POST-CONSTRUCTION BAT MONITORING ASSESSMENT REPORT (APRIL 2024 – OCTOBER 2024) ITP PERMIT NUMBER ESPER0005513

BLUFF POINT WIND ENERGY CENTER JAY AND RANDOLPH COUNTIES, INDIANA

Prepared for

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Executive Summary

Bluff Point Wind Energy Center (project) is an operational 119.7-megawatt (MW) wind facility equipped with 57 General Electric 2.1 MW wind turbine generators located in Jay and Randolph counties, Indiana. The project consists of approximately 23,613 acres and is located approximately five miles south of the city of Portland in east-central Indiana. Bluff Point, LLC (BPW) contracted Atwell, LLC (Atwell) to determine the potential impact on bats during the spring, summer, and fall seasons of 2024.

In March 2021, BPW submitted a Habitat Conservation Plan (HCP) to the U.S. Fish and Wildlife Service – Indiana Field Office (USFWS – INFO) in support of an Incidental Take Permit (ITP) for federally listed endangered Indiana bats (*Myotis sodalis*) and federally listed endangered northern long-eared bats (*Myotis septentrionalis*). The USFWS – INFO issued an ITP on March 25, 2021, which authorizes the take of 165 Indiana bats and 84 northern long-eared bats over the 30-year permit term and is subject to compliance with, and implementation of the HCP. The Bluff Point Wind Energy Center has been operating under the ITP requirements since April 1, 2021, which includes conducting post-construction mortality monitoring for bats. Three years of baseline monitoring under the HCP have already been completed. This report summarizes the first year of implementation monitoring under the HCP.

In total, 1,597 road and pad plot and 336 full plot standardized survey searches were completed from April 1, 2024, through October 15, 2024. Fifty-seven turbines were searched during the spring and fall seasons, and 32 turbines within the USFWS designated buffer areas were searched during the summer. Turbines were typically searched weekly in the spring and summer, and twice per week in the fall. Prior to the start of standardized surveys each season, a “clearance sweep” was performed to remove any carcasses from search plots. Pre-spring clearance sweeps were conducted at 57 turbines between March 26 and March 28, 2024. Pre-summer clearance sweeps were conducted at all 32 summer turbines between May 13 and May 15, 2024 (concurrent with the final week of spring searches). Pre-fall clearance sweeps were conducted at 23 of 26 turbines on July 30 and 31. Due to temporary blade maintenance, one turbine clearance sweep occurred on August 1, another occurred on August 8, and due to ongoing maintenance, the final clearance sweep occurred on August 22. All 32 summer turbines were also searched between July 29 and 30, 2024, which served as both standardized summer searches and pre-fall clearance sweeps.

During the spring, summer, and fall, a total of 100 bat carcasses representing six species were found during standardized searches, including: eastern red bat (*Lasiurus borealis*; 38 carcasses), silver-haired bat (*Lasionycteris noctivagans*; 37 carcasses), , big brown bat (*Eptesicus fuscus*; 14 carcasses), hoary bat (*Lasiurus cinereus*; eight carcasses), evening bat (*Nycticeius humeralis;* state-listed endangered; two carcasses), and Indiana bat (federally and state-listed endangered; one carcass).

In total, 124 searcher efficiency trial carcasses consisting of bat carcasses from previous years were placed throughout the study period. In the spring, searcher efficiency rates were 50.0% and 95.2% at full plots and road and pad plots, respectively. In the summer, searcher efficiency rates were 80.0% and 96.7% at full plots and road and pad plots, respectively. In the fall, searcher efficiency rates were 77.3% and 97.5% at full plots and road and pad plots, respectively.

In total, 120 carcass persistence trials were placed throughout the study, including 54 in the spring, 26 in the summer, and 40 in the fall. The estimated overall median probabilities of persistence by day 3 were 0.79, 0.57, and 0.40 in spring, summer, and fall, respectively. The estimated overall median probabilities of persistence by day 7 were 0.62, 0.47, and 0.25 in spring, summer, and fall, respectively.

Using a Generalized Mortality Estimator (GenEst), the spring, summer, and fall bat fatality estimates at the project were 4.76 bats/turbine (2.27 bats/MW; 271.15 total bats), 6.50 bats/turbine (3.09 bats/MW 207.96 total bats), and 25.46 bats/turbine (12.13 bats/MW; 1,451.45 total bats), respectively.

One Indiana bat and no northern long-eared bat carcasses were found during standardized surveys. Based on Evidence of Absence (EoA) modelling for each species, the median take estimates were 14 Indiana bat fatalities (95% confidence interval: 2,56) and two northern long-eared bat fatalities (95% confidence interval: 0,22) during the 2024 monitoring season. The mean mortality rate (λ) was 18.70 (95% confidence interval: 1.32, 59.56) for Indiana bats and 6.25 (95% confidence interval: 0.006, 31.68) for northern long-eared bats. The estimated overall detection probability for the 2024 spring, summer, and fall monitoring seasons combined was 0.082 (95% confidence interval: 0.062, 0.105; Ba = 51.8592 and Bb= 579.1199).

A detection probability of approximately 0.10 is expected during implementation monitoring (years 4 through 30). As such, the detection probability for the 2024 monitoring season did not meet the target detection probability. The overall detection probability following three years of baseline monitoring and one year of implementation monitoring at the project is 0.170 (95% confidence interval: 0.157, 0.183).

The cumulative median take estimates for Indiana and northern long-eared bats after four years of monitoring are 24 fatalities and one fatality, respectively. The annual mean λ of the three-year window utilized to test against the short-term adaptive management trigger is 8.135 (95% confidence interval: 2.430, 17.300) Indiana bats and 0.904 (95% confidence interval: 0.001, 4.540) northern long-eared bats. The mean mortality rates for Indiana bats and northern long-eared bats do not exceed the short-term adaptive management trigger with 99% credibility.

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AICc	Akaike information criterion (corrected)
AMMs	avoidance and minimization measures
Atwell	Atwell, LLC
BPW	Bluff Point, LLC
DWP	density-weighted proportion
EoA	Evidence of Absence (v2.0)
ESA	Endangered Species Act
FRWF	Fowler Ridge Wind Farm
ft	foot/feet
GenEst	Generalized Fatality Estimator
HCP	Habitat Conservation Plan
ITP	Incidental Take Permit
m	meter(s)
m/s	meter(s) per second
MRLC	Multi Resolution Land Characteristics Consortium
MW	megawatt
PCMM	post-construction mortality monitoring
project	Bluff Point Wind Energy Center
U.S.C.	U.S. Code
USFWS	U.S. Fish and Wildlife Service
USFWS – INFO	U.S. Fish and Wildlife Service – Indiana Field Office

2024 SUMMARY TABLE

	Spring Full Plots	Spring Road/Pad Plots	Summer[a] Full Plots	Summer[a] Road/Pad Plots	Fall Full Plots	Fall Road/Pad Plots	Annual	Cumulative
Dates	April 1 through May 15		May 16 through July 31		August 1 through October 15		-	2021 – 2024
Search Interval	7		7		3.5		-	-
Number of Plots Searched	10	47	6	26	10	47	-	-
Plot Shape	Square	Circle	Square	Circle	Square	Circle	-	-
Plot Dimensions	100 m x 100 m	100 m radius	100 m x 100 m	100 m radius	100 m x 100 m	100 m radius	-	-
Searcher Efficiency (SEEF)	0.500	0.952	0.800	0.967	0.773	0.975	-	-
SEEF Carcass Type	Bats	Bats	Bats	Bats	Bats	Bats	-	-
Median Carcass Persistence (CP)	5.37 days	4.13 days	5.23 days	0.83 days	0.74 days	0.67 days	-	-
CP Carcass Type	Bats	Bats	Bats	Bats	Bats	Bats	-	-
EoA Detection Probability ($\hat{g}$)	-	-	-	-	-	-	0.082	0.170
Average DWP	0.889	0.072	0.889	0.068	0.889	0.072	0.2174[b]	-
Count of Observed Carcasses	9	9	6	7	35	34	100	692
Estimated Number of Fatalities (GenEst)	271.15		207.96		1451.45		-	-
Estimated Indiana Bat Fatalities (EoA)	-		-		-		14	24
Estimated Northern Long-eared Bat Fatalities (EoA)	-		-		-		2	1

[a] Summer estimates are for 32 turbines within 1,000 feet of forested bat habitat (i.e., bat avoidance buffer) only.

[b] The annual DWP is the overall spatial coverage adjusted by the proportion of each plot type and expected seasonal myotis mortality.

1 INTRODUCTION

Bluff Point, LLC (BPW) is a limited liability company and an indirect wholly owned subsidiary of NextEra Energy Resources, LLC. Bluff Point Wind Energy Center (project) is an operational 119.7-megawatt (MW) wind farm equipped with 57 General Electric 2.1 MW wind turbine generators located in Jay and Randolph counties, Indiana (Figure 1).

BPW contracted Atwell, LLC (Atwell) to perform post-construction mortality monitoring (PCMM) surveys and evaluate the potential impact from project operations on bats during the 2024 season. This report documents the results of that work. The survey and statistical methods were developed in coordination with U.S. Fish and Wildlife Service (USFWS) and incorporated relevant guidance and research findings.

This study was conducted under a Habitat Conservation Plan (HCP) that was submitted to the USFWS in support of an application for an Incidental Take Permit (ITP; see Section 1.3) for the federally listed endangered Indiana bat (*Myotis sodalis*) and federally listed endangered northern long-eared bat (*Myotis septentrionalis*).

This report covers the fourth year of PCMM and first year of implementation level monitoring at the project since issuance of the ITP. Baseline PCMM studies were conducted for the first three years of the project following implementation of the HCP.

1.1 STUDY AREA

The project consists of approximately 23,613 acres and is located in east-central Indiana, approximately five miles south of Portland, Indiana (Figure 1). The project spans portions of Madison, Pike, and Jefferson townships within Jay County, and portions of Franklin, Ward, and Jackson townships within Randolph County (Figure 1).

The topography within the project varies, with elevations ranging from approximately 980 and 1,060 feet (ft) above mean sea level. Portions of the project are relatively flat, and many areas are moderately undulating.

Overall, the project is dominated by agricultural land-use consisting of mostly corn *(Zea mays*) and soybeans (*Glycine max*). According to the Multi-Resolution Land Characteristics Consortium's (MRLC) 2021 National Land Cover Database, 84.0% of the land is classified as cultivated crops (19,835.5 acres), followed by 7.4% (1,752.2 acres) classified as deciduous forest, 5.3% (1,260.1 acres) classified as developed (open space; low, medium, and high intensities), and 2.2% (516.0 acres) classified as hay/open pasture. Herbaceous areas, open water, woody and emergent herbaceous wetlands, shrub/scrub, barren land, and evergreen and mixed forest, collectively make up approximately 1.1% (248.6 acres) of remaining land uses (Figure 2) (MRLC 2023). Conservation Reserve Program land is also located within the project area.

1.2 BUFFERED AREAS

In January 2012, the U.S. Fish and Wildlife Service – Indiana Field Office (USFWS – INFO) and BPW established 1,000 ft protective buffers around forested lands that were identified as potential summer habitat for Indiana and northern long-eared bats through desktop research, on-site investigation, and 2011 mist netting and telemetry surveys. These protective buffers (hereafter referred to singularly as a "bat avoidance buffer") cover 13,524 acres of the 23,613-acre project and include 32 turbines from the total project array (Figure 3). Survey parameters and turbine operations for the spring, summer, and fall seasons of 2023 are addressed in the HCP, which designates specific curtailment strategies (see Section 1.3) for turbines within this buffered area.

1.3 INCIDENTAL TAKE PERMIT

BPW has determined that operation of the project may result in take of the federally listed endangered Indiana and northern long-eared bats. Section 9(a)(1)(B) of the Endangered Species Act (ESA), 16 U.S. Code (U.S.C.) § 1538 (a)(1)(B) states that it is unlawful for any person to "take" an endangered species. In addition, take of any threatened species is prohibited pursuant to 50 Code of Federal Regulations § 17.31, issued by the USFWS under the authority of Sections 4(d) and 9(a)(1)(G) of the ESA, 16 U.S.C., §§ 1533 (d) and 1538(a)(1)(G), respectively. Under the ESA, otherwise lawful activities that may cause or result in the incidental take of federally listed threatened or endangered species is prohibited. Section 10 of the ESA allows for certain limited exceptions to the ESA's prohibitions for private actions. Section 10(a)(1)(B) of the ESA provides a mechanism for the USFWS to issue an ITP that authorizes the take of a species listed as threatened or endangered, provided that the take is incidental to, and not the purpose of, the operation of the otherwise lawful activity.

In March 2021, BPW submitted to the USFWS – INFO a final HCP in support of an ITP application and in accordance with the requirements set forth under Section 10(a)(1)(B) of the ESA, as amended, and applicable USFWS guidance documents (Atwell 2021).

