribonucleic acid (DNA) analysis; three were identified as silver-haired bats, two were identified as eastern red bats, another two as Indiana bats, and one as an evening bat. DNA analysis was also used to identify/confirm gender and species on all Indiana bats.

Additionally, eight other carcasses were recorded as unidentified, non-*Myotis* spp. as these exhibited morphometric features (e.g., relatively long forearm length measurements, furred uropatagium, non-*Myotis* spp. dentine structure), which were uncharacteristic of *Myotis* spp., but were heavily scavenged or degraded and could not be designated between the genera of other bat species known to occur in the area. One bat carcass was recorded as an unidentified *Lasiurus* spp. since the degraded specimen could not be discernably distinguished between eastern red bat or a Seminole bat (*Lasiurus seminolus*).

**Table 4. Number and percent (%) of bat carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Species	Included in Area Adjustment		Outside Search Area*		Outside Study Period*		Total	
	Total	%	Total	%	Total	%	Total	%
eastern red bat	201	41.02	1	25.0	4	30.77	206	40.63
silver-haired bat	153	31.22	2	50.0	1	7.69	156	30.77
hoary bat	80	16.33	0	0	4	30.77	84	16.57
big brown bat	43	8.78	1	25.0	1	7.69	45	8.88
unidentified non- <i>Myotis</i> bat	8	1.63	0	0	0	0	8	1.58
Indiana bat	3	0.61	0	0	2	15.38	5	0.99
evening bat	1	0.20	0	0	1	7.69	2	0.39
unidentified <i>Lasiurus</i> bat	1	0.20	0	0	0	0	1	0.20
<b>Total</b>	<b>490</b>	<b>100</b>	<b>4</b>	<b>100</b>	<b>13</b>	<b>100</b>	<b>507</b>	<b>100</b>

\* Carcasses are not included in the area adjustment.

Sums may not equal total values shown due to rounding.

**Table 5. Listed species of bats found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Species	Sex	Date Found	Estimated Time of Death (ETOD)	Season of ETOD	Location	Turbine	Summer Risk Turbine?	Distance
								From Turbine (m)
Indiana bat <sup>1,2</sup>	female	8/3/21	4–7 days	summer	40.10286, -84.98095	48	no	16
Indiana bat <sup>1,2</sup>	male	8/5/21	15–30 days	summer	40.03612, -85.00615	85	no	31
Indiana bat <sup>2</sup>	male	9/10/21	7–14 days	fall	40.06873, -85.10175	94	no	28
Indiana bat <sup>2</sup>	female	9/14/21	4–7 days	fall	40.07929, -85.04010	3	no	11
Indiana bat <sup>2</sup>	male	9/20/21	0–1 days	fall	40.11228, -85.06772	9	no	70
evening bat <sup>3</sup>	unknown	8/3/21	4–7 days	late summer/early fall	40.10300, -84.98096	48	no	32
evening bat <sup>3</sup>	male	9/21/21	2–3 days	fall	40.05222, -84.96126	74	no	5

<sup>1</sup> The carcass was not included in the area adjustment due to being found off plot.

<sup>2</sup> Indiana bats are federally listed as endangered, and are a Covered Species of the Habitat Conservation Plan (HCP).

<sup>3</sup> Evening bats are state-listed as endangered, but are not a Covered Species of the HCP.

Location is in Decimal Degrees.

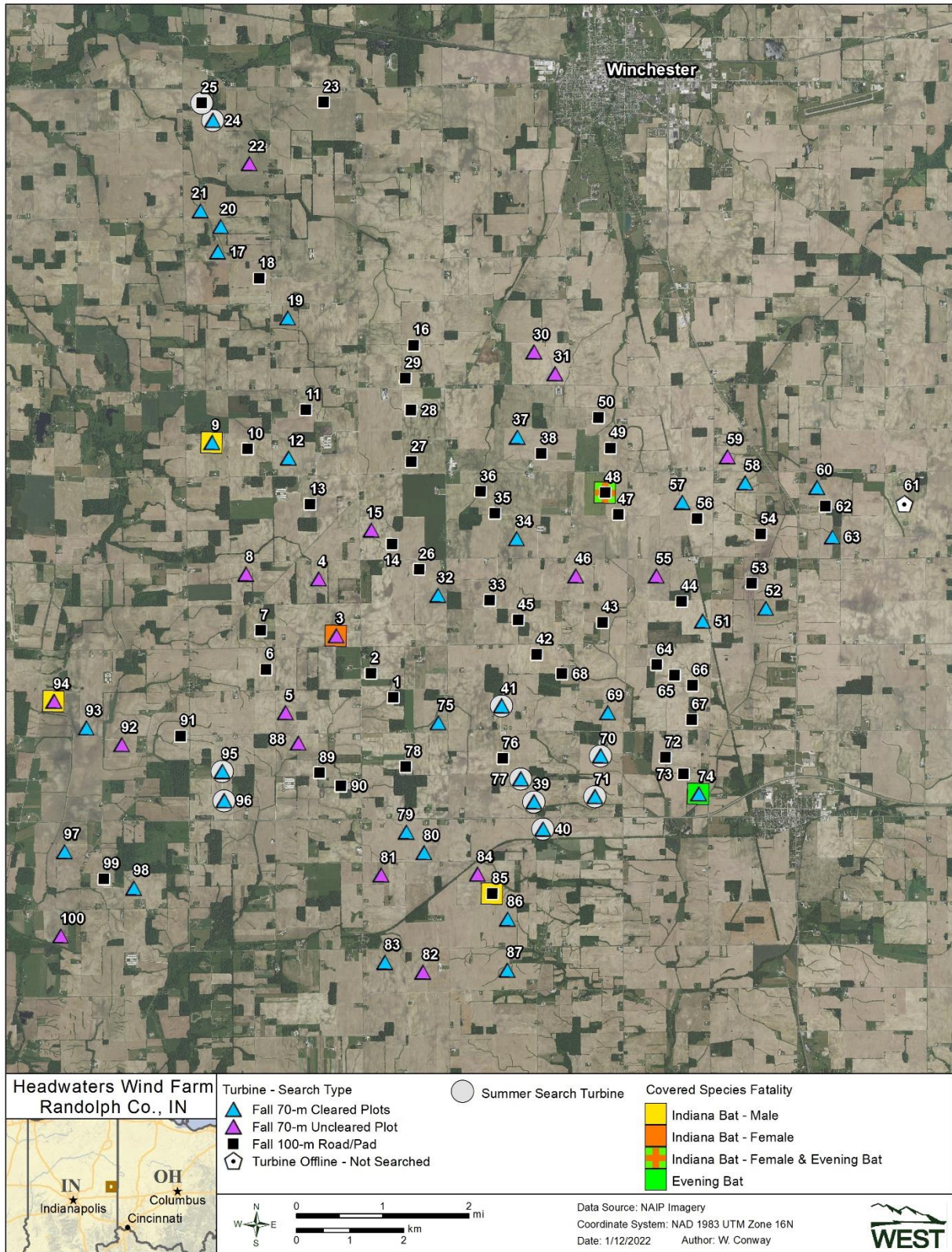


Figure 5. Location of Indiana bat and evening bat carcasses in relation to summer risk turbines at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021. In spring, turbines were searched as road and pad plots.

Table 6. Species composition by season and plot type for bat carcasses\* found at the Headwaters Wind Farm in Randolph County, Indiana. from April 1 – October 15, 2021.

Species	Spring		Summer				Fall					
	Road and Pad		Road and Pad		70-m Cleared Plot		Road and Pad		70-m Cleared Plot		70-m Uncleared Plot	
	# of Carcasses	%	# of Carcasses	%	# of Carcasses	%	# of Carcasses	%	# of Carcasses	%	# of Carcasses	%
eastern red bat	1	100	0	0	3	30.0	26	42.6	131	43.5	40	34.2
silver-haired bat	0	0	0	0	4	40.0	15	24.6	94	31.2	40	34.2
hoary bat	0	0	0	0	1	10.0	14	23.0	40	13.3	25	21.4
big brown bat	0	0	0	0	2	20.0	6	9.8	28	9.3	7	6.0
unidentified non- <i>Myotis</i> bat	0	0	0	0	0	0	0	0	5	1.7	3	2.6
evening bat	0	0	0	0	0	0	0	0	1	0.3	0	0
Indiana bat**	0	0	0	0	0	0	0	0	1	0.3	2	1.7
unidentified <i>Lasiurus</i> bat	0	0	0	0	0	0	0	0	1	0.3	0	0
<b>Total</b>	<b>1</b>	<b>100</b>	<b>0</b>	<b>-</b>	<b>10</b>	<b>100</b>	<b>61</b>	<b>100</b>	<b>301</b>	<b>100</b>	<b>117</b>	<b>100</b>

\* This table only includes bat carcasses included in the area adjustment calculation.

\*\*All Indiana bats (5 carcasses) are included in the Evidence of Absence analysis.

Sums may not equal total values shown due to rounding.

m = meter.



Birds

Sixty-five birds were recorded, belonging to 26 species or species groups (Table 7, Appendix A). No federally or state-listed bird species were recorded. Turkey vulture (*Cathartes aura*) was the most commonly found species, followed by horned lark (*Eremophila alpestris*) and killdeer (*Charadrius vociferus*; Table 7, Appendix A). Thirteen birds were found as partial carcasses or feather spots and could not be identified to species due to extensive decay or lack of identifying characteristics; these carcasses were classified as either unidentified small bird, unidentified sparrow, unidentified kinglet, unidentified passerine, unidentified swallow, or unidentified vireo (Table 7, Appendix A).

**Table 7. Number and percent (%) of bird carcasses by species found at Headwaters Wind Farm, Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Species</b>	<b>Total</b>	<b>%</b>
turkey vulture	12	18.5
horned lark	10	15.4
killdeer	8	12.3
unidentified small bird	5	7.7
red-tailed hawk	3	4.6
unidentified sparrow	3	4.6
chimney swift	2	3.1
golden-crowned kinglet	2	3.1
red-eyed vireo	2	3.1
unidentified kinglet	2	2.9
chestnut-sided warbler	1	1.5
dickcissel	1	1.5
eastern meadowlark	1	1.5
house sparrow	1	1.5
indigo bunting	1	1.5
magnolia warbler	1	1.5
mourning dove	1	1.5
orchard oriole	1	1.5
Philadelphia vireo	1	1.5
rock pigeon	1	1.5
tree swallow	1	1.5
unidentified passerine	1	1.5
unidentified swallow	1	1.5
unidentified vireo	1	1.5
yellow-billed cuckoo	1	1.5
yellow-bellied sapsucker	1	1.5
<b>Total</b>	<b>65</b>	<b>100</b>

Sums may not equal total values shown due to rounding.

*Carcasses for Area Adjustment Analysis*

Seventeen of the 507 bats found during the spring, summer, and fall monitoring seasons were excluded from modeling the area adjustment for EoA; four bat carcasses were excluded from analysis because the carcasses were found off plot. Another 13 bats were excluded because the ETOD was prior to the start of surveys (Appendix A).