On March 25, 2021, the USFWS – INFO issued BPW an incidental take permit (Permit Number: ESPER0005513), which authorizes the take of 165 Indiana bats and 84 northern long-eared bats over the 30-year permit term and is subject to compliance with, and implementation of the HCP. BPW seeks to reduce take of Indiana and northern long-eared bats by at least 50% from the authorized 30-year take limit through careful project planning and turbine siting (implemented prior to construction of the project), as well as implementation of operational curtailment strategies (Atwell 2021). These curtailment strategies are described in Section 1.3.1.

BPW has developed four post-construction mortality monitoring protocols to be used for the project: Preliminary Monitoring, Baseline Monitoring, Implementation Monitoring, and Adaptive

Management Monitoring. Details of these protocols are described within the HCP (Atwell 2021). The timing of these protocols is implemented as follows:

- BPW performed monitoring at the project in 2018, 2019, and 2020. These studies were conducted under a technical assistance letter from the USFWS – INFO to allow for operations while BPW prepared the HCP.
- Baseline level monitoring was conducted for the first three years of operation under the ITP.
- Implementation level monitoring is conducted from year 4 through year 30.
- Adaptive management monitoring occurs for two years following any deviations from avoidance and minimization measures (AMMs) outlined in the HCP, including if any short or long-term trigger has been met (see Section 3.7.1).

2024 is the fourth year of PCMM studies for the project since implementation of the HCP. As such, PCMM studies were conducted under the implementation level monitoring protocol. Monitoring in 2021 yielded a detection probability (list the probability value) below the target of 0.2 outlined in the HCP (Atwell 2021). To address this, BPW, in consultation with USFWS – INFO, increased monitoring efforts for the 2022 summer and fall seasons, achieving a detection probability of 0.268 (Atwell 2023). In 2023, summer monitoring was reduced while fall efforts remained unchanged, resulting in a detection probability of 0.205 (Atwell 2024). Due to the lower-than-expected detection probability during the first year of baseline PCMM at the project, BPW also decided to increase monitoring effort beyond what was outlined in the HCP for the 2024 implementation monitoring season. Monitoring methods are detailed in Section 2 of this report.

To satisfy ITP report requirements, this report summarizes estimates of bat mortality and the results of take compliance monitoring at the project completed for spring, summer, and fall 2024 under the March 25, 2021, ITP.

1.3.1 ITP Minimization Measures

The following minimization measures were proposed within the March 2021 HCP and authorized under the March 25, 2021, ITP as a means of reducing Indiana bat and northern long-eared bat take over the permit term:

- **Spring Curtailment**: Curtailment of all spring turbine operations (April 1 to May 15) at night (from ½ hour before sunset to ½ hour after sunrise) and ambient temperature is above 10 degrees Celsius (°C) by pitching out blades to achieve an RPM of 1 or less when wind speeds are below 3.0 meters per second (m/s) based on a 10-minute rolling average.

- **Summer Curtailment:** Curtailment of 32 summer turbine operations (May 16 – July 31) at night (from ½ hour before sunset to ½ hour after sunrise) when ambient temperature is above 10°C by feathering to a cut-in speed of 6.0 m/s based on a 10-minute rolling average. These 32 turbines are within a 1,000 ft bat avoidance buffer established due to the potential presence of Indiana bats and northern long-eared bats within the project boundary during the summer season. Curtailment of the remaining 25 summer turbine operations outside of the 1000 ft bat avoidance buffer during the summer season at night (from ½ hour before sunset to ½ hour after sunrise) when ambient temperature is above 10°C by feathering to a cut-in speed up to 3.0 m/s based on a 10-minute rolling average.
- **Fall Curtailment:** Curtailment of all fall turbine operations (August 1 – October 15) at night (from ½ hour before sunset to ½ hour after sunrise) when ambient temperature is above 10°C by feathering to a cut-in speed of 5.0 m/s based on a 10-minute rolling average.

The USFWS requested data verifying 2024 operational compliance for turbines 3, 6, 9, 19, 26, 38, 46, 51, 54, and 57 on April 10, May 15, August 13, September 4, and October 14. This data will be provided to USFWS separately.

1.4 STUDY OBJECTIVES

The objectives of the study were to:

- Perform scheduled carcass searches and associated bias trials for spring, summer, and fall seasons (in accordance with the HCP).
- Collect information on bat carcasses found during the search period at the project.
- Evaluate and calculate project-specific bat mortality estimates for each survey season.
- Achieve a target detection probability of 0.1 or greater.
- Estimate take of Indiana and northern long-eared bats (i.e., covered species) to monitor compliance with limits authorized in the ITP.

2 SURVEY METHODS

2.1 STANDARDIZED CARCASS SEARCHES

Standardized carcass searches occurred in the spring (April 1 to May 15, 2024), summer (May 20 to July 30, 2024), and fall (August 1 to October 15, 2024). Turbines were assigned one of two search plot types: road and pad plot or full plot. Each turbine's assigned plot type remained the same throughout the annual monitoring period. Road and pad plots were searched out to 100 meters (m) from the center of the turbine in the spring, summer, and fall. Searchers scanned the entire surface area of the road and pad for carcasses by walking transects, with the initial survey start location at 100 m from the turbine (Figure 4).

Full plot search areas comprised a 100 m by 100 m plot with the wind turbine located at the center of the search area. Full plots were mowed in order to keep vegetation low and increase searcher efficiency. Plots were surveyed by walking 17 linear transects, each approximately 6 m wide, until the entire plot was surveyed (Figure 4).

During the spring migration season, all 57 turbines were typically searched once per week; 10 turbines were searched as full plots and only road and pad searches were conducted at the remaining 47 turbines. During the summer season, the 32 turbines located within the 1,000 ft bat avoidance buffer were typically searched weekly with six turbines searched as full plots and 26 turbines searched as road and pad plots. The remaining turbines located outside of the bat avoidance buffer were not searched during the summer. During the fall migration season, all 57 turbines were typically searched twice weekly with 10 turbines searched as full plots and 47 turbines searched as road and pad plots. Some turbines, on occasion, were not searched on a particular day due to turbine maintenance, farming activity, or inclement weather conditions (e.g., lightning, impassable roads). The lack of searches at some turbines during the scheduled timeframe was accounted for during statistical analysis.

Prior to the start of standardized surveys each season, a “clearance sweep” was performed to remove any carcasses from search plots. Pre-spring clearance sweeps were conducted at 57 turbines between March 26 and March 28, 2024. Pre-summer clearance sweeps were conducted at all 32 summer turbines between May 13 and May 15, 2024 (concurrent with the final week of spring searches). Pre-fall clearance sweeps were conducted between July 30 and July 31 at 23 of 25 turbines that were not searched during the summer season. One pre-fall clearance sweep was conducted on August 1, 2024 and another was conducted on August 8, 2024, due to temporary turbine maintenance that made the turbines inaccessible during the initial round clearance sweeps. The one remaining turbine that was not searched during the summer season (turbine 23) was searched as a pre-fall clearance on August 22, 2024, due to ongoing long-term maintenance. All 32 summer turbines were also searched on July 29 and July 30, 2024, which served as both standardized summer searches and pre-fall clearance sweeps.

Standardized carcasses were defined as those found within the scheduled search window and search area. Incidental finds were defined as carcasses found outside of the scheduled search window or search area (i.e., off plot). Incidental finds were not included in fatality estimates but are reported in Appendix A-1.

For each bat carcass found, the following data were collected:

- Unique carcass ID
- Survey date and time
- Turbine (i.e., plot) number
- Distance and bearing from the nearest turbine
- UTM coordinates
- Species
- Carcass sex, age, and reproductive condition (when possible)
- Carcass condition (intact, partial, dismembered, fur spot(s), alive, or other)
- Forearm length, when possible
- Ground cover where carcass was found
- Estimated time of death
- Current and previous night's weather conditions

When avian carcasses were encountered during searches, the same data as above were generally collected for the carcass (excluding forearm length); however, avian carcasses were not included in analysis for this study. A list of avian carcasses found during the 2024 monitoring year is provided as Appendix A-2.

2.2 SEARCHER EFFICIENCY TRIALS

The objective of searcher efficiency trials was to correct for detection bias by adjusting for trial carcasses found compared to total carcasses available to the searcher. Searcher efficiency trials were conducted each season. Trials were conducted blindly so the searcher was not aware of when trials were being conducted. Carcasses used for the trials consisted of bats with confirmed species identifications (eastern red bat [*Lasiurus borealis*], silver-haired bat [*Lasionycteris noctivagans*], big brown bat [*Eptesicus fuscus*]) found on site in 2023 or earlier. A total of 124 trial carcasses were placed, including 48 in the spring, 32 in the summer, and 44 in the fall. A total of 63 carcasses were placed at full plot locations (24 in spring, 17 in summer, and 22 in fall), and 61 were placed at road and pad plot locations (24 in spring, 15 in summer, and 22 in fall).

Date, turbine number, distance from the turbine, and direction from the turbine were recorded prior to placement within the plot. Turbines were randomly selected for the searcher efficiency trial and no more than two carcasses were placed at a single turbine. Carcasses were discreetly marked (in a manner so the marking did not influence searcher detection) to indicate that the carcass was part of the study. Any trial carcasses that were missed on the first search following placement were collected and were not available to be found during subsequent searches.

2.3 CARCASS PERSISTENCE TRIALS

Carcass persistence trials were used to determine the length of time a carcass would remain within the search area before being scavenged (e.g., by scavengers, insects) or removed from the search area by another means (e.g., weather event, full plot mowing, agricultural tilling). Carcass persistence trials were conducted twice each season. Carcasses used for the trials consisted of bats with confirmed species identifications (eastern red bat, silver-haired bat, big-brown bat) found on site in 2023 or earlier. A total of 120 bat carcasses were placed at randomly selected turbines, including 54 in the spring, 26 in the summer, and 40 in the fall. Samples were allocated to each plot type for a total of 56 carcasses placed at full plots and a total of 64 carcasses placed at road and pad plots.

In the spring and summer carcasses were typically checked by the searcher on days 1, 2, 3, 4, 7, 10, 14, 21, and 30, as survey conditions allowed. During the fall season, carcasses were typically checked by the searcher on days 1, 2, 3, 4, 7, 10, and 14, as survey conditions allowed. During the fall season trials, all carcasses were determined to be missing by day 14 so further checks were not conducted.. The condition of each carcass was recorded as intact, signs of scavenging, fur spot, or missing during each day of observation. Once a carcass was recorded as missing, technicians continued checks for the carcass for a minimum of two additional visits. If the carcass was not rediscovered during subsequent checks, the carcass was deemed missing on the originally missed day. If a missing carcass was relocated on a subsequent check, technicians would continue checking that carcass until the 30-day trial concluded. This check protocol was implemented to account for carcass checks where the carcass was missed by the observer (e.g., due to condition or location shift) rather than being truly missing. Once the 30-day trial concluded, remaining carcasses were removed.

3 STATISTICAL METHODOLOGY

3.1 GENEST

Analyses were performed separately for each season using a Generalized Fatality Estimator (GenEst) v1.4.9 (Dalthorp et al. 2018; Simonis et al. 2018). This program uses five different data sources and user-populated general inputs to run three separate, but related, analyses. The three analyses (discussed in further detail below) used to estimate the mortality rate include searcher efficiency, carcass persistence, and density-weighted proportion (DWP). DWP was calculated separately for each turbine based on the total number of observed carcasses, their distances from the nearest turbine, and area of the plot searched, and was then input into GenEst. These analyses, combined with the carcass observation data and a known search schedule, ultimately provide a median estimate of the number of fatalities at a wind facility while taking into consideration imperfect detection probability. GenEst provides a median estimate rather than a mean because the mortality probability distribution is generally right-skewed, which is not uncommon for mortality data. Because a mean estimate may be strongly influenced by the degree of skewness (Simonis et al. 2018), the median is a more robust measure.

GenEst uses a sophisticated, carcass-specific detection probability to provide fatality estimates. However, for simplicity, the program provides basic detection probability summaries that are based on searcher efficiency, carcass persistence, and average search interval. The estimates are then stratified by the covariates or predictor variables selected for fatality estimation. While these detection probability summaries are not specifically used to provide a fatality rate estimate, an estimate of detection probability may provide useful planning insight (Simonis et al. 2018).

To determine median estimates, the number of parametric bootstrap iterations was set to 10,000 in GenEst and was used to build 90% confidence intervals around parameter estimates (Simonis et al. 2018). As this study focused on providing fatality estimates for bats only, size class was not included as a variable.

3.2 DEFINITION OF VARIABLES

Table 1 provides definitions of variables used for the statistical analyses.

3.3 SEARCHER EFFICIENCY

Searcher efficiency is the probability that a searcher will find a carcass given that the carcass falls within the search area (Simonis et al. 2018). Searcher efficiency was modeled separately for each season with two parameters: *p*, the probability that a present carcass is found during the first search after it arrived, and *k*, the proportional change in searcher efficiency with successive searches. Plot Type (full plot or road and pad plot) was included as a predictor variable. Data from all searcher efficiency trials were pooled each season, and searcher efficiency was modeled with *k* set at 0.75. While searchers in this study had only one opportunity to find trial carcasses, data suggests that *k* tends to remain relatively consistent at 0.75 (Dalthorp 2019 pers. comm.).

Table 1. Definitions of Variables Used for Analysis

Variable	Definition
I	Search interval—the number of days between searches
v	Temporal coverage—the proportion of all carcasses expected to arrive during the monitored period.
p	Searcher efficiency—the probability an observer will find a present carcass during the first search after it arrived
k	The proportional change in searcher efficiency with successive searches
r_t	The estimated probability that a carcass arriving at a uniform random time in an interval of *t* days persists until the end of the interval
MedianCP	The median number of days a carcass will persist after day 0
$\hat{M}_i$	The estimated number of carcasses falling within distance band *i*
$\sum\hat{M}_i$	The total number of estimated carcasses
$f\hat{M}_i$	The estimated proportion of carcasses falling within distance band *i*
X	The total number of observed carcasses during searches
X_i	The total number of carcasses observed within distance band i, pooled across the entire wind facility
fA_{Avg_i}	The proportion of area surveyed in distance band *i* averaged across all turbines
$fA_{Search_{i,j}}$	The proportion of area surveyed within distance band i at turbine j
f_{within}	A correction factor representing the estimated proportion of fatalities occurring within the turbine search radius. This correction factor is applied to the calculated DWP for RP to account for carcasses falling outside of the search radius. For this study, this value was set to 0.99.
a	Spatial coverage-- a density-weighted proportion (DWP) of carcasses falling within the searched area.
DWP_j	The calculated, uncorrected DWP for turbine j
$DWPC_j$	The corrected DWP value for turbine j. This is the product of DWP_j * $f_{within.}$
$\hat{g}$	The estimated probability of detection
M*	Estimated number of fatalities
λ	Fatality rate
τ	Annual fatality rate threshold
Ba and Bb	Parameters that characterize the detection probability

GenEst provided corrected Akaike information criterion (AICc) results for two models per season (Table 2). AICc estimates the relative quality of statistical models for a given set of data. Models with lower AICc scores are generally considered to fit the data better while using fewer predictor variables.

Table 2. Models Evaluated for Searcher Efficiency Trials

Model	k value[a]	AICc[b]	ΔAICc[c]
Spring			
p ~ PlotType	k fixed at 0.75	42.84	0.00
p ~ constant	k fixed at 0.75	53.02	10.18
Summer			
p ~ PlotType	k fixed at 0.75	20.47	0.00
p ~ constant	k fixed at 0.75	21.65	1.18
Fall			
p ~ PlotType	k fixed at 0.75	28.90	0.00
p ~ constant	k fixed at 0.75	32.76	3.86

[a] k is the proportional change in searcher efficiency with successive searches. It remains fixed at 0.75 per D. Dalthorp (personal communication).

[b] AICc is the corrected Akaike's Information Criterion.

[c] ΔAICc is the difference in AICc values between a particular model and the top model. When comparing a set of models, lower ΔAICc values are generally considered better models.

The *p* ~ PlotType models were selected for spring, summer, and fall fatality estimation (Table 3) as they were the lower AICc models for each season (spring ΔAICc = 10.18, summer ΔAICc = 1.18, and fall ΔAICc = 3.86 where ΔAICc is the difference between the model with the lowest and second lowest AICc value).

Table 3. Searcher Efficiency and Carcass Persistence Models Selected for Fatality Estimation in GenEst

Analysis	Model[a]
Spring	
Searcher Efficiency	p ~ Plot Type
Carcass Persistence	Weibull distribution; l~constant s~PlotType
Summer	
Searcher Efficiency	p ~ Plot Type
Carcass Persistence	lognormal distribution; l~constant s~constant
Fall	
Searcher Efficiency	p ~ Plot Type
Carcass Persistence	Weibull distribution; l~constant, s~constant

[a] For carcass persistence, "l" refers to location formula and "s" refers to scale formula in GenEst.

3.4 CARCASS PERSISTENCE

Carcass persistence is the probability that a carcass arriving on day 0 will remain on day *t* (e.g., despite scavenging, decomposition, mowing, weather event, etc.) (Simonis et al. 2018). All trial carcass data from both trials were pooled each season for analysis. For 54 trial carcasses in the spring, 26 trial carcasses in the summer, and 40 trial carcasses in the fall, the last day of detection from day 0 and first day of absence from day 0 were input into GenEst with Plot Type used as predictor variable. Four distributions were modeled: exponential, Weibull, lognormal, and loglogistic. The resulting 14 models per season were compared using AICc (Appendix B), and the most parsimonious model was selected for each season (Table 3). The selected models for the spring was a Weibull distribution with a constant location formula and the scale formula a function of plot type (ΔAICc = 2.11). The selected model for the summer was a lognormal distribution with constant location and scale formulas (ΔAICc = 0.30). The selected model for the fall was a Weibull distribution with constant location and scale formulas (ΔAICc = 1.35).

3.5 DENSITY-WEIGHTED PROPORTION

DWP is the expected proportion of carcasses to fall within the searched area of each individual turbine (Simonis et al. 2018). This estimated value takes into consideration the distance of a carcass from the turbine as carcass density around a turbine may differ with increasing distance from the turbine (Hull and Muir 2010).

For road and pad plots, pooled counts of carcasses within 10 m distance bands were used to estimate the proportion of carcasses falling within each band, $f\hat{M}_i$, where i = the distance band (e.g., 0 to 10 m, out to a maximum of 100 m). These proportions were then multiplied by the turbine-specific proportion of searched area in the plot at each distance band, i. Turbine-specific road and pad DWPs were calculated based on bat carcasses observed during the 2024 monitoring season pooled across spring, summer, and fall to provide a larger sample size for calculating DWP. Only non-incidental carcasses found during road and pad searches were used for DWP calculation. DWP was used to calculate a fatality estimate for each season.

Specifically, $f\hat{M}_i = \hat{M}_i/\sum\hat{M}_i$ where $\hat{M}_i = X_i/fA_{Avg_i}$ and $\sum\hat{M}_i$ is the sum of $\hat{M}$ across all distance bands. X_i is the number of pooled carcass observations in each distance band, i, and fA_{Avg_i} is the average proportion of area surveyed in each distance band, i, across all turbines assigned to road and pad plots. DWP at each turbine is then calculated as $DWP_j = \sum(f\hat{M}_i * fA_{Search_{i,j}})$, where j is the specific turbine number and $fA_{Search_{i,j}}$ is the proportion of area surveyed within distance band i at turbine j.

The calculated DWP within the 100 m search radii (DWP_j) were then adjusted to account for carcasses falling beyond the search radius using $DWPc_j = DWP_j * f_{within}$ where f_{within} is the estimated proportion of carcasses occurring within the search radius. For this study, f_{within} is determined from publicly available results from similar studies.

Hull and Muir (2010) reported percentile distances of the fall zone modeled for bats at small, medium, and large turbine sizes based on data from their study sites. For large size turbines (94 m hub height and 112 m rotor diameter, similar to those in operation at the project), modeling suggested that 99% of bat carcasses fell within 66.46 m of the turbine (Hull and Muir 2010). This is less than the 100 m search radius of this study's road and pad plots. Therefore, turbine-specific

DWP values for road and pad plots were calculated as $DWP_{c_j} = DWP_j*0.99$. The average corrected DWP for road and pad plots at the project in 2024 was 0.072 for spring and fall, and 0.0685 for summer. Average DWP at road and pad plots was based on 47 road and pad plots in the spring and fall and 26 in the summer.

The Fowler Ridge HCP (WEST 2013) estimated the proportion of bat carcasses to fall within its square 80 m x 80 m full plots' dimensions based on a 2011 PCMM study that assessed carcasses within an 80-m radius circular full plot (Good et al. 2012). Fowler Ridge Wind Farm (FRWF) is located approximately 119 miles west of the project, in Benton County Indiana, and is located within a similar physiography and is at a similar elevation as the project. FRWF studies were designed with a robust sample size of large cleared plots that were used to provide mortality estimates that better accounted for carcasses found at greater distances from turbines (Good et al. 2012). Using the full set of carcass data from the 2011 PCMM season at FRWF (Good et al. 2012), DWP values for 100 m x 100 m full plot locations at the project were calculated as 0.889 (i.e., approximately 88.9% of bat carcasses fall within the 100 m x 100 m square plot).

3.6 PROJECT-SPECIFIC FATALITY ESTIMATE

To calculate a fatality estimate using GenEst, searcher efficiency models and carcass persistence models were first selected for each season (see Sections 3.3 and 3.4 above; Table 3). For searcher efficiency, the "Plot Type" model (*p*~PlotType) was selected for all three seasons. For carcass persistence, a Weibull distribution with constant location formula and scale formula a function of PlotType (l~constant, s~PlotType) was selected for spring fatality estimation. Lognormal and Weibull distributions, both with constant location and scale formulas (i.e., l~constant, l~constant), were selected for summer and fall fatality estimation, respectively.

Other inputs required to calculate mortality in GenEst included the *Fraction of Facility Surveyed*, turbine-specific *Density-Weighted Proportions* (discussed above), and the *Observation Date* for each carcass found. GenEst combines the carcass *Observation Date* with *Turbine Search Schedule* (uploaded to GenEst as a separate database) to estimate detection probability following arrival (Simonis et al. 2018). All 57 turbines within the project were surveyed for carcasses in the spring and fall. Therefore, *Fraction of Facility Surveyed* was set to 1 for these seasons. In the summer, all 32 turbines within the bat avoidance buffer were surveyed. These turbines were operating with a different cut-in speed than turbines outside of the bat avoidance buffer. Therefore, *Fraction of Facility Surveyed* was also set to 1 to provide a summer fatality estimate for turbines only within the bat avoidance buffer. *Density-weighted Proportion* and *Turbine Search Schedule* are provided as separate CSV files that are uploaded to GenEst.

3.7 EVIDENCE OF ABSENCE

Evidence of Absence (EoA) software version 2.0 (Dalthorp et al. 2017) multiple class module was used to model estimated take of federally listed endangered Indiana bats and northern long-eared bats during the monitoring period. EoA uses several parameters to estimate a detection probability ($\hat{g}$), which is ultimately used to estimate take levels at a user-defined credibility level. Detection probability is a function of search interval, timespan of survey effort, spatial (*a*) and temporal (*v*) coverage, searcher efficiency (p), the factor by which searcher efficiency changes between subsequent searches (*k*),and carcass persistence (*r*).

Within the multiple class module, total mortality (M) was estimated with a 50% credibility level and $\hat{g}$ parameters were calculated from monitoring data by adding a search class for each plot type and season. A credibility level of 50% was used as this value provides a median estimate. Inputs used for each class (i.e., plot type per season) are provided in Table 4.

Mortality monitoring began on April 1, 2024, May 20, 2024, and August 1, 2024, for spring, summer, and fall seasons, respectively. Surveys were conducted approximately once per week for seven weeks in the spring, once per week for 11 weeks in the and summer, and twice weekly for a total of 22 searches in the fall. Temporal coverage was set to 1 for all seasons in order to keep the period of inference restricted to the season in question.

Searcher efficiency and carcass persistence data were based on field trials, and the results were entered into EoA. The factor by which searcher efficiency changes between subsequent searches was set to 0.75 (Dalthorp 2019 pers. comm.) and persistence distributions recommended by EoA as the most appropriate models (Table 4) were selected for each season and plot type. For spring carcass persistence analysis, an exponential distribution was selected for full plots and a Weibull distribution was selected for road and pad plots. For summer carcass persistence analysis, a lognormal distribution was selected for both full plots and road and pad plots. For fall carcass persistence analysis, a lognormal distribution was selected for full plots and a Weibull distribution was selected for road and pad plots.

Table 4. Search Class Inputs for Multiple Class Analysis in EoA

Variable	Spring Full Plots	Spring Road and Pad Plots	Summer Full Plots	Summer Road and Pad Plots	Fall Full Plots	Fall Road and Pad Plots
Search Schedule						
Start of monitoring	2024-04-01	2024-04-01	2024-05-20	2024-05-20	2024-08-01	2024-08-01
Search interval (days)	7	7	7	7	3.5	3.5
Number of searches	7	7	11	11	22	22
Temporal coverage (v)	1	1	1	1	1	1
Searcher Efficiency						
Carcasses available	22	21	15	15	22	20
Carcasses found	11	20	12	15	17	20
Factor by which searcher efficiency changes with each search (k)	0.75	0.75	0.75	0.75	0.75	0.75
Persistence Distribution (from field trials)						
Distribution	Exponential	Weibull	Lognormal	Lognormal	Lognormal	Weibull
Shape (α)	0.1549	0.6785	10.2200	9.08	3.1340	0.6207
Scale (β)	6.4560	8.134	1.6750	0	-0.4020	1.4430
95% confidence interval for β	[4.168, 9.999]	[4.537, 14.58]	[-0.447, 3.797]	[-2.087, 2.086]	[-1.561, 0.757]	[0.594, 3.504]
r for Ir = 7 (spring and summer) and 3.5 (fall)	0.610	0.601	0.584	0.379	0.360	0.380
95% confidence interval for r	[0.484, 0.719]	[0.479, 0.705]	[0.336, 0.803]	[0.168, 0.638]	[0.179, 0.588]	[0.213, 0.558]
Fatality Estimation						
Indiana bat carcass count (X)	0	0	0	0	0	1
Northern long-eared bat carcass count (X)	0	0	0	0	0	0
Credibility level	0.5	0.5	0.5	0.5	0.5	0.5

One Indiana bat carcass and no northern long-eared bat carcasses were found over the course of standardized surveys in spring, summer, and fall seasons (see Section 4.2). The Indiana bat carcass was discovered at a road and pad plot during the fall season. Therefore, the analysis was run twice: once with carcass count (X) set to one for road and pad plots in the fall (and zero for all other seasons) to represent observed Indiana bat take, and once with carcass count set to zero for all search classes to represent observed northern long-eared bat take. Searcher efficiency and carcass persistence estimates using EoA for each search class are provided in Section 4.6.