**Bias Trials**

*Searcher Efficiency Trials*

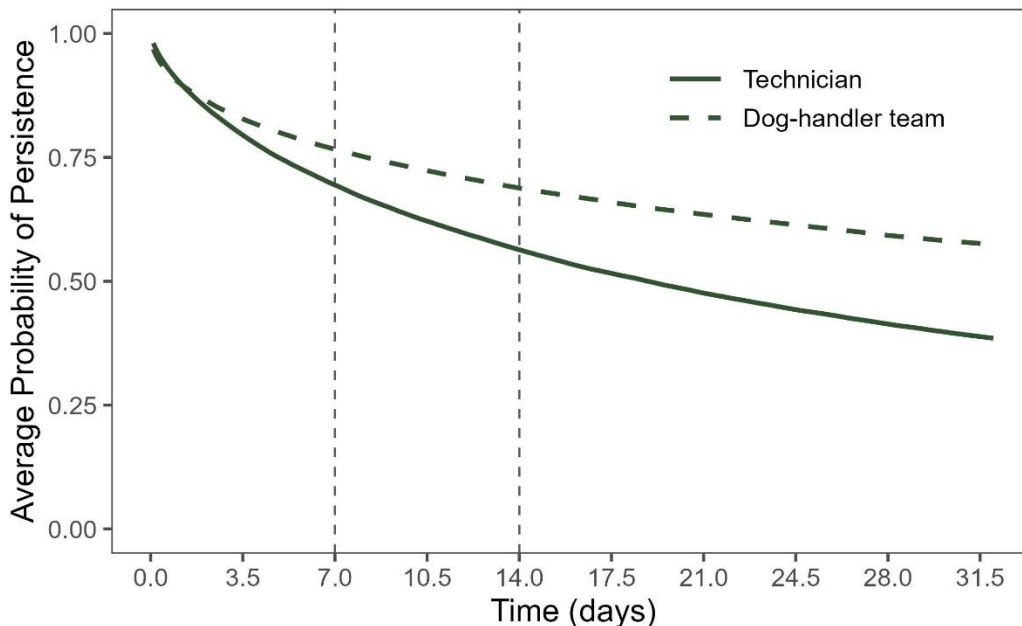
One-hundred and sixty bats were placed for SEEF trials throughout the study period and across all plot types. Due to scavenging, 141 remained available for searchers. Technicians found 84.8% of bat carcasses on road and pad plots, while the dog-handler teams found 65.7% and 84.2% of bat carcasses on cleared and uncleared plots, respectively (Table 8). The best-fit model for SEEF on 70-m plots did not support the inclusion of plot type or season as a covariate, meaning SEEF rates were similar across all plot types and seasons searched by dog-handler teams (Appendix B1). The best-fit model for SEEF on road and pad plots did not support the inclusion of season as a covariate, meaning technician SEEF rates did not vary by season (Appendix B2).

**Table 8. Searcher efficiency results by plot type at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Season	Plot Type	Searcher Type	Number Placed	Number Available	Number Found	% Found
Spring	Road and pad	Technician	27	25	20	80.0
	Road and pad	Technician	14	13	11	84.6
Summer	Cleared	Dog-handler Team	47	43	30	69.8
	Road and pad	Technician	26	21	19	90.5
Fall	Cleared	Dog-handler Team	23	20	16	80.0
	Uncleared	Dog-handler Team	23	19	16	84.2
<b>Cleared 70-meter (m) plots</b>			<b>70</b>	<b>63</b>	<b>46</b>	<b>65.7</b>
<b>Uncleared (soy) 70-m plot</b>			<b>23</b>	<b>19</b>	<b>16</b>	<b>84.2</b>
<b>Overall 70-m plots (cleared and uncleared)</b>			<b>93</b>	<b>82</b>	<b>62</b>	<b>75.6</b>
<b>Overall road and pad plots</b>			<b>67</b>	<b>59</b>	<b>50</b>	<b>84.8</b>
<b>Overall</b>			<b>160</b>	<b>141</b>	<b>112</b>	<b>79.4</b>

*Carcass Persistence Trials*

Ninety carcasses were placed to estimate CP for plot and searcher type. The best-fit model for CP rates for dog-handler team searches was a Weibull distribution with no covariates, which suggests bat CP rates did not vary between cleared and uncleared plot types or by season (Appendix B3). The best fit model for CP rates for technician searches was a Weibull distribution with no covariates, which suggests bat CP rates did not vary by season (Appendix B4). The estimated median CP times were 7.86 days for technician searches on road and pad plots and 21.15 days for dog-handler team searches on cleared and uncleared plots (Appendix B5). The average probability that a carcass persisted through a 7-day search interval was 0.77 (95% CI: 0.69–0.86) for dog-handler teams on cleared and uncleared plots and 0.70 (95% CI: 0.61–0.78) for technicians on road and pad plots (Figure 6). The average probability that a carcass persisted through the 14-day search interval (technician on road and pad only) was 0.56 (95% CI: 0.47–0.65).

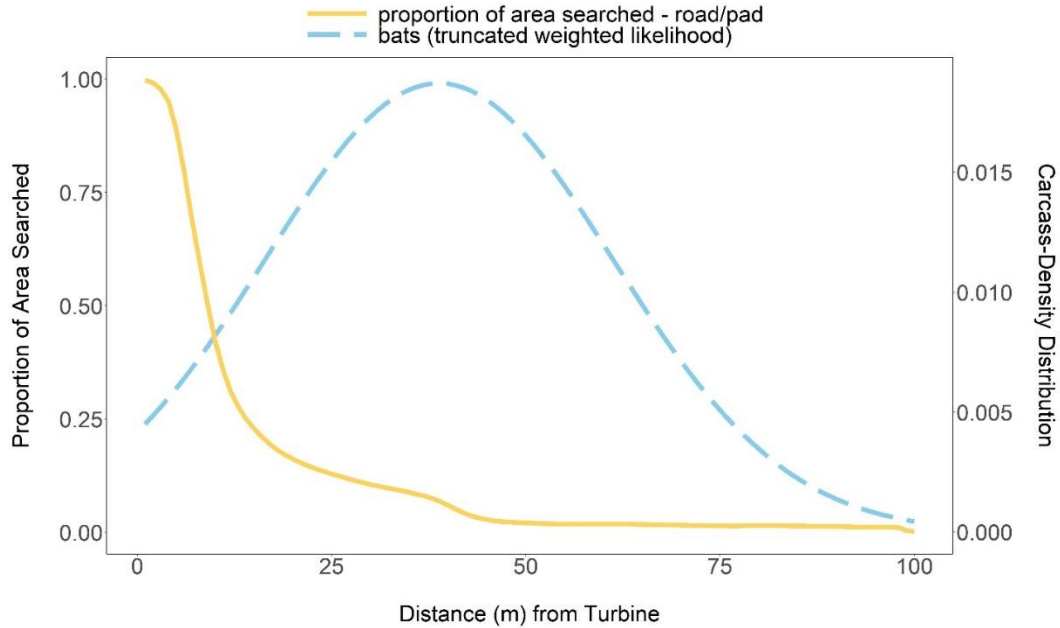


**Figure 6.** The average probability of persistence, in days, at different search intervals at the Headwaters Wind Farm Randolph County, Indiana, from April 1 – October 15, 2021. Dog-handler teams searched full plots and technician searched road and pad plots. \*Dashed vertical lines represent search intervals of plots during the study period (14 day interval in spring and 7 day interval for summer and fall turbines searched).

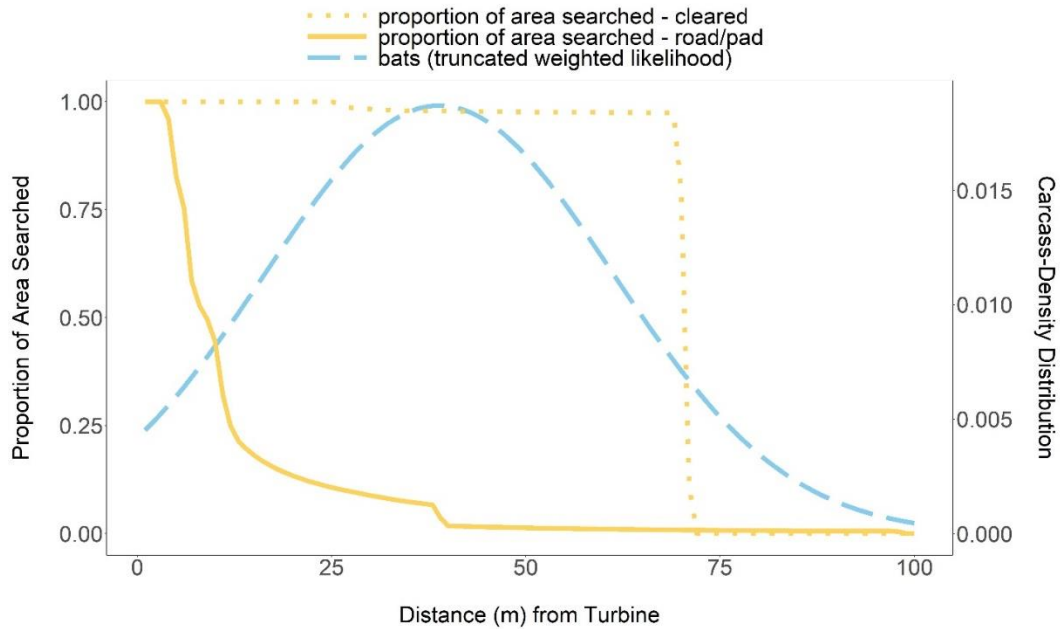
## Statistical Analysis

### Area Adjustment

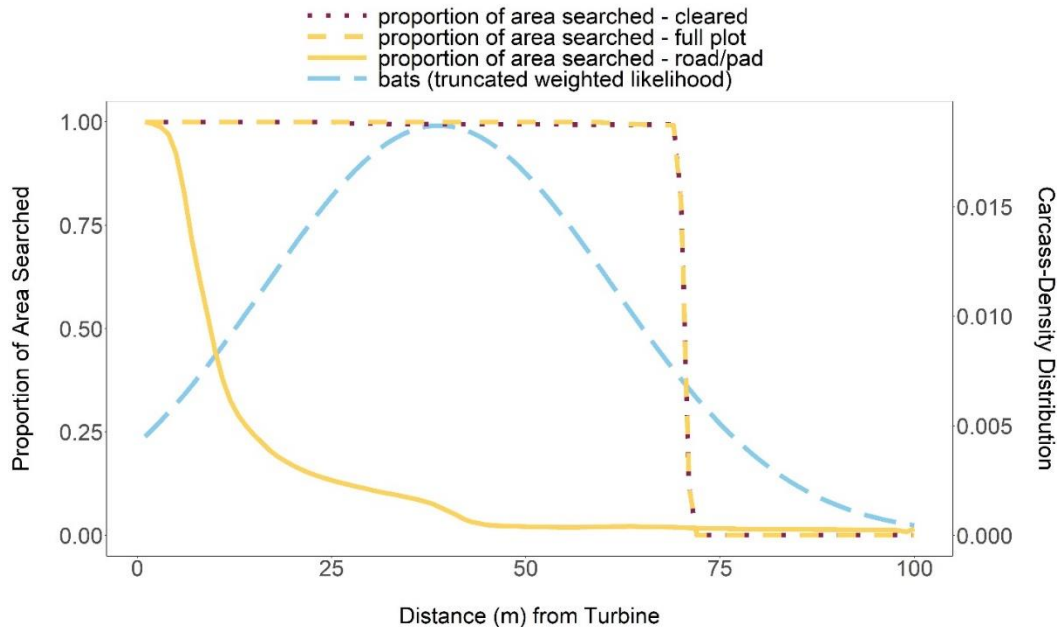
Road and pad search areas covered a smaller proportion of the area in which a bat carcass was likely to be found, compared to cleared and uncleared plots. The TWL area adjustment (proportion of bats expected to fall within the search area) was 0.12 for road and pad plots in all seasons (Figure 7) and 0.91 for cleared plots in the summer and fall (Figure 8, Figure 9, and Appendix C).