Associated Ba and Bb values, which are parameters that characterize the detection probability, are also provided with the EoA search class output. These Ba and Bb values (see Section 4.6) for each search class were then entered into EoA's multiple class module to provide a single combined take estimate for each covered species during the monitoring period.

Spatial coverage for each plot type and season was manually entered into the "dwp" field of the multiple class module. Spatial coverage was the average DWP (Section 3.5) of turbines searched for each plot type and season (i.e., 0.8890 for full plots, 0.072 for spring and fall road and pad plots, and 0.0685 for summer road and pad plots,), weighted by the proportion of each plot type for each season (i.e., 0.1754 and 0.1875 for full plots in spring/fall and summer, respectively, and 0.8246 and 0.8125 for road and pad plots in spring/fall and summer, respectively) and the estimated seasonal proportions of *Myotis* mortality, as described in the HCP for Bluff Point (Atwell 2021). Spring, summer, and fall *Myotis* mortality was estimated as 4%, 30%, and 66%, in the spring, summer, and fall, respectively. Therefore, spatial coverage at full plots was 0.0062, 0.0500, and 0.1029 in the spring, summer, and fall, respectively. Spatial coverage at road and pad plots was 0.0024, 0.0167, and 0.0392 in the spring, summer, and fall, respectively. Approximately 78.26% of the expected fall zone for bats was unsearched. Therefore, 0.7826 was entered into the "dwp" field for the "unsearched" class in the multiple class module. Spatial coverage for the summer was based on the 32 searched turbine plots located within the bat habitat avoidance buffer only as it was assumed that no take of covered species occurred outside of these buffered turbines during the summer.

Cumulative take estimates (M*) will be tracked with a 50% credibility level over the life of the ITP using the "Track past mortality" option in EoA's multiple years module.

3.7.1 Adaptive Management Triggers

The EoA software has incorporated a framework that addresses specific adaptive management "triggers" to help ensure permit compliance and potentially alleviate the project from current AMMs described in Section 6.2 of the HCP (Atwell 2021). Adaptive management triggers built into the software include the short-term trigger, long-term trigger, and reversion trigger (Dalthorp et al. 2017), as described below:

- The short-term trigger acts as a warning tool and fires when the annual fatality rate is greater than a given threshold over the course of one or a few years. BPW will utilize a 3-year window for the short-term trigger against the estimated annual take rate threshold (5.5 Indiana bats and 2.8 northern long-eared bats) with a 99% credibility level (Atwell 2021), as recommended by the software to protect against the trigger firing unnecessarily (Dalthorp et al. 2017). The short-term trigger was applicable to the 2024 monitoring results as it was the fourth year of monitoring under the HCP and ITP. Results of the short-term trigger analysis are provided in Section 4.6 and incorporate the last two years of baseline monitoring and the first year of implementation monitoring.
- The long-term trigger indicates when total cumulative take has exceeded the authorized threshold (i.e., 165 Indiana bats and 84 northern long-eared bats) with a certain credibility level. As described above, BPW will track estimated cumulative take (M*) using EoA's multiple years module with a 50% credibility level. This credibility level was determined to most accurately track fatality rates over time while reducing the likelihood of a false trigger (i.e., firing before the cumulative take limit has been exceeded) (Dalthorp et al. 2017).
- The reversion trigger indicates when fatality rates are low enough to allow for a less restrictive operational minimization strategy that will not result in annual fatality rates exceeding the take limit at a given credibility level. BPW expects to reduce the annual take of Indiana bats from 5.5 to 2.09 bats and northern long-eared bats from 2.8 to 1.07 bats. BPW will use the reversion test against the lesser of the expected take threshold (i.e., 2.09 Indiana bats and 1.07 northern long-eared bats) or the average annual take rate as calculated using EoA after three years of baseline monitoring. BPW will initially run the reversion test with a 99% credibility level and 50% assumed relative mortality rate (ρ) in Year 6, allowing for 3 years of Baseline Monitoring and 3 years of implementation monitoring to be completed prior to considering reducing AMMs.

4 RESULTS

4.1 STANDARDIZED CARCASS SEARCHES

Throughout the spring, summer, and fall seasons at the project, 1,597 road and pad plot searches and 336 full plot searches were completed during standardized surveys, excluding clearance sweeps at 10 full plots and 47 road and pad plots prior to the spring, and four full plots and 21 road and pad plots prior to the fall. During the study, 100 bats representing six species were found across 40 turbine locations during standardized searches (Figures 5a-c). Eastern red bat and silver-haired bat were the most commonly found species, followed by big brown and hoary bat (*Lasiurus borealis*) (Table 5). Carcass counts of all bat species found during standardized surveys, as well as the proportion of all bats represented by each species, are presented in Table 5.

Table 5. Species Composition of Observed Bat Carcasses

Common Name	Federal Status[a]	State Status[b]	Scientific Name	Count[c]	Percentage of All Bat Carcasses
Eastern red bat	-	SC	*Lasiurus borealis*	38	38.0%
Silver-haired bat	-	SC	*Lasionycteris noctivagans*	37	37.0%
Big brown bat	-	-	*Eptesicus fuscus*	14	14.0%
Hoary bat	-	SC	*Lasiurus cinereus*	8	8.0%
Evening bat	-	SE	*Nycticeius humeralis*	2	2.0%
Indiana bat	FE	SE	*Myotis sodalis*	1	1.0%
All Species	-	-	-	100	100.0%

[a] FE = federally listed endangered. A hyphen indicates no listing status.

[b] SE = state-listed endangered; SC = state species of special concern. A hyphen indicates no listing status.

[c] Incidental finds were excluded from analysis and are not included in this table.

In addition to the 100 bats found during standardized surveys, 10 bats were found incidentally, including bats found during clearance sweeps, outside of standardized search areas, or outside of scheduled searches. A list of all bat carcasses found during searches, including incidental finds not summarized in Table 5, is provided in Appendix A-1. Avian carcasses were not included in the analysis; however, a list of avian carcasses found during searches is provided in Appendix A-2.

Of the 100 bats included in the analysis, 18 carcasses (18%) were found during the spring season, 13 carcasses (13%) were found during the summer season, and 69 carcasses (69%) were found during the fall season (Table 6).

Table 6. Total Bat Carcasses Found by Season during Standardized Searches

Season	Total Bats[a]	Percentage
Spring	18	18.0%
Summer	13	13.0%
Fall	69	69.0%
Total	100	100.0%

[a] Incidental finds were excluded from analysis and are not included in this table.

Carcasses were evenly split between full plots and road and pad plots (50 carcasses at each plot type; Table 7). At full plots, a majority of carcasses were found within 40 m of the turbine (68%), though the 40 to 50 m distance band contained the most carcass discoveries. At road and pad plots, a majority of carcasses were found within 10 m of the turbine (52%). A breakdown of the distribution of bat carcasses at each plot type is provided in Table 7.

Table 7. Total Counts of Bat Carcasses by Plot Type and Distance from Turbine

Distance Band (m)	Full Plots[a]	Percentage[a, b] (Full Plots)	Roads/Pads Plots	Percentage[b] (Road and Pad Plots)	Total Standardized Carcasses[c]	Percentage[b] (All Plots)
0 to 10	5	10.0%	26	52.0%	31	31.0%
10 to 20	8	16.0%	4	8.0%	12	12.0%
20 to 30	7	14.0%	9	18.0%	16	16.0%
30 to 40	14	28.0%	4	8.0%	18	18.0%
40 to 50	15	30.0%	3	6.0%	18	18.0%
50 to 60	1	2.0%	1	2.0%	2	2.0%
60 to 70	0	0.0%	1	2.0%	1	1.0%
70 to 80	0	0.0%	0	0.0%	0	0.0%
80 to 90	N/A	N/A	1	2.0%	1	1.0%
90 to 100	N/A	N/A	1	2.0%	1	1.0%
Total	50	50.0%	50	50.0%	100	100.0%

[a] N/A indicates not applicable. The maximum distance a carcass could be found within the standardized 100 m x 100 m full plots was approximately 70.7 m, (i.e., the corners of the square plots).

[b] Percentage for each distance band is based on the total number of standardized carcasses for each plot type. The total percentage for each plot type is based on all plots combined.

[c] Incidental finds were excluded from analysis and are not included in this table.

4.2 SENSITIVE SPECIES

One federally and state-listed endangered Indiana bat carcass was found over the course of standardized spring, summer, and fall surveys (Figure 6). The carcass was found at a road and pad plot (turbine 57) during the fall season (September 6, 2024). No northern long-eared bats were discovered during 2024 PCMM surveys. Section 4.6 provides take estimates for Indiana and northern long-eared bats, which are species covered under the HCP (Atwell 2021). No federally listed threatened or endangered species were found incidentally.

Two state-listed endangered evening bats were, found over the course of spring, summer, and fall surveys (Figure 6). The first evening bat was found at turbine 42 (road and pad plot) on May 15, 2024, and the second was found at turbine 7 (road and pad plot) on June 3, 2024. No state-listed endangered species were found incidentally.

4.3 SEARCHER EFFICIENCY

As previously described, a total of 124 trial carcasses were placed throughout the study period, including 48 in the spring, 32 in the summer, and 44 in the fall. Sixty-three carcasses were placed at full plot locations (24 in spring, 17 in summer, and 22 in fall) and 61 were placed at road and pad plot locations (24 in spring, 15 in summer, and 22 in fall). Nine carcasses were scavenged prior to the search, including five in the spring (two from full plots and three from road and pad plots), two in the summer (both from full plots), and two in the fall (both from road and pad plots). These carcasses were subsequently removed from the searcher efficiency calculation. The total number of available carcasses for searchers is presented in Table 8.

Searcher efficiency was higher at road and pad plots (95.2%, 96.7%, and 97.5% in spring, summer, and fall, respectively; Table 8) compared to full plots (50.0%, 80.0%, and 77.3% in spring, summer, and fall, respectively; Table 8). Overall searcher efficiency was higher in the summer and fall (90.0% and 88.1%, respectively) compared to the spring (72.1%; Table 8).

Table 8. Searcher Efficiency Estimates by Season and Plot Type

Predictor Variable	n[a]	*p*[b]	90% Confidence Interval	
Spring				
Full Plots	22	0.500	0.332	0.668
Road and Pad Plots	21	0.952	0.788	0.991
Overall[c]	43	0.721	0.596	0.819
Summer				
Full Plots	15	0.800	0.580	0.920
Road and Pad Plots	15	0.967	0.845	0.994
Overall[c]	30	0.900	0.768	0.961
Fall				
Full Plots	22	0.773	0.596	0.887
Road and Pad Plots	20	0.975	0.881	0.995
Overall[c]	42	0.881	0.772	0.942

[a] n is the number of carcasses placed for the searcher efficiency trial excluding carcasses scavenged prior to search.

[b] *p* is the calculated searcher efficiency.

[c] Overall searcher efficiency was estimated in GenEst using a constant searcher efficiency model. However, this model was not selected for fatality estimation.

4.4 CARCASS PERSISTENCE

In all, 120 trial carcasses were placed throughout the study period, including 54 (23 at full plots and 31 at road and pad plots) in the spring, 26 in the summer (13 at full plots and 13 at road and pad plots), and 40 in the fall (20 at full plots and 20 at road and pad plots). In total, 23 (42.6%) and 10 (38.5%) carcasses were remaining after seven days in the spring and summer, respectively. A total of 10 carcasses (25.0%) were remaining after three days in the fall. By mid-trial (day 14), eight (14.8%), seven (26.9%), and zero (0.0%) carcasses were remaining in the spring, summer, and fall, respectively. The longest a carcass was known to persist during the fall season was 10 days. By the end of the trial (day 30), two (3.7%) and six (23.1%) carcasses were remaining in the spring and summer, respectively.

Based on the selected models for fatality estimation in GenEst (Table 3), median carcass persistence in the spring was 5.37 days and 4.13 days at full plots and road and pad plots, respectively (Table 9). In the summer and fall, overall median carcass persistence was 2.10 days and 0.70 days, respectively (Table 9). In the spring, the estimated median probabilities of persisting through the search interval (i.e., day 7 after placement) was 0.68 and 0.57 at full plots and road and pad plots, respectively (Table 9; Figures 7a). In the summer, the estimated overall median probability of persisting through the search interval (i.e., day 7 after placement) was 0.47 (Table 9; Figures 7b). In the fall, the estimated overall median probability of persisting through the search interval (i.e., approximately day 3 after placement) was 0.40 (Table 9; Figures 7c). In general, the probability of persisting throughout the entire 30-day trial period was highest in the summer, followed by the spring and fall (0.33, 0.28, and 0.08 by day 28 for summer, spring, and fall respectively; Table 9; Figures 7a-c). Estimates provided in Table 9 do not represent the proportion of carcasses remaining at the end of an interval of *t* days (where *t* = 1, 3, 7, 14, or 28 days) but rather the probability that a carcass arriving within an interval of *t* days persists until the end of the interval.

Table 9. Carcass Persistence Estimates by Season and Plot Type

Plot Type	n[a]	Median CP[b]	90% Confidence Interval		Probability of Persistence[c]														
					r_1	90% Confidence Interval		r_3	90% Confidence Interval		r_7	90% Confidence Interval		r_{14}	90% Confidence Interval		r_{28}	90% Confidence Interval	
Spring																			
Full Plots	23	5.37	4.01	7.12	0.96	0.92	0.99	0.87	0.78	0.93	0.68	0.58	0.78	0.45	0.36	0.54	0.24	0.19	0.31
Road and Pad Plots	31	4.13	2.92	5.66	0.85	0.77	0.91	0.72	0.64	0.80	0.57	0.50	0.65	0.43	0.37	0.49	0.28	0.23	0.33
Overall[d]	54	4.95	3.56	6.84	0.91	0.85	0.95	0.79	0.71	0.86	0.62	0.54	0.71	0.45	0.38	0.53	0.28	0.22	0.35
Summer																			
Full Plots[e]	13	5.23	1.00	27.47	0.78	0.60	0.92	0.67	0.49	0.85	0.58	0.39	0.77	0.50	0.31	0.69	0.42	0.23	0.61
Road and Pad Plots[e]	13	0.83	0.14	4.88	0.59	0.40	0.80	0.46	0.28	0.68	0.37	0.20	0.57	0.30	0.15	0.49	0.23	0.10	0.40
Overall	26	2.10	0.60	7.29	0.68	0.55	0.84	0.57	0.43	0.72	0.47	0.34	0.62	0.40	0.26	0.54	0.33	0.20	0.46
Fall																			
Full Plots[f]	20	0.74	0.32	1.68	0.60	0.46	0.75	0.41	0.28	0.56	0.25	0.16	0.39	0.15	0.09	0.26	0.08	0.04	0.15
Road and Pad Plots[f]	20	0.67	0.29	1.51	0.59	0.45	0.74	0.39	0.27	0.54	0.24	0.15	0.37	0.14	0.08	0.24	0.08	0.04	0.14
Overall	40	0.70	0.36	1.37	0.59	0.48	0.73	0.40	0.31	0.52	0.25	0.18	0.34	0.15	0.10	0.22	0.08	0.05	0.13

[a] n is the number of carcasses placed for the carcass persistence trial.

[b] MedianCP is the estimated median number of days a carcass will persist after day 0.

[c] Probability of persistence is the estimated median probability that a carcass arriving at a uniform random time in an interval of t days (i.e., 1, 3, 7, 14, 28 days) persists until the end of the interval.

[d] In the spring, estimates for the overall season were determined using a Weibull distribution with the location and scale formulas constant; however, this model was not selected for fatality estimation in GenEst.

[e] In the summer, estimates for road and pad plots and full plots were determined using a lognormal distribution with the location formula a function of Plot Type and the scale formula constant; however, this model was not selected for fatality estimation in GenEst.

[f] In the fall, estimates for road and pad plots and full plots were determined using a Weibull distribution with the location formula a function of Plot Type and the scale formula constant; however, this model was not selected for fatality estimation in GenEst.

4.5 PROJECT-SPECIFIC FATALITY ESTIMATION

In total, 100 bat carcasses (Appendix A-1) were found during standardized searches and input into GenEst to calculate adjusted project-specific fatality estimates for each season. The overall probability of detection ($\hat{g}$) was highest in the spring, followed by the summer then fall (Table 10). The higher detection probability in the spring is primarily driven by higher carcass persistence rates.

The estimated probability of detection tended to be higher at road and pad plots compared to full plots (Table 10), which was primarily driven by higher searcher efficiency at road and pad plots. As previously mentioned, the $\hat{g}$-values provided in GenEst (and presented in Table 10) are simplistic estimates based on searcher efficiency estimates, carcass persistence estimates, and the average search interval. However, these estimates do not incorporate spatial coverage of survey plots (i.e., DWP).

Table 10. Detection Probability Estimates by Season and Plot Type

Plot Type	Estimated Detection Probability (g)[a]	90% Confidence Interval (lower)	90% Confidence Interval (upper)
Spring			
Full Plots	0.408	0.277	0.549
Road and Pad Plots	0.576	0.492	0.659
Overall[b]	0.524	0.432	0.616
Summer			
Full Plots	0.432	0.296	0.579
Road and Pad Plots	0.479	0.340	0.626
Overall[b]	0.464	0.337	0.612
Fall			
Full Plots	0.279	0.195	0.386
Road and Pad Plots	0.334	0.248	0.449
Overall[b]	0.311	0.228	0.417

[a] The g-values presented in this table are a function of the selected searcher efficiency model, the selected carcass persistence model, and the average search interval. They do not account for spatial coverage (i.e., DWP).

[b] The overall detection probability in spring, summer, and fall was determined using constant searcher efficiency and carcass persistence models. However, while constant carcass persistence models were selected for summer and fall fatality estimation in GenEst, searcher efficiency was modeled as function of plot type for all seasons, and spring carcass persistence was modeled with the scale formula as a function of plot type.

The median fatality estimate was highest in the fall (25.46 bat fatalities/turbine or 12.13 bat fatalities/MW) followed by the summer (6.50 bat fatalities/turbine or 3.09 bat fatalities/MW) then spring (4.76 bat fatalities/turbine or 2.27 bat fatalities/MW) (Table 11).

Table 11. Bat Fatality Estimates by Season

Season	Total Bats[a]	Percentage[b]	Median Fatality Estimate	90% Confidence Interval (lower)	90% Confidence Interval (upper)
Facility-Wide					
Spring	18	18.00%	271.15	144.80	426.94
Summer	13	13.00%	207.96	87.10	389.50
Fall	69	69.00%	1451.45	963.23	2090.40
Per Turbine[c]					
Spring	18	18.00%	4.76	2.54	7.49
Summer	13	13.00%	6.50	2.72	12.17
Fall	69	69.00%	25.46	16.90	36.67
Per Megawatt[d]					
Spring	18	18.00%	2.27	1.21	3.57
Summer	13	13.00%	3.09	1.30	5.80
Fall	69	69.00%	12.13	8.05	17.46

[a] Incidental finds were excluded from analysis and are not included in this table.

[b] Percentage is the percent of total bats found during each season.

[c] Based on 57 turbines for spring and fall, and 32 turbines for summer

[d] Based on 119.7 MW for spring and fall, and 67.2 MW for summer

4.6 ESTIMATED TAKE OF COVERED SPECIES

One Indiana bat carcass, a species covered under the HCP (Atwell 2021), was found over the course of standardized surveys in 2024. No northern long-eared bat carcasses were found at the project in 2024.

Results from the searcher efficiency and carcass persistence trials, as well as the site spatial coverage were input into EoA to model estimated Indiana and northern long-eared bat take. Using the multiple class module, EoA estimated searcher efficiency at full plots to be 0.500 (95% confidence interval: 0.302, 0.698), 0.800 (95% confidence interval: 0.556, 0.940), and 0.773 (95% confidence interval: 0.571, 0.908) in the spring, summer, and fall, respectively. Searcher efficiency at road and pad plots was estimated to be 0.952 (95% confidence interval: 0.798, 0.995), 1.000 (95% confidence interval: 0.848, 1.000), and 1.000 (95% confidence interval: 0.883, 1.000) in the spring, summer, and fall, respectively.

For a search interval of seven days in the spring, carcass persistence (*r*) was estimated to be 0.610 (95% confidence interval: 0.484, 0.719) and 0.601 (95% confidence interval: 0.479, 0.705) for full plots and road and pad plots, respectively (Table 4). For a search interval of seven days in the summer, carcass persistence (*r*) was estimated to be 0.584 (95% confidence interval: 0.336, 0.803) at full plots and 0.379 (95% confidence interval: 0.168, 0.638) at road and pad plots (Table 4). For a search interval of three and a half days in the fall, carcass persistence (*r*) was estimated to be 0.360 (95% confidence interval: 0.179, 0.588) at full plots and 0.380 (95% confidence interval: 0.213, 0.558) at road and pad plots (Table 4).

Ba and Bb values, detection probabilities, and spatial coverage values that were input into the multiple class module for each plot type and season are shown in Table 12, below. The overall spatial coverage for full plots and road and pad plots combined was 0.2193.

The estimated overall detection probability in 2024 was 0.082 (95% confidence interval: 0.062, 0.105; Ba = 51.8592 and Bb= 579.1199; Table 13). With one Indiana bat carcass found at a road and pad plot during standardized surveys in the fall (X = 1), the median fatality estimate for Indiana bats (M*) was 14 fatalities in 2024 and the mean mortality rate (λ) was 18.74 (95% confidence interval: 1.32, 59.56; Table 13). With no northern long-eared bat carcasses found at the project in 2024, the median fatality estimate for northern long-eared bats was two fatalities in 2024 and the mean λ was 6.25 (95% confidence interval: 0.006, 31.68; Table 13). EoA outputs are provided in Appendix C.

The "Track past mortality" option in EoA's multiple years module was used to track long-term cumulative take with a 50% credibility level at the project over the life of the ITP. The overall detection probability following three years of baseline monitoring and one year of implementation monitoring is 0.170 (95% confidence interval: 0.157, 0.183). The cumulative median take estimates after four years are 24 Indiana bat fatalities and one northern long-eared bat fatality (Table 14). Cumulative mean λ estimates are 26.570 and 2.952 for Indiana and northern long-eared bat, respectively (Table 14). As such, the overall annual mean λ after four years of monitoring is 6.64 (95% confidence interval: 1.99, 14.1) Indiana bats and 0.74 (95% confidence interval: 0.001, 3.71) northern long-eared bats.

As described in section 3.7.1, a short-term trigger analysis was conducted using the most recent three years of monitoring data (2022 – 2024; two years of baseline monitoring and one year of implementation monitoring). The annual mean λ of this three-year window is 8.135 (95% confidence interval: 2.430, 17.300) Indiana bats and 0.904 (95% confidence interval: 0.001, 4.540) northern long-eared bats (Table 15). These values were utilized to test against the annual take rate thresholds outlined in the HCP (5.5 Indiana bats and 2.8 northern long-eared bats) (Atwell 2021). The mean mortality rates for Indiana bats and northern long-eared bats do not exceed the short-term adaptive management triggers with 99% credibility (Table 15; Appendix C).

Table 12. Multiple Class Module Inputs to Estimate Take of HCP-Covered Species using EoA

Season	Plot Type	dwp[a]	Indiana Bat Carcass Count (X)	Northern Long-eared Bat Carcass Count (X)	Ba[b]	Bb[b]	Detection Probability ($\hat{g}$)	95% Confidence Interval for $\hat{g}$ (lower limit)	95% Confidence Interval for $\hat{g}$ (upper limit)
Spring	Full Plot	0.0062	0	0	13.6360	26.0259	0.344	0.206	0.496
Spring	Road and Pad Plot	0.0024	0	0	25.1546	18.5925	0.575	0.428	0.716
Summer	Full Plot	0.0500	0	0	9.1692	8.5591	0.517	0.292	0.739
Summer	Road and Pad Plot	0.0167	0	0	6.6278	10.7720	0.381	0.175	0.613
Fall	Full Plot	0.1030	0	0	9.3857	21.2640	0.306	0.159	0.477
Fall	Road and Pad Plot	0.0392	1	0	12.0310	19.5280	0.381	0.223	0.554

[a] "dwp" is the average density-weighted proportion for each plot type weighted by the proportion of plots the plot type comprises and the estimated seasonal proportions of *Myotis* mortality as described in the Bluff Point HCP (Atwell 2021).

[b] Ba and Bb values for each plot type were determined from search class inputs in EoA's multiple class module.

Table 13. Overall Detection Probability, Median Fatality Estimate, and Mean Fatality Rate Estimate for HCP-Covered Species

Species	Carcass Count (x)	Overall Detection Probability ($\hat{g}$)	95% CI for $\hat{g}$ (lower limit)[a]	95% CI for $\hat{g}$ (upper limit)[a]	Ba[b]	Bb[b]	Median Fatality Estimate (M*)	95% CI for M* (lower limit)[a]	95% CI for M* (upper limit)[a]	Mean Fatality Rate Estimate (λ)	95% CI for λ (lower limit)[a]	95% CI for λ (upper limit)[a]
Indiana bat	1	0.082	0.062	0.105	51.8592	579.1199	14	2	56	18.7	1.32	59.56
Northern long-eared bat	0	0.082	0.062	0.105	51.8592	579.1199	2	0	23	6.25	0.006	31.68

[a] CI = Confidence Interval

[b] Ba and Bb values were calculated from EoA's multiple class module and characterize the overall detection probability.