**Figure 7. Density of bat carcasses per area searched at all road and pad plots at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – May 15, 2021.**



**Figure 8. Density of bat carcasses per area searched at all road and pad plots and cleared plots at the Headwaters Wind Farm in Randolph County, Indiana, from May 16 – July 31, 2021.**



**Figure 9** Density of bat carcasses per area searched at all road and pad plots, cleared full plots, and uncleared full plots at the Headwaters Wind Farm in Randolph County, Indiana, from August 1 – October 15, 2021.

*Indiana Bat and Northern Long-Eared Bat Take Estimates*

Evidence of Absence Framework

Five Indiana bats and no northern long-eared bat carcasses were found during the study period. Seven Indiana bats and zero northern long-eared bats have been found to date under the ITP. The annual probability of detection distribution in 2021 had a mean of 0.35 (95% CI: 0.31–0.38; Table 9). Inputs required to run the EoA Single Class Module and stratum-specific *g* distribution values and inputs required for the Multiple Class Module are described in Appendix B.

**Table 9.** Annual and overall probabilities of detection (*g*), *Ba*, *Bb*, and  $\rho$  for the Headwaters Wind Project in Randolph County, Indiana, from 2019 – 2021.

Year	Ba*	Bb*	$\rho$ **	<i>g</i>	95% CI
2019	26.57	97.63	0.88	0.21	0.15–0.29
2020	522.96	1728.37	1	0.23	0.22–0.25
2021	304.41	576.54	0.91	0.35	0.31–0.38
<b>Short-Term Trigger (Last 3 Years)</b>	298.11	833.83	NA	0.26	0.24–0.29
<b>Long-Term Trigger (Cumulative)</b>	298.11	833.83	NA	0.26	0.24–0.29

\* *Ba* and *Bb* are the parameters for the Beta distribution used to characterize the probability of detection. The *g* value is the mean of that distribution.

\*\*  $\rho$  is the weight in the weighted average that is used to combine the probability of detection distributions across years.

CI = confidence interval

Mean annual take rate over the last three years was 9.53 (95% CI: 3.95–17.57) Indiana bats per year and 0.64 (95% CI: less than 0.01–3.19) northern long-eared bats per year (Table 10). The

expected average annual take rate reported in the HCP was 9.55 Indiana bats per year and 2.53 northern long-eared bats per year.

**Table 10. Probability the estimated take rates exceeded the expected take rates of 9.55 Indiana bats per year and 2.53 northern long-eared bats per year at Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

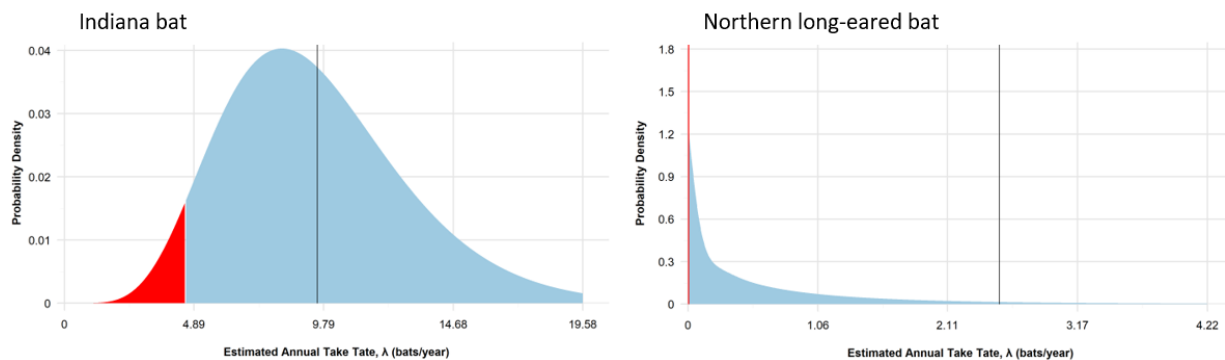
Species	Mean $\lambda$ (95% CI)	Expected Take		Short-Term Trigger Fires at $\alpha = 0.1$ ?
		Rate ( $\tau$ )	$\Pr(\lambda > \tau)$ *	
Indiana bat	9.53 (3.95–17.57)	9.55	0.45	No
northern long-eared bat	0.64 (0.01–3.19)	2.53	0.05	No

\*  $\Pr(\lambda > \tau)$  reads, “the probability that  $\lambda$  (the annual take rate) is greater than  $\tau$  (the expected annual take rate based on the total permitted take, used as a threshold for adaptive management).” If this probability is less than 0.90 (e.g.,  $\alpha = 0.1$  for a one-sided test), then no adaptive management is triggered because there is not sufficient evidence that the estimated annual take rate is greater than the expected annual take rate.

CI = confidence interval

### Adaptive Management—Evidence of Absence Short-term Trigger

Mean annual take rates based on Years 1-3 of the ITP were 9.53 (95% CI: 3.95–17.57) Indiana bats per year and 0.64 (95% CI: less than 0.01–3.19) northern long-eared bat per year (Table 10). The expected average annual take rates reported in the HCP were 9.55 Indiana bats per year and 2.53 northern long-eared bats per year. The short-term trigger assesses the probability that the estimated take rate exceeded the expected take rate,  $\Pr(\lambda > \tau)$ . At a 95% confidence level ( $\alpha = 0.05$ ),  $\Pr(\lambda > \tau)$  must be greater than or equal to 0.95 for the short-term trigger to fire. For Indiana bat,  $\Pr(\lambda > \tau)$  was 0.45, and for northern long-eared bat,  $\Pr(\lambda > \tau)$  was 0.05 (Table 10). Neither probability meets or exceeds 0.95, indicating the short-term trigger was not met and no adaptive management actions are necessary (Table 10, Figure 10).



**Figure 10. Estimated annual take rate ( $\lambda$ ) bats per year at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Note: The red region of the posterior distributions shows the region of the lower 5% quantile of the distributions (red region may not be visible when the posterior distribution is skewed heavily toward zero). The vertical line marks the expected take rate. The short-term trigger evaluates whether the vertical line falls within or to the left of the red region of the posterior distributions. For both species, the short-term trigger is not met because the vertical line (expected take rate) is not within or to the left of the red regions. In other words, the probability that estimated take rate is greater than the expected take rate does not exceed 95%.

Adaptive Management—Evidence of Absence Long-term Trigger

Cumulative take under the ITP to-date (2019-2021),  $M^*$  at  $\alpha = 0.5$  (50<sup>th</sup> credible bound), is estimated to be 27 Indiana bats and zero northern long-eared bats (Table 11). The cumulative take to-date is below the total permitted take for each of the Covered Species (258 Indiana bats and 68 northern long-eared bats over the 30-year permit term).

**Table 11. Cumulative take estimate to date using Evidence of Absence for studies conducted at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Species	Cumulative Take ( $M^*$ )	Permitted Take (T)	Long-Term Trigger Fires at $\alpha = 0.5$ ?
Indiana bat (50 <sup>th</sup> credible bound)	27	258	No
northern long-eared bat (50 <sup>th</sup> credible bound)	0	68	No

## CONCLUSIONS

The post-construction monitoring effort completed in 2021 was consistent with the HCP's monitoring requirement and the 2021 study plan.

Five federally listed endangered Indiana bats (two female, three male), a Covered Species, were found in 2021. Two Indiana bats (one male and one female) were found during the initial clearing round of the fall season. The remaining three Indiana bats found (one female, two male) were found in the fall during the month of September. No Indiana bats were found at the 10 identified summer risk turbines as outlined in the HCP. Estimates of potential take for the Covered Species were below the levels authorized by the ITP and no adaptive management was necessary. However, the HCP's changed circumstance for a change in summer risk for the Covered Species (HCP Section 8.2.6) was triggered by the female Indiana bat found at turbine 48, a non-summer-risk turbine. Headwaters has coordinated with USFWS, and turbine 48 will be included as a summer risk turbine moving forward, as consistent with the HCP's prescribed response to this changed circumstance. The other summer season Indiana bat fatality (male) was found at turbine 85, but no further action was needed for this turbine (M. Reed, USFWS, pers. comm., January 21, 2022).

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**Appendix A. Carcasses Found at the Headwaters Wind Farm in Randolph County,  
Indiana, during 2021 Post-Construction Monitoring Surveys**