Table 14. Cumulative Mortality Estimates for Covered Species (2021 – 2024)

Year	Cumulative Carcass Count (X)	Detection Probability (ĝ)	95% CI for ĝ (lower limit)[a]	95% CI for ĝ (upper limit)[a]	Median Fatality Estimate (M*)	95% CI for M* (lower limit)[a]	95% CI for M* (upper limit)[a]	Mean Fatality Rate Estimate (λ)	95% CI for λ (lower limit)[a]	95% CI for λ (upper limit)[a]
Indiana bat										
2021	0	0.124	0.103	0.147	1	0	14	4.076	0.004	20.570
2022	1	0.196	0.179	0.214	6	1	18	7.675	0.551	23.970
2023	3	0.199	0.183	0.215	16	5	35	17.640	4.246	40.460
2024	4	0.170	0.157	0.183	24	9	51	26.570	7.948	56.330
Northern long-eared bat										
2021	0	0.124	0.103	0.147	1	0	14	4.076	0.004	20.570
2022	0	0.196	0.179	0.214	1	0	8	2.558	0.003	12.860
2023	0	0.199	0.183	0.215	1	0	8	2.519	0.002	12.670
2024	0	0.170	0.157	0.183	1	0	10	2.952	0.003	14.840

[a] CI = Confidence Interval

Table 15. Results of an EoA Short-Term Trigger Analysis for HCP-Covered Species

Timeframe	Term (Years)	Species	Detection Probability (ĝ)	95% CI for ĝ (lower limit)[b]	95% CI for ĝ (upper limit)[b]	Baseline Fatality Rate Estimate (λ)[a]	95% CI for λ (lower limit)[b]	95% CI for λ (upper limit)[b]	Annual Rate Threshold (τ)	P(λ > τ)[c]	Result[d]
2022 - 2024	3	Indiana bat	0.185	0.169	0.201	8.135	2.430	17.300	5.500	0.730	Compliance
2022 - 2024	3	Northern long-eared bat	0.185	0.169	0.201	0.904	0.001	4.540	2.800	0.078	Compliance

[a] The baseline fatality rate estimate is the average estimate over the term length.

[b] CI = Confidence Interval

[c] P(λ > τ) is the probability that the baseline fatality rate is greater than the annual rate threshold set per the Bluff Point HCP (Atwell 2021).

[d] Compliance indicates that λ cannot be inferred as greater than τ with 99% credibility.

5 DISCUSSION

Over the course of the study, 100 bat carcasses representing six species were found during standardized surveys. Using GenEst, the estimated adjusted fatality rates in the spring, summer, and fall were 4.76 bats/turbine (2.27 bats/MW; 271.15 total bats), 6.50 bats/turbine (3.09 bats/MW; 207.96 total bats), and 25.46 bats/turbine (12.13 bats/MW; 1,451.45 total bats), respectively. While the spring and fall fatality estimates were for all 57 turbines at the project, the summer fatality estimate was only for 32 turbines within the bat avoidance buffer. This is because all turbines were surveyed and operating at a 3.0 m/s and 5.0 m/s cut-in speed during the spring and fall, respectively, whereas only turbines within the bat avoidance buffer were surveyed and operating at a 6.0 m/s cut-in speed in the summer. Turbines located outside of the bat avoidance buffer were not surveyed in the summer and were operating at the manufacturer's recommended cut-in speed (3.0 m/s).

Spring and summer fatality estimates at the project were higher in 2024 compared to baseline monitoring years (2023 [0.70 and 0.52 bats/MW in spring and summer respectively], 2022 [1.27 and 1.94 bats/MW in spring and summer respectively] and 2021 [0.93 and 1.06 bats/MW in spring and summer respectively]). The fall estimate in 2024 was lower than the 2023 and 2021 fall estimates (12.96 bats/MW and 18.64 bats/MW, respectively) but higher than the 2022 fall estimate (9.65 bats/MW).

Silver-haired and eastern red bats made up a majority (75.0%, collectively) of the carcasses found at the project with significant numbers of big brown (14.0%) and hoary bats (8.0%) found, as well (Table 5). This is similar to the species composition found at other wind facilities throughout the Midwest. However, specific proportions of each species may differ (Arnett et al. 2008; AWWI 2020). Based on the timing of peak carcass counts, it is likely that these were fall migrants.

Bat carcass counts were relatively low throughout the spring and summer but higher in the fall, with carcass counts generally peaking in mid-to-late August (Figure 8). While this pattern may be partially attributed to a lower turbine cut-in speed during the fall monitoring period compared to the summer monitoring period, this temporal influx of carcasses at the project is also similar to trends from other wind facilities throughout the Midwest and United States as a whole. A majority of bat carcasses tend to correspond with the fall migratory period and dispersal from summer breeding grounds compared to the spring and summer seasons (Johnson 2005; Arnett et al. 2008; AWWI 2020). The timing of peak carcass counts at the project was generally driven by an influx of eastern red bats (38% of carcasses) in mid-to-late August with smaller contributions from big brown bats (14% of carcasses). Silver-haired bat, which was the species with the second-highest fatality count in 2024 overall, peaked two weeks later (early September) than the cumulative bat count (Figure 9).

While an approximately equal number of carcasses were discovered at full plots and road and pad plots, full plots tended to have more observed carcasses on a per turbine basis. This was expected since full plots have a greater amount of area searched compared to roads and pads, particularly at distance bands closer to the turbine tower where a greater proportion of fatalities are likely to be found (Hull and Muir 2010).

Bat carcasses were generally distributed throughout the array during each season and there did not appear to be any areas of significant concentration (Figures 5a-c). Turbine 9, which is a full plot in the western portion of the project area, had the highest carcass count. A total of nine carcasses were found during the fall season alone (Figure 5c).

The overall detection probability of 0.082 in 2024 did not meet the expected target detection probability of 0.1 established in the HCP for Implementation Monitoring (Atwell 2021). Baseline monitoring efforts in 2021, 2022, and 2023 resulted in detection probabilities of 0.124, 0.268, and 0.205, respectively (Atwell 2022; Atwell 2023; Atwell 2024). As such, the average detection probability following four full years of monitoring was 0.170.

As previously mentioned, one Indiana bat and no northern long-eared bats were found during PCMM surveys in 2024. Therefore, over the course of 2021 – 2023 (baseline monitoring) and 2024 (implementation monitoring) at the project, a total of four Indiana bats and no northern long-eared bats were discovered. The cumulative take after four years of monitoring, based on EoA modelling, is estimated to be 24 Indiana bats and one northern long eared bat. The long-term trigger threshold has not been exceeded for either species. Furthermore, the short-term adaptive management trigger did not indicate that the project is at risk of exceeding its take limit with 99% credibility. Long-term progress toward the total authorized take limit will be tracked over the life of the ITP using EoA's multiple years module.

PCMM surveys of the project have been conducted in the spring, summer, and fall seasons since April 2021. A summary of PCMM survey effort, curtailment conditions, and Indiana bat and northern long-eared bat fatalities are presented in table 16. Throughout the entirety of four years of monitoring, all 57 turbines were searched during the spring and fall seasons, and 32 turbines within the USFWS buffer area were searched during the summer seasons. Indiana bat and northern long-eared bat fatalities are noted along with the closest associated turbine.

Table 16. 2021-2024 Summary Table

Year	Dates[a]	Search Interval	Curtailment Conditions	Indiana bat fatalities[b]	Northern long-eared bat fatalities
2021					
Spring	April 1 - May 15	7	1/2 hour before sunset to 1/2 hour after sunrise, below 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Summer	May 16 - July 31	7	32 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, below 6.0 m/s, above 50F (10C) based on 10 minute rolling average. 25 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, up to 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Fall	August 1 - October 15	7	1/2 hour before sunset to 1/2 hour after sunrise, below 5.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
2022					
Spring	April 1 - May 15	7	1/2 hour before sunset to 1/2 hour after sunrise, below 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Summer	May 16 - July 31	1	32 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, below 6.0 m/s, above 50F (10C) based on 10 minute rolling average. 25 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, up to 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Fall	August 1 - October 15	1	1/2 hour before sunset to 1/2 hour after sunrise, below 5.0 m/s, above 50F (10C) based on 10 minute rolling average.	WTG-044 (1)	0
2023					
Spring	April 1 - May 15	7	1/2 hour before sunset to 1/2 hour after sunrise, below 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0

Year	Dates[a]	Search Interval	Curtailment Conditions	Indiana bat fatalities[b]	Northern long-eared bat fatalities
Summer	May 16 - July 31	7	32 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, below 6.0 m/s, above 50F (10C) based on 10 minute rolling average. 25 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, up to 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Fall	August 1 - October 15	1	1/2 hour before sunset to 1/2 hour after sunrise, below 5.0 m/s, above 50F (10C) based on 10 minute rolling average.	WTG-036 (1), WTG-010 (1)	0
2024					
Spring	April 1 - May 15	7	1/2 hour before sunset to 1/2 hour after sunrise, below 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Summer	May 16 - July 31	7	32 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, below 6.0 m/s, above 50F (10C) based on 10 minute rolling average. 25 turbines - 1/2 hour before sunset to 1/2 hour after sunrise, up to 3.0 m/s, above 50F (10C) based on 10 minute rolling average.	0	0
Fall	August 1 - October 15	3.5	1/2 hour before sunset to 1/2 hour after sunrise, below 5.0 m/s, above 50F (10C) based on 10 minute rolling average.	WTG-057 (1)	0
Cumulative	**--**	**--**	**--**	**4**	**0**

[a] Each year of monitoring included searches at 57 turbines during the spring and fall seasons and 32 turbines within the USFWS buffer area during the summer seasons.

[b] WTG = wind turbine generator

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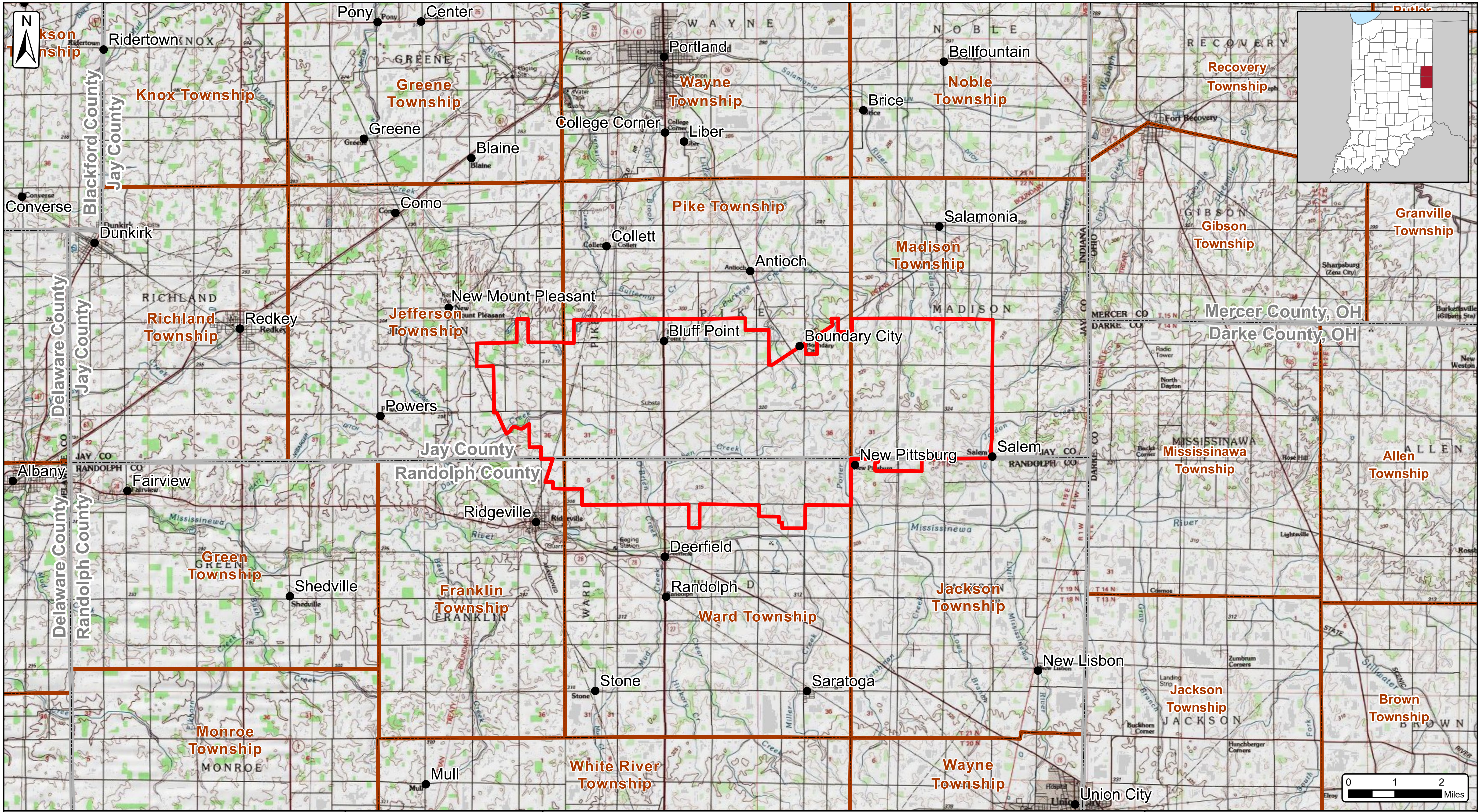
FIGURES