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Found Date	Common Name	Distance from Turbine (m)	Search Location	Search Type	Search Area Type	Physical Condition	Dog-Aided Search
<b>Bat Carcasses</b>							
4/12/2021	eastern red bat	1	11	carcass search	100-m road and pad	intact	none
6/19/2021	big brown bat	30	39	carcass search	70-m cleared plot	injured	dog
6/19/2021	silver-haired bat	35	41	carcass search	70-m cleared plot	scavenged	dog
6/19/2021	silver-haired bat	40	70	carcass search	70-m cleared plot	scavenged	dog
6/26/2021	eastern red bat	64	39	carcass search	70-m cleared plot	scavenged	dog
6/26/2021	eastern red bat	38	95	carcass search	70-m cleared plot	dismembered	dog
6/26/2021	silver-haired bat	46	71	carcass search	70-m cleared plot	scavenged	dog
6/26/2021	silver-haired bat	49	96	carcass search	70-m cleared plot	scavenged	dog
7/10/2021	eastern red bat	66	96	carcass search	70-m cleared plot	dismembered	dog
7/11/2021	big brown bat	33	24	carcass search	70-m cleared plot	scavenged	dog
7/25/2021	hoary bat	44	24	carcass search	70-m cleared plot	scavenged	dog
8/2/2021	eastern red bat	7	31	carcass search	70-m uncleared plot	intact	dog
8/2/2021	hoary bat	43	34	carcass search	70-m cleared plot	intact	dog
8/3/2021	big brown bat	16	62	carcass search	100-m road and pad	scavenged	none
8/3/2021	eastern red bat	4	16	carcass search	100-m road and pad	scavenged	none
8/3/2021	eastern red bat	35	51	carcass search	70-m cleared plot	intact	dog
8/3/2021	evening bat	16	48	carcass search	100-m road and pad	scavenged	none
8/3/2021	hoary bat	32	16	carcass search	100-m road and pad	dismembered	none
8/3/2021	hoary bat	12	16	carcass search	100-m road and pad	scavenged	none
8/3/2021	hoary bat	37	56	carcass search	100-m road and pad	scavenged	none
8/3/2021	Indiana bat	32	48	carcass search	100-m road and pad	scavenged	none
8/5/2021	eastern red bat	5	55	carcass search	70-m uncleared plot	scavenged	dog
8/5/2021	eastern red bat	18	87	carcass search	70-m cleared plot	intact	dog
8/5/2021	hoary bat	16	66	carcass search	100-m road and pad	intact	none
8/5/2021	Indiana bat	31	85	carcass search	100-m road and pad	scavenged	none
8/5/2021	silver-haired bat	60	90	carcass search	100-m road and pad	scavenged	none
8/6/2021	eastern red bat	14	92	carcass search	70-m uncleared plot	intact	dog
8/6/2021	hoary bat	4	79	carcass search	70-m cleared plot	scavenged	none
8/6/2021	hoary bat	7	92	carcass search	70-m uncleared plot	intact	dog
8/6/2021	unidentified non- <i>Myotis</i>	17	95	carcass search	70-m cleared plot	intact	dog
8/9/2021	big brown bat	71	59	carcass search*	70-m uncleared plot	scavenged	dog
8/9/2021	eastern red bat	16	32	carcass search	70-m cleared plot	intact	dog
8/9/2021	eastern red bat	50	58	carcass search	70-m cleared plot	intact	dog
8/9/2021	eastern red bat	39	59	carcass search	70-m uncleared plot	intact	dog
8/9/2021	eastern red bat	21	59	carcass search	70-m uncleared plot	intact	dog
8/9/2021	hoary bat	18	30	carcass search	70-m uncleared plot	intact	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
8/9/2021	hoary bat	8	4	carcass search	70-m uncleared plot	intact	dog
8/10/2021	big brown bat	26	3	carcass search	70-m uncleared plot	intact	dog
8/10/2021	big brown bat	18	74	carcass search	70-m cleared plot	intact	dog
8/10/2021	eastern red bat	42	11	carcass search	100-m road and pad	scavenged	none
8/10/2021	eastern red bat	31	35	carcass search	100-m road and pad	scavenged	none
8/10/2021	eastern red bat	40	41	carcass search	70-m cleared plot	intact	dog
8/10/2021	eastern red bat	2	44	carcass search	100-m road and pad	scavenged	none
8/10/2021	hoary bat	25	22	carcass search	70-m uncleared plot	intact	dog
8/10/2021	hoary bat	41	29	carcass search	100-m road and pad	scavenged	none
8/12/2021	big brown bat	34	98	carcass search	70-m cleared plot	intact	dog
8/12/2021	eastern red bat	33	87	carcass search	70-m cleared plot	intact	dog
8/12/2021	hoary bat	3	74	incidental	70-m cleared plot	scavenged	none
8/13/2021	eastern red bat	13	94	carcass search	70-m uncleared plot	intact	dog
8/13/2021	eastern red bat	50	96	carcass search	70-m cleared plot	intact	dog
8/13/2021	hoary bat	43	94	carcass search	70-m uncleared plot	intact	dog
8/14/2021	eastern red bat	39	80	carcass search	70-m cleared plot	intact	dog
8/14/2021	hoary bat	56	79	carcass search	70-m cleared plot	intact	dog
8/14/2021	hoary bat	40	81	carcass search	70-m uncleared plot	intact	dog
8/16/2021	big brown bat	29	59	carcass search	70-m uncleared plot	intact	dog
8/16/2021	big brown bat	48	8	carcass search	70-m uncleared plot	intact	dog
8/16/2021	eastern red bat	35	32	carcass search	70-m cleared plot	intact	dog
8/16/2021	eastern red bat	28	34	carcass search	70-m cleared plot	intact	dog
8/16/2021	eastern red bat	35	52	carcass search	70-m cleared plot	intact	dog
8/16/2021	eastern red bat	40	58	carcass search	70-m cleared plot	intact	dog
8/16/2021	eastern red bat	66	8	carcass search	70-m uncleared plot	intact	dog
8/16/2021	hoary bat	40	4	carcass search	70-m uncleared plot	intact	dog
8/16/2021	hoary bat	5	4	carcass search	70-m uncleared plot	injured	dog
8/17/2021	big brown bat	5	36	carcass search	100-m road and pad	scavenged	none
8/17/2021	big brown bat	17	74	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	25	11	carcass search	100-m road and pad	scavenged	none
8/17/2021	eastern red bat	26	17	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	44	17	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	22	19	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	46	19	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	29	21	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	52	21	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	5	21	carcass search	70-m cleared plot	intact	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
8/17/2021	eastern red bat	40	21	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	7	25	carcass search	100-m road and pad	scavenged	none
8/17/2021	eastern red bat	6	36	carcass search	100-m road and pad	intact	none
8/17/2021	eastern red bat	9	43	carcass search	100-m road and pad	scavenged	none
8/17/2021	eastern red bat	54	51	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	52	51	carcass search	70-m cleared plot	intact	dog
8/17/2021	eastern red bat	52	69	carcass search	70-m cleared plot	scavenged	dog
8/17/2021	eastern red bat	58	70	carcass search	70-m cleared plot	scavenged	dog
8/17/2021	eastern red bat	38	70	carcass search	70-m cleared plot	scavenged	dog
8/17/2021	hoary bat	32	17	carcass search	70-m cleared plot	intact	dog
8/17/2021	hoary bat	42	19	carcass search	70-m cleared plot	intact	dog
8/17/2021	hoary bat	10	19	carcass search	70-m cleared plot	intact	dog
8/17/2021	hoary bat	30	24	carcass search	70-m cleared plot	intact	dog
8/17/2021	hoary bat	50	3	carcass search	70-m uncleared plot	scavenged	dog
8/17/2021	hoary bat	38	51	carcass search	70-m cleared plot	intact	dog
8/19/2021	big brown bat	48	77	carcass search	70-m cleared plot	intact	dog
8/19/2021	eastern red bat	32	39	carcass search	70-m cleared plot	intact	dog
8/19/2021	eastern red bat	33	55	carcass search	70-m uncleared plot	intact	dog
8/19/2021	eastern red bat	16	77	carcass search	70-m cleared plot	intact	dog
8/19/2021	eastern red bat	60	77	carcass search	70-m cleared plot	intact	dog
8/19/2021	hoary bat	6	6	carcass search	100-m road and pad	intact	none
8/19/2021	unidentified <i>Lasiurus</i> bat	40	98	carcass search	70-m cleared plot	intact	dog
8/20/2021	big brown bat	35	79	carcass search	70-m cleared plot	intact	dog
8/20/2021	big brown bat	46	96	carcass search	70-m cleared plot	intact	dog
8/20/2021	eastern red bat	40	81	carcass search	70-m uncleared plot	intact	dog
8/20/2021	eastern red bat	35	93	carcass search	70-m cleared plot	intact	dog
8/20/2021	eastern red bat	19	96	carcass search	70-m cleared plot	intact	dog
8/20/2021	hoary bat	0	12	incidental	70-m cleared plot	intact	none
8/20/2021	hoary bat	27	92	carcass search	70-m uncleared plot	intact	dog
8/21/2021	eastern red bat	6	85	carcass search	100-m road and pad	scavenged	none
8/21/2021	eastern red bat	38	87	carcass search	70-m cleared plot	intact	dog
8/22/2021	big brown bat	15	12	incidental	70-m cleared plot	scavenged	dog
8/22/2021	big brown bat	20	15	carcass search	70-m uncleared plot	scavenged	dog
8/22/2021	eastern red bat	40	4	carcass search	70-m uncleared plot	scavenged	dog
8/22/2021	eastern red bat	10	4	carcass search	70-m uncleared plot	scavenged	dog
8/22/2021	eastern red bat	50	57	carcass search	70-m cleared plot	intact	dog
8/22/2021	eastern red bat	9	57	carcass search	70-m cleared plot	scavenged	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
8/22/2021	hoary bat	22	34	carcass search	70-m cleared plot	intact	dog
8/22/2021	hoary bat	20	34	carcass search	70-m cleared plot	scavenged	dog
8/22/2021	hoary bat	34	34	carcass search	70-m cleared plot	scavenged	dog
8/23/2021	big brown bat	18	58	carcass search	70-m cleared plot	intact	dog
8/23/2021	eastern red bat	19	12	carcass search	70-m cleared plot	intact	dog
8/23/2021	eastern red bat	32	58	carcass search	70-m cleared plot	intact	dog
8/23/2021	hoary bat	47	12	carcass search	70-m cleared plot	intact	dog
8/23/2021	hoary bat	12	30	carcass search	70-m uncleared plot	intact	dog
8/23/2021	hoary bat	54	32	carcass search	70-m cleared plot	intact	dog
8/24/2021	big brown bat	5	10	carcass search	100-m road and pad	intact	none
8/24/2021	big brown bat	19	17	carcass search	70-m cleared plot	intact	dog
8/24/2021	big brown bat	35	24	carcass search	70-m cleared plot	intact	dog
8/24/2021	big brown bat	4	24	carcass search	70-m cleared plot	intact	dog
8/24/2021	big brown bat	35	51	carcass search	70-m cleared plot	intact	dog
8/24/2021	eastern red bat	33	17	carcass search	70-m cleared plot	intact	dog
8/24/2021	eastern red bat	9	21	carcass search	70-m cleared plot	intact	dog
8/24/2021	eastern red bat	24	21	carcass search	70-m cleared plot	intact	dog
8/24/2021	eastern red bat	22	23	carcass search	100-m road and pad	scavenged	none
8/24/2021	eastern red bat	4	44	carcass search	100-m road and pad	scavenged	none
8/24/2021	eastern red bat	40	51	carcass search	70-m cleared plot	intact	dog
8/24/2021	eastern red bat	32	56	carcass search	100-m road and pad	scavenged	none
8/24/2021	hoary bat	16	21	carcass search	70-m cleared plot	intact	dog
8/24/2021	hoary bat	7	50	carcass search	100-m road and pad	scavenged	none
8/24/2021	silver-haired bat	41	19	carcass search	70-m cleared plot	intact	dog
8/25/2021	eastern red bat	37	3	carcass search	70-m uncleared plot	intact	dog
8/25/2021	eastern red bat	20	3	carcass search	70-m uncleared plot	intact	dog
8/25/2021	eastern red bat	23	3	carcass search	70-m uncleared plot	intact	dog
8/25/2021	eastern red bat	52	37	carcass search	70-m cleared plot	intact	dog
8/25/2021	eastern red bat	52	5	carcass search	70-m uncleared plot	scavenged	dog
8/25/2021	eastern red bat	15	69	carcass search	70-m cleared plot	intact	dog
8/25/2021	eastern red bat	30	69	carcass search	70-m cleared plot	intact	dog
8/25/2021	hoary bat	0	34	incidental	70-m cleared plot	intact	none
8/26/2021	big brown bat	36	14	carcass search	100-m road and pad	intact	none
8/26/2021	big brown bat	31	39	carcass search	70-m cleared plot	intact	dog
8/26/2021	big brown bat	45	74	carcass search	70-m cleared plot	intact	dog
8/26/2021	big brown bat	7	74	carcass search	70-m cleared plot	intact	dog
8/26/2021	eastern red bat	10	60	carcass search	70-m cleared plot	scavenged	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
8/26/2021	eastern red bat	6	7	carcass search	100-m road and pad	intact	none
8/26/2021	eastern red bat	62	74	carcass search	70-m cleared plot	intact	dog
8/26/2021	eastern red bat	47	77	carcass search	70-m cleared plot	intact	dog
8/26/2021	eastern red bat	20	77	carcass search	70-m cleared plot	intact	dog
8/26/2021	hoary bat	32	55	carcass search	70-m uncleared plot	intact	dog
8/26/2021	hoary bat	50	66	carcass search	100-m road and pad	scavenged	none
8/26/2021	silver-haired bat	4	85	carcass search	100-m road and pad	scavenged	none
8/27/2021	big brown bat	29	100	carcass search	70-m uncleared plot	intact	dog
8/27/2021	big brown bat	34	96	carcass search	70-m cleared plot	intact	dog
8/27/2021	eastern red bat	24	79	carcass search	70-m cleared plot	dismembered	dog
8/27/2021	eastern red bat	10	87	carcass search	70-m cleared plot	intact	dog
8/27/2021	eastern red bat	21	98	carcass search	70-m cleared plot	intact	dog
8/27/2021	hoary bat	46	98	carcass search	70-m cleared plot	intact	dog
8/28/2021	eastern red bat	1	93	carcass search	70-m cleared plot	intact	dog
8/30/2021	big brown bat	28	4	carcass search	70-m uncleared plot	intact	dog
8/30/2021	big brown bat	27	8	carcass search	70-m uncleared plot	intact	dog
8/30/2021	eastern red bat	24	30	carcass search	70-m uncleared plot	scavenged	dog
8/30/2021	eastern red bat	20	32	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	46	34	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	47	34	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	50	34	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	61	57	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	47	57	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	46	57	carcass search	70-m cleared plot	intact	dog
8/30/2021	eastern red bat	20	58	carcass search	70-m cleared plot	scavenged	dog
8/30/2021	eastern red bat	37	58	carcass search	70-m cleared plot	intact	dog
8/30/2021	hoary bat	24	12	carcass search	70-m cleared plot	scavenged	dog
8/30/2021	hoary bat	24	57	carcass search	70-m cleared plot	intact	dog
8/30/2021	unidentified non- <i>Myotis</i>	21	4	carcass search	70-m uncleared plot	intact	dog
8/31/2021	big brown bat	46	51	carcass search	70-m cleared plot	scavenged	dog
8/31/2021	big brown bat	30	52	carcass search	70-m cleared plot	intact	dog
8/31/2021	big brown bat	21	52	carcass search	70-m cleared plot	intact	dog
8/31/2021	big brown bat	24	52	carcass search	70-m cleared plot	intact	dog
8/31/2021	eastern red bat	8	21	carcass search	70-m cleared plot	intact	dog
8/31/2021	eastern red bat	20	21	carcass search	70-m cleared plot	intact	dog
8/31/2021	eastern red bat	22	23	carcass search	100-m road and pad	scavenged	none
8/31/2021	eastern red bat	4	24	carcass search	70-m cleared plot	intact	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
8/31/2021	eastern red bat	32	24	carcass search	70-m cleared plot	intact	dog
8/31/2021	eastern red bat	6	27	carcass search	100-m road and pad	scavenged	none
8/31/2021	eastern red bat	28	48	carcass search	100-m road and pad	intact	none
8/31/2021	eastern red bat	29	56	carcass search	100-m road and pad	scavenged	none
8/31/2021	hoary bat	26	19	carcass search	70-m cleared plot	intact	dog
8/31/2021	hoary bat	37	35	carcass search	100-m road and pad	scavenged	none
9/1/2021	eastern red bat	6	58	incidental	70-m cleared plot	intact	dog
9/2/2021	big brown bat	33	64	carcass search	100-m road and pad	scavenged	none
9/2/2021	eastern red bat	8	15	incidental	70-m uncleared plot	intact	none
9/2/2021	eastern red bat	54	33	carcass search	100-m road and pad	intact	none
9/2/2021	eastern red bat	47	39	carcass search	70-m cleared plot	intact	dog
9/2/2021	eastern red bat	76	46	carcass search*	70-m uncleared plot	intact	dog
9/2/2021	eastern red bat	49	55	carcass search	70-m uncleared plot	intact	dog
9/2/2021	eastern red bat	37	60	carcass search	70-m cleared plot	intact	dog
9/2/2021	eastern red bat	44	60	carcass search	70-m cleared plot	intact	dog
9/2/2021	eastern red bat	47	60	carcass search	70-m cleared plot	intact	dog
9/2/2021	eastern red bat	49	63	carcass search	70-m cleared plot	intact	dog
9/2/2021	eastern red bat	49	63	carcass search	70-m cleared plot	intact	dog
9/2/2021	eastern red bat	45	64	carcass search	100-m road and pad	intact	none
9/2/2021	eastern red bat	27	64	carcass search	100-m road and pad	intact	none
9/2/2021	hoary bat	41	97	carcass search	70-m cleared plot	scavenged	dog
9/2/2021	hoary bat	31	98	carcass search	70-m cleared plot	intact	dog
9/2/2021	silver-haired bat	25	17	carcass search	70-m cleared plot	injured	dog
9/2/2021	silver-haired bat	21	60	carcass search	70-m cleared plot	dismembered	dog
9/2/2021	silver-haired bat	58	63	carcass search	70-m cleared plot	intact	dog
9/3/2021	big brown bat	44	93	carcass search	70-m cleared plot	scavenged	dog
9/3/2021	eastern red bat	36	79	carcass search	70-m cleared plot	intact	dog
9/3/2021	eastern red bat	28	79	carcass search	70-m cleared plot	intact	dog
9/3/2021	eastern red bat	46	80	carcass search	70-m cleared plot	intact	dog
9/3/2021	hoary bat	31	93	carcass search	70-m cleared plot	scavenged	dog
9/3/2021	silver-haired bat	25	79	carcass search	70-m cleared plot	intact	dog
9/3/2021	silver-haired bat	26	79	carcass search	70-m cleared plot	intact	dog
9/3/2021	silver-haired bat	35	88	carcass search	70-m uncleared plot	scavenged	dog
9/3/2021	silver-haired bat	58	93	carcass search	70-m cleared plot	dismembered	dog
9/3/2021	silver-haired bat	7	93	carcass search	70-m cleared plot	intact	dog
9/5/2021	eastern red bat	38	4	carcass search	70-m uncleared plot	scavenged	dog
9/5/2021	eastern red bat	0	51	incidental	70-m cleared plot	intact	none



**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
9/5/2021	eastern red bat	0	57	incidental	70-m cleared plot	intact	none
9/5/2021	hoary bat	29	15	carcass search	70-m uncleared plot	intact	dog
9/5/2021	unidentified non- <i>Myotis</i>	46	8	carcass search	70-m uncleared plot	scavenged	dog
9/6/2021	big brown bat	17	24	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	big brown bat	59	57	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	eastern red bat	52	12	carcass search	70-m cleared plot	intact	dog
9/6/2021	eastern red bat	38	24	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	eastern red bat	46	34	carcass search	70-m cleared plot	intact	dog
9/6/2021	eastern red bat	28	51	carcass search	70-m cleared plot	intact	dog
9/6/2021	eastern red bat	9	58	carcass search	70-m cleared plot	intact	dog
9/6/2021	eastern red bat	69	58	carcass search	70-m cleared plot	intact	dog
9/6/2021	eastern red bat	48	58	carcass search	70-m cleared plot	intact	dog
9/6/2021	eastern red bat	50	9	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	hoary bat	37	30	carcass search	70-m uncleared plot	intact	dog
9/6/2021	hoary bat	43	57	carcass search	70-m cleared plot	dismembered	dog
9/6/2021	silver-haired bat	61	12	carcass search	70-m cleared plot	dismembered	dog
9/6/2021	silver-haired bat	23	12	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	silver-haired bat	35	24	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	silver-haired bat	5	24	carcass search	70-m cleared plot	scavenged	dog
9/6/2021	silver-haired bat	41	32	carcass search	70-m cleared plot	intact	dog
9/7/2021	big brown bat	10	11	carcass search	100-m road and pad	intact	none
9/7/2021	eastern red bat	7	47	carcass search	100-m road and pad	scavenged	none
9/7/2021	eastern red bat	16	5	carcass search	70-m uncleared plot	intact	dog
9/7/2021	hoary bat	25	10	carcass search	100-m road and pad	scavenged	none
9/7/2021	hoary bat	32	75	carcass search	70-m cleared plot	scavenged	dog
9/7/2021	silver-haired bat	44	23	carcass search	100-m road and pad	intact	none
9/7/2021	silver-haired bat	32	23	carcass search	100-m road and pad	intact	none
9/7/2021	silver-haired bat	50	39	carcass search	70-m cleared plot	scavenged	dog
9/7/2021	silver-haired bat	59	39	carcass search	70-m cleared plot	intact	dog
9/7/2021	silver-haired bat	30	69	carcass search	70-m cleared plot	intact	dog
9/7/2021	silver-haired bat	45	70	carcass search	70-m cleared plot	intact	dog
9/8/2021	eastern red bat	48	79	carcass search	70-m cleared plot	scavenged	dog
9/8/2021	eastern red bat	67	87	carcass search	70-m cleared plot	scavenged	dog
9/8/2021	eastern red bat	61	87	carcass search	70-m cleared plot	dismembered	dog
9/8/2021	hoary bat	7	40	carcass search	70-m cleared plot	intact	dog
9/8/2021	silver-haired bat	67	79	carcass search	70-m cleared plot	scavenged	dog
9/8/2021	silver-haired bat	64	80	carcass search	70-m cleared plot	scavenged	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
9/8/2021	silver-haired bat	33	81	carcass search	70-m uncleared plot	intact	dog
9/9/2021	big brown bat	43	60	carcass search	70-m cleared plot	intact	dog
9/9/2021	big brown bat	27	97	carcass search	70-m cleared plot	intact	dog
9/9/2021	eastern red bat	51	60	carcass search	70-m cleared plot	intact	dog
9/9/2021	eastern red bat	49	63	carcass search	70-m cleared plot	intact	dog
9/9/2021	eastern red bat	28	82	carcass search	70-m uncleared plot	intact	dog
9/9/2021	eastern red bat	52	82	carcass search	70-m uncleared plot	intact	dog
9/9/2021	eastern red bat	30	82	carcass search	70-m uncleared plot	intact	dog
9/9/2021	eastern red bat	42	97	carcass search	70-m cleared plot	intact	dog
9/9/2021	eastern red bat	37	98	carcass search	70-m cleared plot	intact	dog
9/9/2021	hoary bat	48	100	carcass search	70-m uncleared plot	intact	dog
9/9/2021	silver-haired bat	3	7	carcass search	100-m road and pad	intact	none
9/9/2021	silver-haired bat	19	73	carcass search	100-m road and pad	scavenged	none
9/9/2021	silver-haired bat	67	82	carcass search	70-m uncleared plot	intact	dog
9/9/2021	silver-haired bat	42	82	carcass search	70-m uncleared plot	intact	dog
9/9/2021	unidentified non- <i>Myotis</i>	45	97	carcass search	70-m cleared plot	scavenged	dog
9/9/2021	unidentified non- <i>Myotis</i>	30	98	carcass search	70-m cleared plot	scavenged	dog
9/10/2021	eastern red bat	58	92	carcass search	70-m uncleared plot	intact	dog
9/10/2021	Indiana bat	28	94	carcass search	70-m uncleared plot	scavenged	dog
9/13/2021	eastern red bat	8	31	carcass search	70-m uncleared plot	scavenged	dog
9/13/2021	eastern red bat	47	34	carcass search	70-m cleared plot	scavenged	dog
9/13/2021	eastern red bat	39	34	carcass search	70-m cleared plot	intact	dog
9/13/2021	eastern red bat	33	34	carcass search	70-m cleared plot	intact	dog
9/13/2021	eastern red bat	47	51	carcass search	70-m cleared plot	intact	dog
9/13/2021	eastern red bat	31	51	carcass search	70-m cleared plot	scavenged	dog
9/13/2021	eastern red bat	40	57	carcass search	70-m cleared plot	intact	dog
9/13/2021	hoary bat	18	34	carcass search	70-m cleared plot	intact	dog
9/13/2021	hoary bat	28	4	carcass search	70-m uncleared plot	intact	dog
9/13/2021	silver-haired bat	50	32	carcass search	70-m cleared plot	scavenged	dog
9/13/2021	silver-haired bat	46	34	carcass search	70-m cleared plot	intact	dog
9/13/2021	silver-haired bat	16	51	carcass search	70-m cleared plot	intact	dog
9/13/2021	silver-haired bat	52	57	carcass search	70-m cleared plot	intact	dog
9/13/2021	silver-haired bat	59	8	carcass search	70-m uncleared plot	intact	dog
9/13/2021	silver-haired bat	50	9	carcass search	70-m cleared plot	intact	dog
9/14/2021	eastern red bat	25	21	carcass search	70-m cleared plot	intact	dog
9/14/2021	eastern red bat	33	22	carcass search	70-m uncleared plot	intact	dog
9/14/2021	hoary bat	51	22	carcass search	70-m uncleared plot	intact	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
9/14/2021	Indiana bat	11	3	carcass search	70-m uncleared plot	scavenged	dog
9/14/2021	silver-haired bat	4	10	carcass search	100-m road and pad	intact	none
9/14/2021	silver-haired bat	38	21	carcass search	70-m cleared plot	intact	dog
9/14/2021	silver-haired bat	55	24	carcass search	70-m cleared plot	scavenged	dog
9/14/2021	silver-haired bat	60	24	carcass search	70-m cleared plot	intact	dog
9/14/2021	silver-haired bat	24	69	carcass search	70-m cleared plot	scavenged	dog
9/14/2021	silver-haired bat	18	69	carcass search	70-m cleared plot	dismembered	dog
9/14/2021	silver-haired bat	42	70	carcass search	70-m cleared plot	intact	dog
9/14/2021	unidentified non- <i>Myotis</i>	0	58	incidental	70-m cleared plot	scavenged	none
9/16/2021	big brown bat	31	97	carcass search	70-m cleared plot	scavenged	dog
9/16/2021	eastern red bat	43	63	carcass search	70-m cleared plot	scavenged	dog
9/16/2021	eastern red bat	38	85	carcass search	100-m road and pad	scavenged	none
9/16/2021	hoary bat	18	14	carcass search	100-m road and pad	injured	none
9/16/2021	hoary bat	33	64	carcass search	100-m road and pad	intact	none
9/16/2021	silver-haired bat	63	55	carcass search	70-m uncleared plot	intact	dog
9/16/2021	silver-haired bat	43	55	carcass search	70-m uncleared plot	intact	dog
9/16/2021	silver-haired bat	47	75	carcass search	70-m cleared plot	scavenged	dog
9/16/2021	silver-haired bat	23	75	carcass search	70-m cleared plot	scavenged	dog
9/16/2021	silver-haired bat	56	82	carcass search	70-m uncleared plot	scavenged	dog
9/16/2021	silver-haired bat	35	85	carcass search	100-m road and pad	scavenged	none
9/16/2021	silver-haired bat	63	98	carcass search	70-m cleared plot	scavenged	dog
9/17/2021	eastern red bat	56	79	carcass search	70-m cleared plot	intact	dog
9/17/2021	eastern red bat	43	81	carcass search	70-m uncleared plot	intact	dog
9/17/2021	silver-haired bat	56	87	carcass search	70-m cleared plot	intact	dog
9/17/2021	silver-haired bat	25	93	carcass search	70-m cleared plot	scavenged	dog
9/19/2021	silver-haired bat	0	51	incidental	70-m cleared plot	scavenged	none
9/20/2021	big brown bat	38	52	carcass search	70-m cleared plot	dismembered	dog
9/20/2021	big brown bat	21	52	carcass search	70-m cleared plot	dismembered	dog
9/20/2021	eastern red bat	22	15	carcass search	70-m uncleared plot	scavenged	dog
9/20/2021	eastern red bat	24	9	carcass search	70-m cleared plot	intact	dog
9/20/2021	hoary bat	35	32	carcass search	70-m cleared plot	intact	dog
9/20/2021	hoary bat	58	51	carcass search	70-m cleared plot	dismembered	dog
9/20/2021	Indiana bat	70	9	carcass search	70-m cleared plot	dismembered	dog
9/20/2021	silver-haired bat	16	15	carcass search	70-m uncleared plot	scavenged	dog
9/20/2021	silver-haired bat	38	4	carcass search	70-m uncleared plot	scavenged	dog
9/20/2021	silver-haired bat	21	52	carcass search	70-m cleared plot	scavenged	dog
9/20/2021	silver-haired bat	20	57	carcass search	70-m cleared plot	scavenged	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
9/20/2021	silver-haired bat	31	57	carcass search	70-m cleared plot	scavenged	dog
9/20/2021	silver-haired bat	27	58	carcass search	70-m cleared plot	scavenged	dog
9/20/2021	silver-haired bat	21	9	carcass search	70-m cleared plot	intact	dog
9/21/2021	big brown bat	1	10	carcass search	100-m road and pad	scavenged	none
9/21/2021	eastern red bat	65	24	carcass search	70-m cleared plot	scavenged	dog
9/21/2021	eastern red bat	10	48	carcass search	100-m road and pad	scavenged	none
9/21/2021	eastern red bat	15	74	carcass search	70-m cleared plot	scavenged	dog
9/21/2021	evening bat	35	74	carcass search	70-m cleared plot	intact	dog
9/21/2021	hoary bat	5	10	carcass search	100-m road and pad	scavenged	none
9/21/2021	hoary bat	15	23	carcass search	100-m road and pad	injured	none
9/21/2021	hoary bat	14	23	carcass search	100-m road and pad	scavenged	none
9/21/2021	hoary bat	9	24	carcass search	70-m cleared plot	intact	dog
9/21/2021	hoary bat	67	3	carcass search	70-m uncleared plot	intact	dog
9/21/2021	hoary bat	10	50	carcass search	100-m road and pad	scavenged	none
9/21/2021	hoary bat	13	56	carcass search	100-m road and pad	intact	none
9/21/2021	hoary bat	39	70	carcass search	70-m cleared plot	intact	dog
9/21/2021	silver-haired bat	62	20	carcass search	70-m cleared plot	intact	dog
9/21/2021	silver-haired bat	42	29	carcass search	100-m road and pad	scavenged	none
9/21/2021	silver-haired bat	58	3	carcass search	70-m uncleared plot	intact	dog
9/21/2021	silver-haired bat	36	3	carcass search	70-m uncleared plot	intact	dog
9/21/2021	silver-haired bat	65	35	carcass search	100-m road and pad	intact	none
9/21/2021	silver-haired bat	15	50	carcass search	100-m road and pad	scavenged	none
9/21/2021	silver-haired bat	51	70	carcass search	70-m cleared plot	intact	dog
9/22/2021	eastern red bat	43	5	carcass search	70-m uncleared plot	intact	dog
9/22/2021	silver-haired bat	0	15	incidental	70-m uncleared plot	scavenged	none
9/22/2021	silver-haired bat	0	32	incidental	70-m cleared plot	scavenged	none
9/23/2021	silver-haired bat	89	89	carcass search	100-m road and pad	intact	none
9/24/2021	eastern red bat	39	63	carcass search	70-m cleared plot	intact	dog
9/24/2021	eastern red bat	68	98	carcass search	70-m cleared plot	intact	dog
9/24/2021	hoary bat	42	82	carcass search	70-m uncleared plot	intact	dog
9/24/2021	silver-haired bat	22	40	carcass search	70-m cleared plot	scavenged	dog
9/24/2021	silver-haired bat	24	60	carcass search	70-m cleared plot	scavenged	dog
9/24/2021	silver-haired bat	51	82	carcass search	70-m uncleared plot	intact	dog
9/24/2021	silver-haired bat	47	98	carcass search	70-m cleared plot	intact	dog
9/25/2021	hoary bat	33	93	carcass search	70-m cleared plot	scavenged	dog
9/25/2021	silver-haired bat	15	92	carcass search	70-m uncleared plot	scavenged	dog
9/25/2021	silver-haired bat	46	92	carcass search	70-m uncleared plot	intact	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
9/25/2021	silver-haired bat	50	94	carcass search	70-m uncleared plot	intact	dog
9/25/2021	silver-haired bat	37	94	carcass search	70-m uncleared plot	intact	dog
9/25/2021	silver-haired bat	49	96	carcass search	70-m cleared plot	intact	dog
9/25/2021	unidentified non- <i>Myotis</i>	43	94	carcass search	70-m uncleared plot	scavenged	dog
9/27/2021	eastern red bat	57	51	carcass search	70-m cleared plot	intact	dog
9/27/2021	eastern red bat	63	57	carcass search	70-m cleared plot	intact	dog
9/27/2021	hoary bat	40	15	carcass search	70-m uncleared plot	intact	dog
9/27/2021	hoary bat	37	34	carcass search	70-m cleared plot	intact	dog
9/27/2021	hoary bat	31	57	carcass search	70-m cleared plot	intact	dog
9/27/2021	hoary bat	28	58	carcass search	70-m cleared plot	scavenged	dog
9/27/2021	silver-haired bat	42	12	carcass search	70-m cleared plot	scavenged	dog
9/27/2021	silver-haired bat	67	12	carcass search	70-m cleared plot	scavenged	dog
9/27/2021	silver-haired bat	32	32	carcass search	70-m cleared plot	scavenged	dog
9/27/2021	silver-haired bat	46	34	carcass search	70-m cleared plot	intact	dog
9/27/2021	silver-haired bat	61	4	carcass search	70-m uncleared plot	intact	dog
9/27/2021	silver-haired bat	43	51	carcass search	70-m cleared plot	intact	dog
9/27/2021	silver-haired bat	43	51	carcass search	70-m cleared plot	intact	dog
9/27/2021	silver-haired bat	20	57	carcass search	70-m cleared plot	scavenged	dog
9/27/2021	silver-haired bat	37	9	carcass search	70-m cleared plot	scavenged	dog
9/28/2021	silver-haired bat	0	38	carcass search	100-m road and pad	intact	none
9/28/2021	silver-haired bat	56	74	carcass search	70-m cleared plot	scavenged	dog
9/29/2021	eastern red bat	51	22	carcass search	70-m uncleared plot	scavenged	dog
9/29/2021	hoary bat	54	22	carcass search	70-m uncleared plot	intact	dog
9/29/2021	silver-haired bat	30	20	carcass search	70-m cleared plot	dismembered	dog
9/29/2021	silver-haired bat	56	20	carcass search	70-m cleared plot	intact	dog
9/29/2021	silver-haired bat	22	21	carcass search	70-m cleared plot	intact	dog
9/29/2021	silver-haired bat	35	22	carcass search	70-m uncleared plot	intact	dog
9/29/2021	silver-haired bat	68	22	carcass search	70-m uncleared plot	intact	dog
9/30/2021	eastern red bat	62	46	carcass search	70-m uncleared plot	intact	dog
9/30/2021	eastern red bat	21	55	carcass search	70-m uncleared plot	intact	dog
9/30/2021	eastern red bat	62	79	carcass search	70-m cleared plot	intact	dog
9/30/2021	eastern red bat	12	97	carcass search	70-m cleared plot	intact	dog
9/30/2021	eastern red bat	47	97	carcass search	70-m cleared plot	scavenged	dog
9/30/2021	hoary bat	41	60	carcass search	70-m cleared plot	scavenged	dog
9/30/2021	silver-haired bat	66	46	carcass search	70-m uncleared plot	intact	dog
9/30/2021	silver-haired bat	59	46	carcass search	70-m uncleared plot	intact	dog
9/30/2021	silver-haired bat	67	60	carcass search	70-m cleared plot	dismembered	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
9/30/2021	silver-haired bat	81	79	carcass search*	70-m cleared plot	intact	dog
9/30/2021	silver-haired bat	77	81	carcass search*	70-m uncleared plot	scavenged	dog
9/30/2021	silver-haired bat	70	81	carcass search	70-m uncleared plot	scavenged	dog
9/30/2021	silver-haired bat	46	98	carcass search	70-m cleared plot	scavenged	dog
10/1/2021	eastern red bat	59	84	carcass search	70-m uncleared plot	intact	dog
10/1/2021	eastern red bat	49	86	carcass search	70-m cleared plot	intact	dog
10/1/2021	eastern red bat	36	86	carcass search	70-m cleared plot	intact	dog
10/1/2021	eastern red bat	30	92	carcass search	70-m uncleared plot	scavenged	dog
10/1/2021	silver-haired bat	20	93	carcass search	70-m cleared plot	scavenged	dog
10/1/2021	silver-haired bat	32	94	carcass search	70-m uncleared plot	scavenged	dog
10/1/2021	silver-haired bat	27	95	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	eastern red bat	37	34	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	eastern red bat	52	51	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	eastern red bat	58	57	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	hoary bat	41	32	carcass search	70-m cleared plot	intact	dog
10/3/2021	hoary bat	30	57	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	hoary bat	49	57	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	hoary bat	38	58	carcass search	70-m cleared plot	intact	dog
10/3/2021	hoary bat	60	8	carcass search	70-m uncleared plot	scavenged	dog
10/3/2021	silver-haired bat	26	12	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	silver-haired bat	33	52	carcass search	70-m cleared plot	intact	dog
10/3/2021	silver-haired bat	55	57	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	silver-haired bat	15	58	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	silver-haired bat	59	9	carcass search	70-m cleared plot	scavenged	dog
10/4/2021	eastern red bat	35	22	carcass search	70-m uncleared plot	intact	dog
10/4/2021	eastern red bat	27	24	carcass search	70-m cleared plot	intact	dog
10/4/2021	eastern red bat	18	3	carcass search	70-m uncleared plot	intact	dog
10/4/2021	eastern red bat	63	3	carcass search	70-m uncleared plot	intact	dog
10/4/2021	eastern red bat	41	41	carcass search	70-m cleared plot	intact	dog
10/4/2021	eastern red bat	60	41	carcass search	70-m cleared plot	intact	dog
10/4/2021	eastern red bat	62	5	carcass search	70-m uncleared plot	scavenged	dog
10/4/2021	eastern red bat	51	69	carcass search	70-m cleared plot	intact	dog
10/4/2021	eastern red bat	25	74	carcass search	70-m cleared plot	intact	dog
10/4/2021	eastern red bat	41	75	carcass search	70-m cleared plot	intact	dog
10/4/2021	silver-haired bat	58	22	carcass search	70-m uncleared plot	scavenged	dog
10/4/2021	silver-haired bat	17	22	carcass search	70-m uncleared plot	intact	dog
10/4/2021	silver-haired bat	24	24	carcass search	70-m cleared plot	scavenged	dog