Bluff Point Wind Energy Center

Figure 1

Regional Setting

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

Project Boundary (~23,613 acres)

Populated Places (USGS)

Township

County Boundaries

Source: USGS 30-by-60 Minute Topographic Quadrangles

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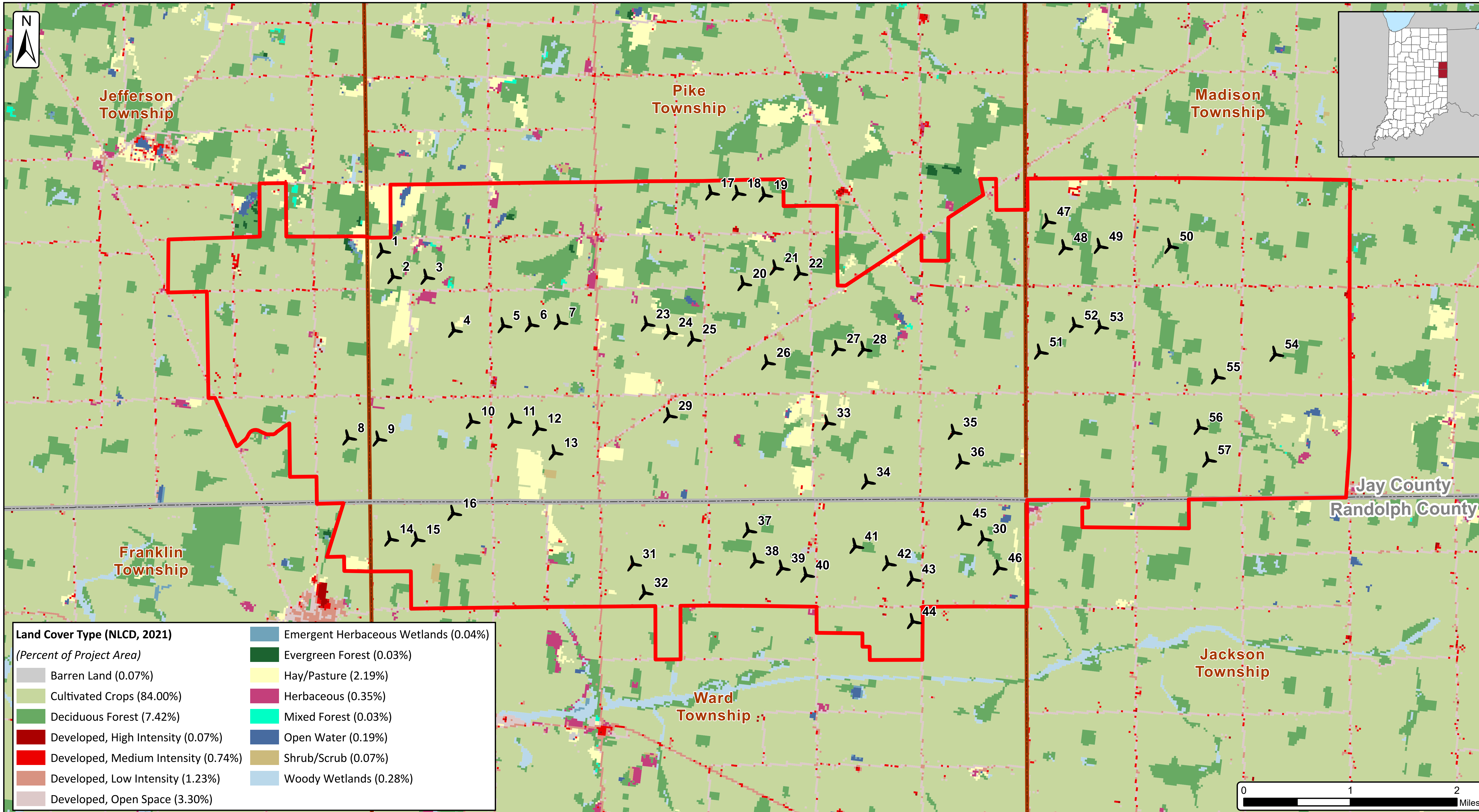

Bluff Point Wind Energy Center

Figure 2

2021 National Land Cover Database

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

As-Built Turbine Locations (10/24/2017)

Project Boundary (~23,612 acres)

Township

County Boundaries

Source: USGS National Land Cover Database (2021)

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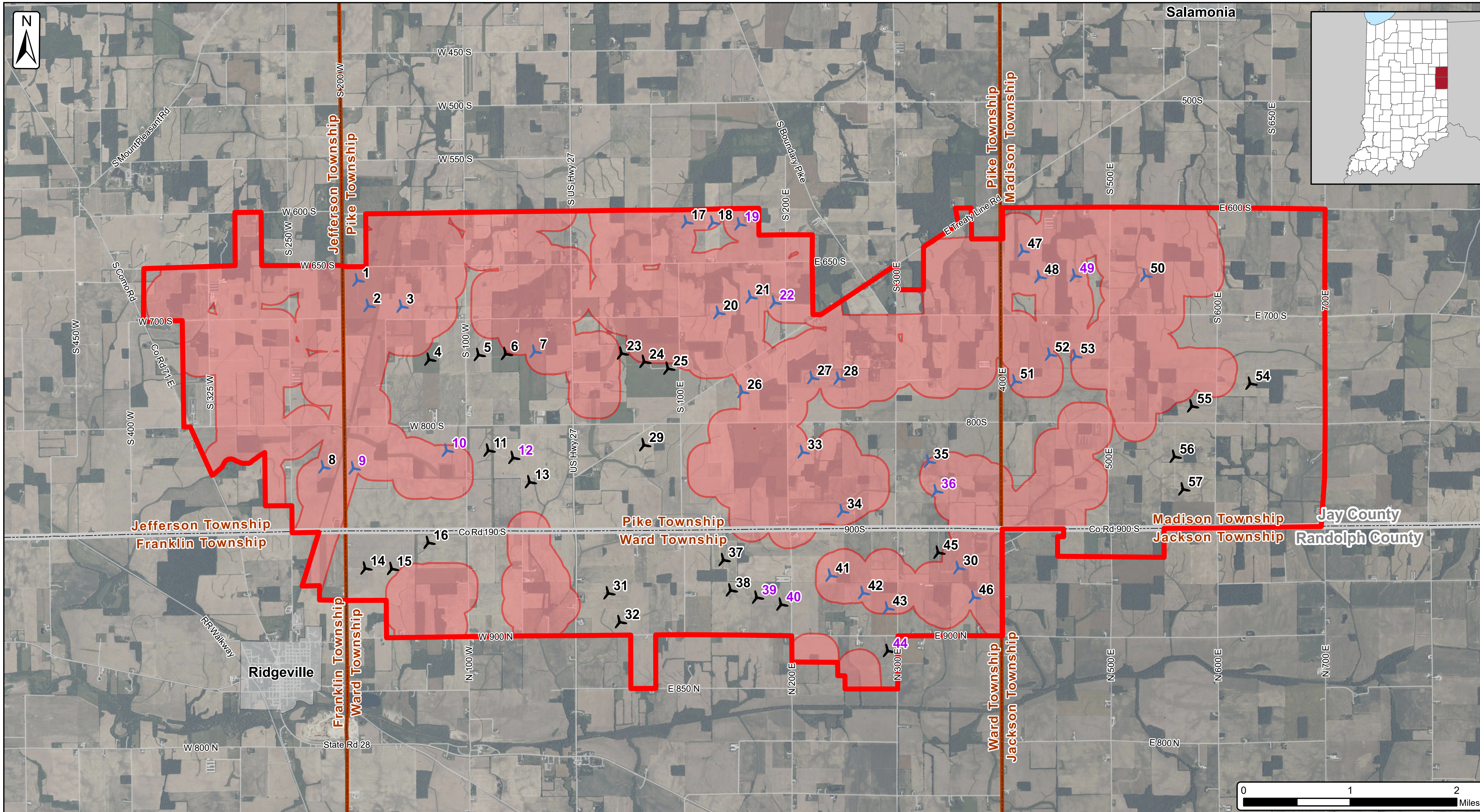

Bluff Point Wind Energy Center

Figure 3

As-Built Turbines and Bat Carcass Search Locations

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

As-Built Turbine Locations (10/24/2017)*

- 25 Turbines Outside USFWS Bat Avoidance Area
- 32 Turbines Within USFWS Bat Avoidance Buffer
- USFWS Bat Avoidance Buffer
- Project Boundary (~23,613 acres)
- City/Village
- Township Boundary
- County Boundary

* Turbines with purple text label represent 100 x 100 meter full plot survey areas.

Source: USDA National Agriculture Imagery Program (2022)

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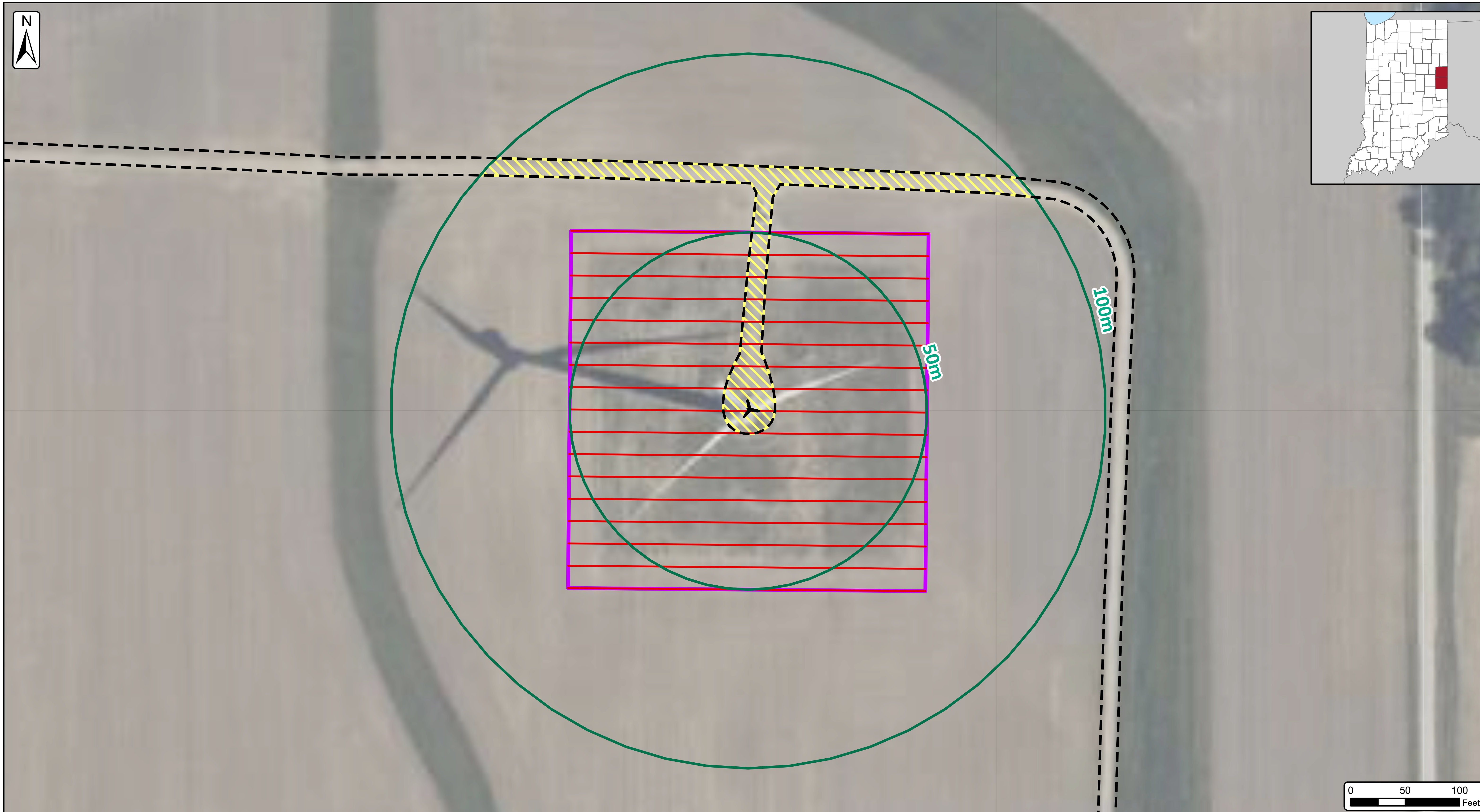

Bluff Point Wind Energy Center
Figure 4
Example Schematic of Two Search Plot Types
Jay & Randolph Counties, Indiana
Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

As-Built Turbine Location (10/24/2017)
Distance from Turbine
100 x 100 Meter Full Plot
100 m x 100 m Full Plot Transect
As-Built Access Road (10/24/2017)
Road and Pad Search Area

Source: USDA National Agriculture Imagery Program (2022)