**Appendix A. Carcasses found at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
10/4/2021	silver-haired bat	61	41	carcass search	70-m cleared plot	scavenged	dog
10/4/2021	silver-haired bat	29	41	carcass search	70-m cleared plot	scavenged	dog
10/4/2021	silver-haired bat	57	5	carcass search	70-m uncleared plot	scavenged	dog
10/4/2021	silver-haired bat	18	69	carcass search	70-m cleared plot	intact	dog
10/4/2021	silver-haired bat	40	69	carcass search	70-m cleared plot	intact	dog
10/5/2021	eastern red bat	24	35	carcass search	100-m road and pad	scavenged	none
10/5/2021	eastern red bat	20	36	carcass search	100-m road and pad	intact	none
10/5/2021	eastern red bat	56	55	carcass search	70-m uncleared plot	scavenged	dog
10/5/2021	silver-haired bat	34	40	carcass search	70-m cleared plot	intact	dog
10/5/2021	silver-haired bat	18	55	carcass search	70-m uncleared plot	scavenged	dog
10/5/2021	silver-haired bat	2	60	carcass search	70-m cleared plot	dismembered	dog
10/5/2021	silver-haired bat	1	77	carcass search	70-m cleared plot	scavenged	dog
10/6/2021	eastern red bat	41	82	carcass search	70-m uncleared plot	intact	dog
10/6/2021	eastern red bat	17	97	carcass search	70-m cleared plot	intact	dog
10/6/2021	eastern red bat	44	97	carcass search	70-m cleared plot	intact	dog
10/6/2021	hoary bat	51	82	carcass search	70-m uncleared plot	intact	dog
10/6/2021	hoary bat	69	82	carcass search	70-m uncleared plot	intact	dog
10/6/2021	silver-haired bat	28	100	carcass search	70-m uncleared plot	scavenged	dog
10/6/2021	silver-haired bat	25	19	carcass search	70-m cleared plot	intact	dog
10/6/2021	silver-haired bat	55	82	carcass search	70-m uncleared plot	intact	dog
10/6/2021	silver-haired bat	31	82	carcass search	70-m uncleared plot	intact	dog
10/7/2021	eastern red bat	15	64	carcass search	100-m road and pad	intact	none
10/7/2021	eastern red bat	61	79	carcass search	70-m cleared plot	intact	dog
10/7/2021	eastern red bat	30	86	carcass search	70-m cleared plot	intact	dog
10/7/2021	silver-haired bat	68	73	carcass search	100-m road and pad	scavenged	none
10/7/2021	silver-haired bat	26	81	carcass search	70-m uncleared plot	intact	dog
10/7/2021	silver-haired bat	36	84	carcass search	70-m uncleared plot	intact	dog
10/7/2021	silver-haired bat	44	84	carcass search	70-m uncleared plot	intact	dog
10/7/2021	silver-haired bat	27	84	carcass search	70-m uncleared plot	intact	dog
10/8/2021	hoary bat	53	94	carcass search	70-m uncleared plot	intact	dog
10/8/2021	silver-haired bat	37	94	carcass search	70-m uncleared plot	intact	dog
10/9/2021	eastern red bat	53	96	carcass search	70-m cleared plot	scavenged	dog
10/10/2021	eastern red bat	45	34	carcass search	70-m cleared plot	intact	dog
10/10/2021	eastern red bat	25	57	carcass search	70-m cleared plot	intact	dog
10/10/2021	eastern red bat	32	58	carcass search	70-m cleared plot	intact	dog
10/10/2021	silver-haired bat	2	15	carcass search	70-m uncleared plot	intact	dog
10/10/2021	silver-haired bat	34	24	carcass search	70-m cleared plot	intact	dog

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<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
10/10/2021	silver-haired bat	62	24	carcass search	70-m cleared plot	intact	dog
10/10/2021	silver-haired bat	47	34	carcass search	70-m cleared plot	intact	dog
10/10/2021	silver-haired bat	45	4	carcass search	70-m uncleared plot	intact	dog
10/10/2021	silver-haired bat	58	57	carcass search	70-m cleared plot	scavenged	dog
10/10/2021	silver-haired bat	41	58	carcass search	70-m cleared plot	scavenged	dog
10/10/2021	silver-haired bat	48	58	carcass search	70-m cleared plot	scavenged	dog
10/10/2021	silver-haired bat	46	9	carcass search	70-m cleared plot	intact	dog
10/10/2021	silver-haired bat	32	9	carcass search	70-m cleared plot	scavenged	dog
10/11/2021	eastern red bat	11	21	carcass search	70-m cleared plot	intact	dog
10/11/2021	eastern red bat	16	41	carcass search	70-m cleared plot	intact	dog
10/11/2021	eastern red bat	27	51	carcass search	70-m cleared plot	intact	dog
10/11/2021	silver-haired bat	28	19	carcass search	70-m cleared plot	intact	dog
10/11/2021	silver-haired bat	52	21	carcass search	70-m cleared plot	intact	dog
10/11/2021	silver-haired bat	14	51	carcass search	70-m cleared plot	scavenged	dog
10/11/2021	unidentified non- <i>Myotis</i>	24	41	carcass search	70-m cleared plot	dismembered	dog
10/12/2021	eastern red bat	57	75	carcass search	70-m cleared plot	intact	dog
10/12/2021	eastern red bat	44	82	carcass search	70-m uncleared plot	scavenged	dog
10/12/2021	silver-haired bat	6	23	carcass search	100-m road and pad	scavenged	none
10/12/2021	silver-haired bat	1	25	carcass search	100-m road and pad	scavenged	none
10/12/2021	silver-haired bat	19	82	carcass search	70-m uncleared plot	scavenged	dog
10/12/2021	silver-haired bat	49	97	carcass search	70-m cleared plot	intact	dog
10/12/2021	silver-haired bat	38	98	carcass search	70-m cleared plot	scavenged	dog
10/13/2021	eastern red bat	33	81	carcass search	70-m uncleared plot	intact	dog
10/13/2021	silver-haired bat	24	77	carcass search	70-m cleared plot	intact	dog
10/13/2021	silver-haired bat	44	77	carcass search	70-m cleared plot	intact	dog
10/13/2021	silver-haired bat	32	96	carcass search	70-m cleared plot	intact	dog
10/14/2021	eastern red bat	2	90	carcass search	100-m road and pad	intact	none
<b>Bird Carcasses</b>							
4/12/2021	yellow-bellied sapsucker	5	25	carcass search	100-m road and pad	intact	none
4/26/2021	turkey vulture	25	17	carcass search*	100-m road and pad	intact	none
5/13/2021	killdeer	9	83	carcass search	100-m road and pad	dismembered	none
6/26/2021	horned lark	47	70	carcass search	70-m cleared plot	scavenged	dog
7/17/2021	eastern meadowlark	65	39	carcass search	70-m cleared plot	dismembered	dog
7/30/2021	unidentified sparrow	68	40	carcass search	70-m cleared plot	injured	dog
8/2/2021	horned lark	3	34	carcass search	70-m cleared plot	intact	dog
8/2/2021	indigo bunting	7	58	carcass search	70-m cleared plot	intact	dog
8/3/2021	horned lark	38	51	carcass search	70-m cleared plot	intact	dog



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<b>Found Date</b>	<b>Common Name</b>	<b>Distance from Turbine (m)</b>	<b>Search Location</b>	<b>Search Type</b>	<b>Search Area Type</b>	<b>Physical Condition</b>	<b>Dog-Aided Search</b>
8/3/2021	tree swallow	57	22	carcass search	70-m uncleared plot	intact	dog
8/3/2021	turkey vulture	27	17	carcass search	70-m cleared plot	feather spot	dog
8/3/2021	turkey vulture	75	5	carcass search*	70-m uncleared plot	scavenged	dog
8/3/2021	unidentified small bird	61	20	carcass search	70-m cleared plot	feather spot	dog
8/5/2021	horned lark	11	82	carcass search	70-m uncleared plot	dismembered	dog
8/5/2021	killdeer	45	14	carcass search	100-m road and pad	scavenged	none
8/6/2021	horned lark	4	80	carcass search	70-m cleared plot	feather spot	none
8/6/2021	killdeer	9	84	carcass search	70-m uncleared plot	feather spot	dog
8/9/2021	unidentified small bird	25	12	carcass search	70-m cleared plot	intact	dog
8/10/2021	dickcissel	4	86	incidental	70-m cleared plot	intact	none
8/12/2021	killdeer	14	83	carcass search	70-m cleared plot	intact	dog
8/12/2021	killdeer	6	87	carcass search	70-m cleared plot	scavenged	dog
8/16/2021	unidentified sparrow	18	12	carcass search	70-m cleared plot	dismembered	dog
8/17/2021	chimney swift	33	19	carcass search	70-m cleared plot	intact	dog
8/19/2021	killdeer	3	14	carcass search	100-m road and pad	scavenged	none
8/19/2021	turkey vulture	42	82	carcass search	70-m uncleared plot	dismembered	dog
8/22/2021	turkey vulture	47	34	carcass search	70-m cleared plot	scavenged	dog
8/24/2021	turkey vulture	29	17	carcass search	70-m cleared plot	intact	dog
8/24/2021	turkey vulture	41	51	carcass search	70-m cleared plot	dismembered	dog
8/26/2021	killdeer	22	63	carcass search	70-m cleared plot	feather spot	dog
8/26/2021	turkey vulture	28	60	carcass search	70-m cleared plot	intact	dog
8/28/2021	unidentified small bird	33	92	carcass search	70-m uncleared plot	feather spot	dog
8/30/2021	red-tailed hawk	38	15	carcass search	70-m uncleared plot	dismembered	dog
8/31/2021	unidentified small bird	38	21	carcass search	70-m cleared plot	feather spot	dog
9/2/2021	horned lark	1	99	carcass search	100-m road and pad	intact	none
9/2/2021	red-eyed vireo	40	60	carcass search	70-m cleared plot	intact	dog
9/6/2021	turkey vulture	238	52	incidental*	70-m cleared plot	injured	none
9/6/2021	yellow-billed cuckoo	51	9	carcass search	70-m cleared plot	intact	dog
9/8/2021	horned lark	18	87	carcass search	70-m cleared plot	intact	dog
9/9/2021	red-eyed vireo	47	63	carcass search	70-m cleared plot	intact	dog
9/10/2021	chestnut-sided warbler	47	37	carcass search	70-m cleared plot	intact	dog
9/13/2021	mourning dove	1	12	carcass search	70-m cleared plot	intact	dog
9/13/2021	turkey vulture	33	4	carcass search	70-m uncleared plot	intact	dog
9/14/2021	turkey vulture	68	20	carcass search	70-m cleared plot	scavenged	dog
9/17/2021	house sparrow	49	79	carcass search	70-m cleared plot	intact	dog
9/17/2021	unidentified small bird	58	79	carcass search	70-m cleared plot	feather spot	dog
9/20/2021	magnolia warbler	33	12	carcass search	70-m cleared plot	dismembered	dog

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9/21/2021	horned lark	30	70	carcass search	70-m cleared plot	feather spot	dog
9/21/2021	orchard oriole	69	74	carcass search	70-m cleared plot	scavenged	dog
9/21/2021	unidentified swallow	55	3	carcass search	70-m uncleared plot	intact	dog
9/22/2021	chimney swift	36	5	carcass search	70-m uncleared plot	intact	dog
9/27/2021	horned lark	58	57	carcass search	70-m cleared plot	injured	dog
9/28/2021	red-tailed hawk	22	24	carcass search	70-m cleared plot	scavenged	dog
9/28/2021	red-tailed hawk	18	38	carcass search	100-m road and pad	dismembered	none
9/29/2021	rock pigeon	18	37	carcass search	70-m cleared plot	scavenged	dog
9/30/2021	golden-crowned kinglet	89	26	carcass search	100-m road and pad	intact	none
9/30/2021	horned lark	12	79	carcass search	70-m cleared plot	dismembered	dog
9/30/2021	turkey vulture	22	72	carcass search*	100-m road and pad	scavenged	none
9/30/2021	unidentified passerine	14	79	carcass search	70-m cleared plot	scavenged	dog
10/3/2021	unidentified kinglet	66	59	carcass search	70-m uncleared plot	dismembered	dog
10/3/2021	unidentified sparrow	69	58	carcass search	70-m cleared plot	scavenged	dog
10/6/2021	Philadelphia vireo	35	98	carcass search	70-m cleared plot	intact	dog
10/10/2021	unidentified kinglet	24	9	carcass search	70-m cleared plot	scavenged	dog
10/12/2021	killdeer	34	8	carcass search	70-m uncleared plot	dismembered	dog
10/12/2021	unidentified vireo	44	46	carcass search	70-m uncleared plot	intact	dog
10/14/2021	golden-crowned kinglet	28	33	carcass search	100-m road and pad	intact	none

\* Carcass was found outside the search area

m = meters

**Appendix B. Carcass Count Adjustments and Inputs for Single Class and Multiple Class Modules in Evidence of Absence**

**Appendix B1. Searcher efficiency models for 70-meter plots at the Headwaters Wind Farm in Randolph County, Indiana, from May 16 – October 15, 2021.**

<b>Covariates</b>	<b>k Value</b>	<b>AICc</b>	<b>Delta AICc</b>
No Covariates	0.67	93.16	0*
Plot Search Type + Season	0.67	93.56	0.40
Plot Type	0.67	94.20	1.04
Season	0.67	95.60	2.44

\* Selected model.

AICc = corrected Akaike Information Criterion.

**Appendix B2. Searcher efficiency models for road and pad plots at the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Covariates</b>	<b>k Value</b>	<b>AICc</b>	<b>Delta AICc</b>
No Covariates	0.67	52.47	0*
Season	0.67	55.83	3.36

\* Selected model.

AICc = corrected Akaike Information Criterion.

**Appendix B3. Carcass persistence models with covariates and distributions for bats/dog-handler team at the Headwaters Wind Farm, Randolph County, Indiana, from August 1 – October 15, 2021 (n = 45).**

<b>Location Covariates</b>	<b>Scale Covariates</b>	<b>Distribution</b>	<b>AICc</b>	<b>Delta AICc</b>
No Covariates	PlotSearchType	Weibull	168.11	0
No Covariates	No Covariates	Weibull	168.97	0.86*
No Covariates	No Covariates	loglogistic	169.35	1.24
PlotSearchType	No Covariates	loglogistic	169.37	1.26
No Covariates	PlotSearchType	loglogistic	169.49	1.38
PlotSearchType	No Covariates	lognormal	169.59	1.48
No Covariates	No Covariates	lognormal	169.61	1.50
PlotSearchType	No Covariates	Weibull	169.80	1.69
No Covariates	PlotSearchType	lognormal	170.09	1.98
PlotSearchType	PlotSearchType	Weibull	170.24	2.13
PlotSearchType	PlotSearchType	loglogistic	170.40	2.29
PlotSearchType	PlotSearchType	lognormal	171.12	3.01
No Covariates	-	exponential	180.75	12.64
PlotSearchType	-	exponential	181.05	12.94

\* Selected model

AICc = corrected Akaike Information Criterion.

**Appendix B4. Carcass persistence models with covariates and distributions for bats/technician at the Headwaters Wind Farm, Randolph County, Indiana, from April 1 – October 15, 2021 (n = 45).**

Location Covariates	Scale Covariates	Distribution	AICc	Delta AICc
No Covariates	No Covariates	Weibull	199.58	0*
Season	No Covariates	lognormal	199.59	0.01
Season	No Covariates	loglogistic	199.86	0.28
No Covariates	No Covariates	loglogistic	200.38	0.80
No Covariates	No Covariates	lognormal	200.74	1.16
No Covariates	Season	Weibull	200.85	1.27
Season	No Covariates	Weibull	200.89	1.31
No Covariates	Season	lognormal	201.47	1.89
No Covariates	Season	loglogistic	201.51	1.93
Season	Season	lognormal	201.75	2.17
Season	Season	loglogistic	202.05	2.47
Season	Season	Weibull	202.34	2.76
No Covariates	-	exponential	204.13	4.55
Season	-	exponential	204.19	4.61

\* Selected model

AICc = corrected Akaike Information Criterion.

**Appendix B5. Carcass persistence top models with covariates, distributions, and model parameters for the Headwaters Wind Farm, Randolph County, Indiana, from April 1 – October 15, 2021.**

Size Class	Distribution	Predicted Median Removal Times		
		(days)	Parameter 1	Parameter 2
Bat/dog team (cleared and uncleared plots)	Weibull*	21.15	shape = 0.5038	scale = 43.7722
Bat/technician (road and pad plots)	Weibull*	7.86	shape = 0.692	scale = 13.3565

\* Parameterization follows the base R parameterization for this distribution.

**Appendix B6. Inputs needed to run Evidence of Absence: Single Class Module for the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Season	Plot Type	Search Interval (I)	Number of Searches*	Spatial Coverage (a)	Searcher Efficiency**		Carcass Persistence***		
					Carcasses Available	Carcasses Found	Shape (α)	Scale (β)	Scale (β) 95% CI
spring	road/pad	12.5	4	0.12	59	50	0.69	13.36	8.36-21.35
summer	road/pad	7	12	0.12	59	50	0.69	13.36	8.36-21.35
summer	cleared	7	11	0.91	82	62	0.5	43.77	18.82-101.8
fall	road/pad	7	11	0.12	59	50	0.69	13.36	8.36-21.35
fall	cleared	7	10	0.91	82	62	0.5	43.77	18.82-101.8
fall	uncleared	7	11	0.91	82	62	0.5	43.77	18.82-101.8

\*An additional search must be added to these numbers for the Evidence of Absence Graphical User Interface (GUI), because the GUI automatically discards the first search as a clearing search. This column is the number of searches with the clearing search already excluded.

\*\*  $k = 0.67$ , as per the Habitat Conservation Plan.

\*\*\*A loglogistic distribution was used for carcass persistence distribution.

**Appendix B7. Inputs needed to run Evidence of Absence model to combine across plot types within each season: Multiple Class Module for the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

Season	Plot Type	Ba	Bb	Sampling Fraction	Within-Season Relative Turbine Operations	Weights (DWP*)
spring	unsearched**	0.01	1000	0.01	0.5	0.01
spring	road and pad	101.13	1600.58	0.99	0.5	0.99
summer	road and pad	166.66	2141.49	0.1	0.51	0.1
summer	cleared	69.76	43.68	0.9	0.49	0.9
fall	road and pad	173.17	2219.3	0.46	0.34	0.47
fall	cleared	66.74	42.13	0.35	0.33	0.35
fall	full plot	73.28	45.83	0.18	0.34	0.19

\* DWP – density weighted proportion. The DWP can be any relative weighting for combining across strata. At this stage, plot types are combined within each season relative to their sampling fraction and the within-season relative operations. Therefore, DWP in this table is: Sampling Fraction x Within-Season Relative Turbine Operations, rescaled to sum to one (1). The area correction for each stratum was accounted for in the Single Class Module (Table B6).

\*\* Two turbines weren't searched in the spring due to maintenance.

**Appendix B8. Inputs needed to run Evidence of Absence model to combine across seasons: Multiple Class Module for the Headwaters Wind Farm, Randolph County, Indiana, from April 1 – October 15, 2021.**

Year	Ba	Bb	Arrival Proportion	Cross-Season Relative Turbine Operations	Weights (DWP)
spring	101.19	1619.12	0.07	0.29	0.08
summer	82.43	65.27	0.36	0.03	0.05
fall	248.86	441.86	0.57	0.38	0.87

\* DWP – density weighted proportion. The DWP can be any relative weighting for combining across strata. At this stage, seasons are combined relative to their arrival proportion and the cross-season relative operations. Therefore, DWP in this table is: Arrival Proportion x Cross-Season Relative Turbine Operations, rescaled to sum to one (1). The area correction for each stratum was accounted for in the Single Class Module (Table B6) and the sampling fraction of each plot type was accounted for when combining across plot types (Table B7).

**Appendix B9. Inputs needed to run Evidence of Absence model to combine across years: Multiple Years Module for the Headwaters Wind Farm in Randolph County, Indiana, from 2019 – 2021**

Year	Ba	Bb	Weights (ρ)
2019	26.57	97.63	0.88
2020	522.96	1728.37	1.0
2021	304.41	576.54	0.91

**Appendix C. Truncated Weighted Likelihood Area Adjustment Estimate Model Fitting  
Results**



**Appendix C1. Search area adjustment models for bats from the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Distribution</b>	<b>AICc</b>	<b>Delta AICc</b>
normal	14,957.00	0*
Rayleigh	15,022.38	65.38
Weibull	15,023.97	66.97
Gompertz	15,069.65	112.66
gamma	15,132.92	175.92

\* Selected model

AICc = corrected Akaike Information Criteria

**Appendix C2. Truncated weighted maximum likelihood search area estimates for the Headwaters Wind Farm in Randolph County, Indiana, from April 1 – October 15, 2021.**

<b>Season</b>	<b>Search Area Type</b>	<b>Distribution</b>	<b>Parameter 1</b>	<b>Parameter 2</b>	<b>Area Adjustment*</b>
spring	road and pad	normal	38.83	22.43	0.12
summer	road and pad	normal	38.83	22.43	0.12
summer	cleared	normal	38.83	22.43	0.91
fall	road and pad	normal	38.83	22.43	0.12
fall	cleared	normal	38.83	22.43	0.91
fall	uncleared plot	normal	38.83	22.43	0.91

n = 490 bats

\* Area adjustment is the proportion of bats expected to fall within the search area