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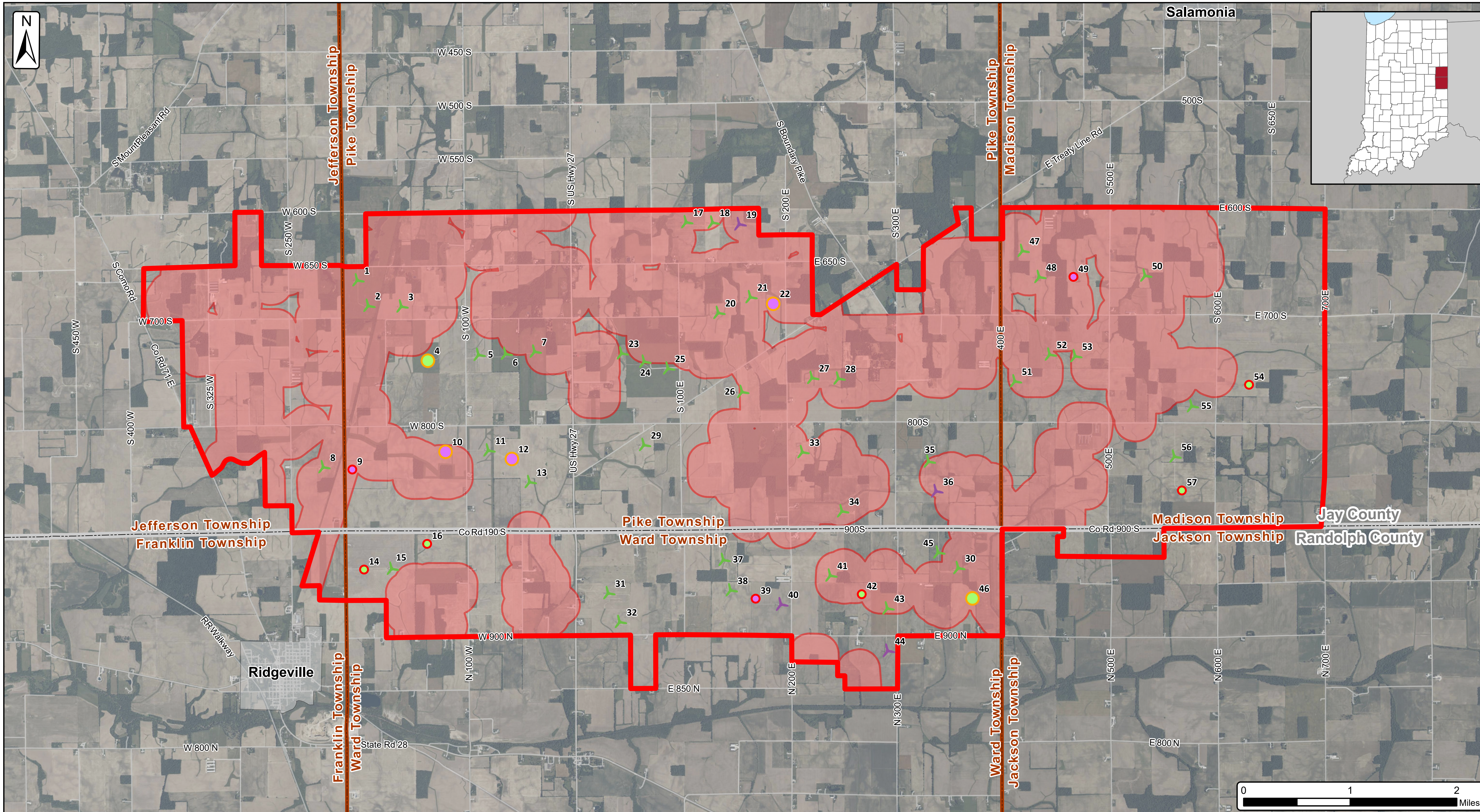

Bluff Point Wind Energy Center

Figure 5a
Weighted Standardized Bat Carcass Discoveries (Spring)

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

Road and Pad Plot with Standardized Bat Fatalities
Cleared Full Plot with Standardized Bat Fatalities
Road and Pad Plot with Zero Standardized Bat Fatalities
Cleared Full Plot with Zero Standardized Bat Fatalities
USFWS Bat Avoidance Buffer
Project Boundary (~23,613 acres)

Town/Village
Township Boundary
County Boundary

Weighted Standardized Fatalities
1
2

Source: USDA National Agriculture Imagery Program (2022)

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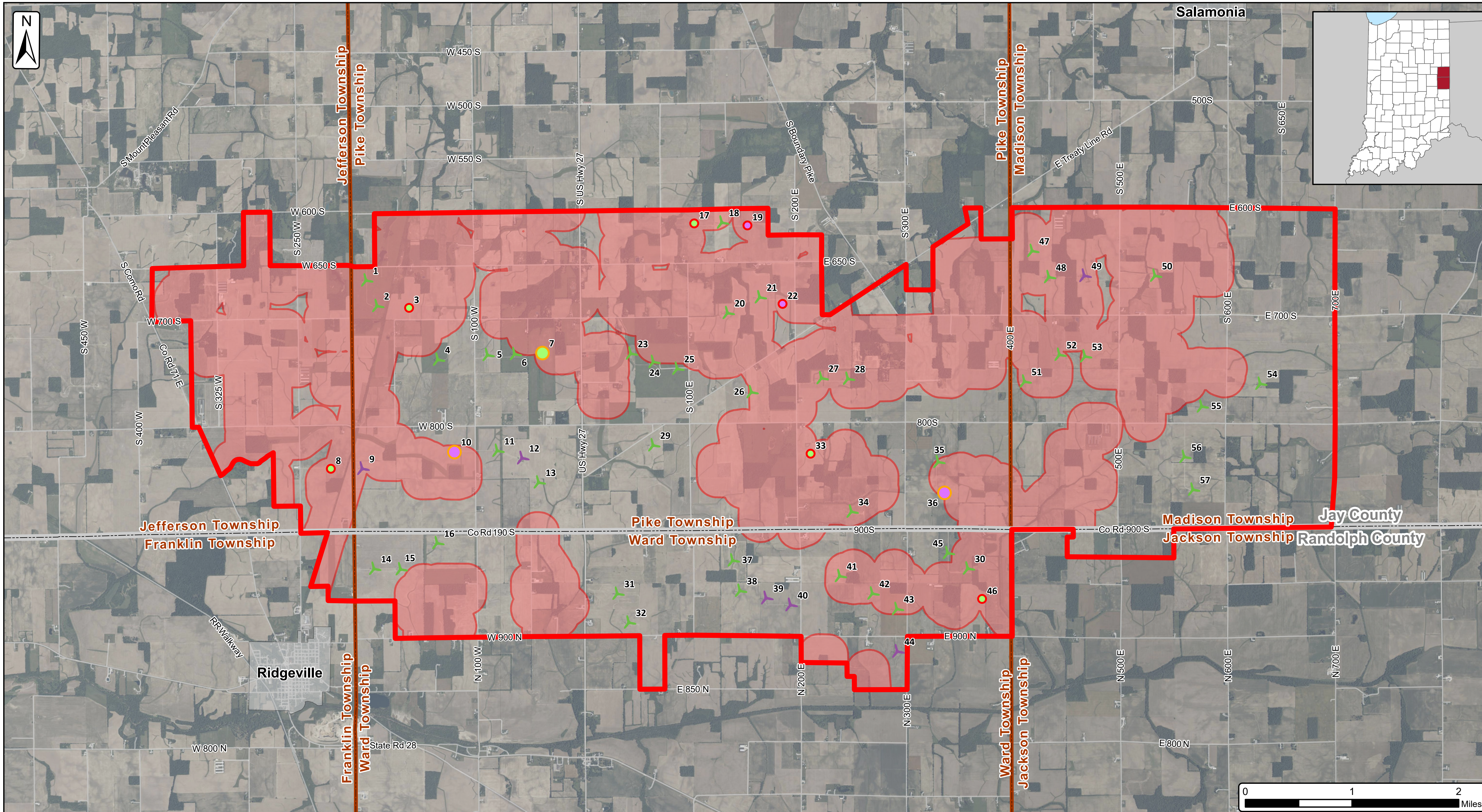

Bluff Point Wind Energy Center

Figure 5b

Weighted Standardized Bat Carcass Discoveries (Summer)

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

- Road and Pad Plot with Standardized Bat Fatalities
- Cleared Full Plot with Standardized Bat Fatalities
- Road and Pad Plot with Zero Standardized Bat Fatalities
- Cleared Full Plot with Zero Standardized Bat Fatalities
- USFWS Bat Avoidance Buffer
- Project Boundary (~23,613 acres)
- Town/Village
- Township Boundary
- County Boundary

Weighted Standardized Fatalities

- 1
- 2

Source: USDA National Agriculture Imagery Program (2022)

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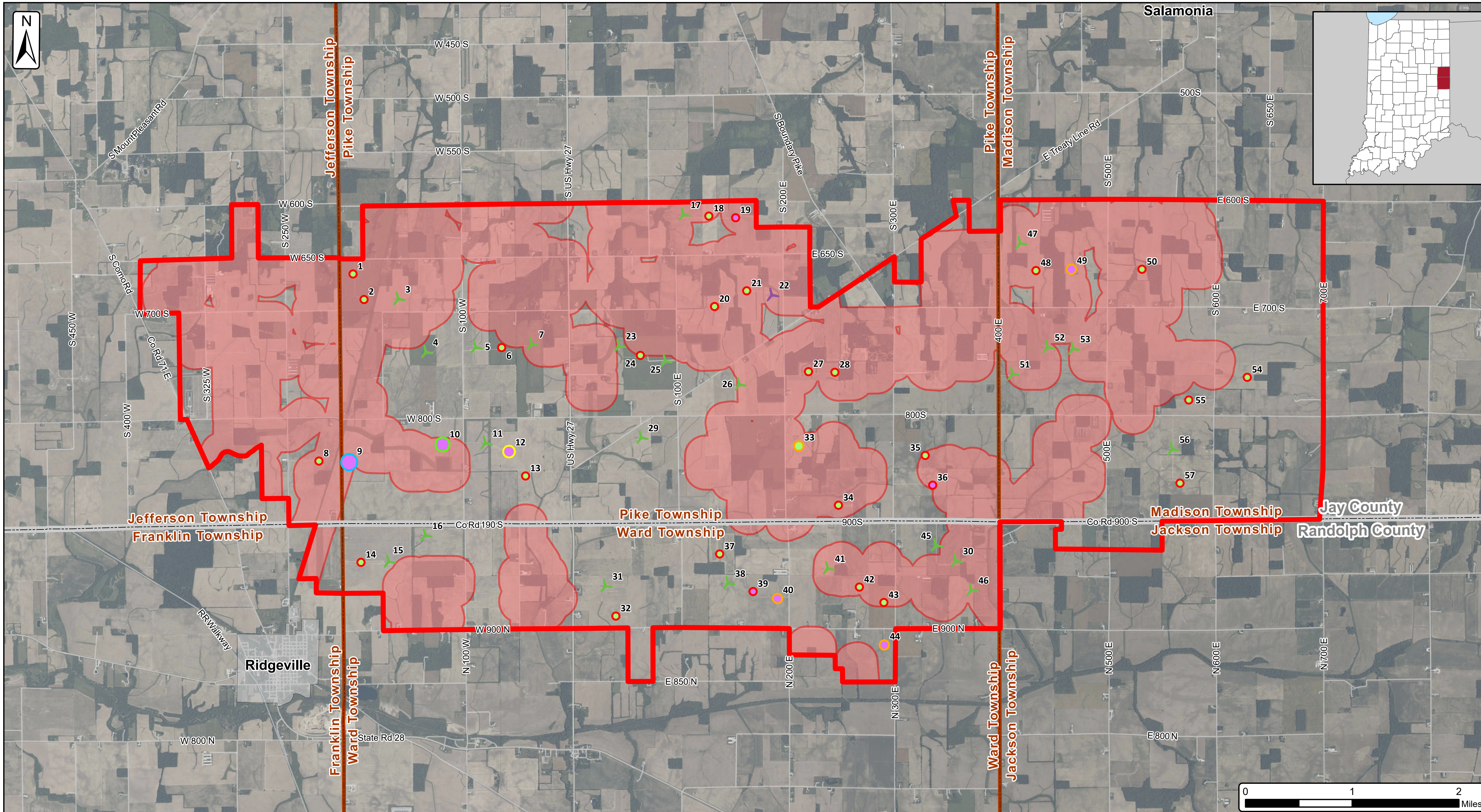

Bluff Point Wind Energy Center

Figure 5c

Weighted Standardized Bat Carcass Discoveries (Fall)

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

- Road and Pad Plot with Standardized Bat Fatalities
- Cleared Full Plot with Standardized Bat Fatalities
- Road and Pad Plot with Zero Standardized Bat Fatalities
- Cleared Full Plot with Zero Standardized Bat Fatalities
- USFWS Bat Avoidance Buffer
- Project Boundary (~23,613 acres)
- Town/Village
- Township Boundary
- County Boundary

Weighted Standardized Fatalities

- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 8
- 9

Source: USDA National Agriculture Imagery Program (2022)

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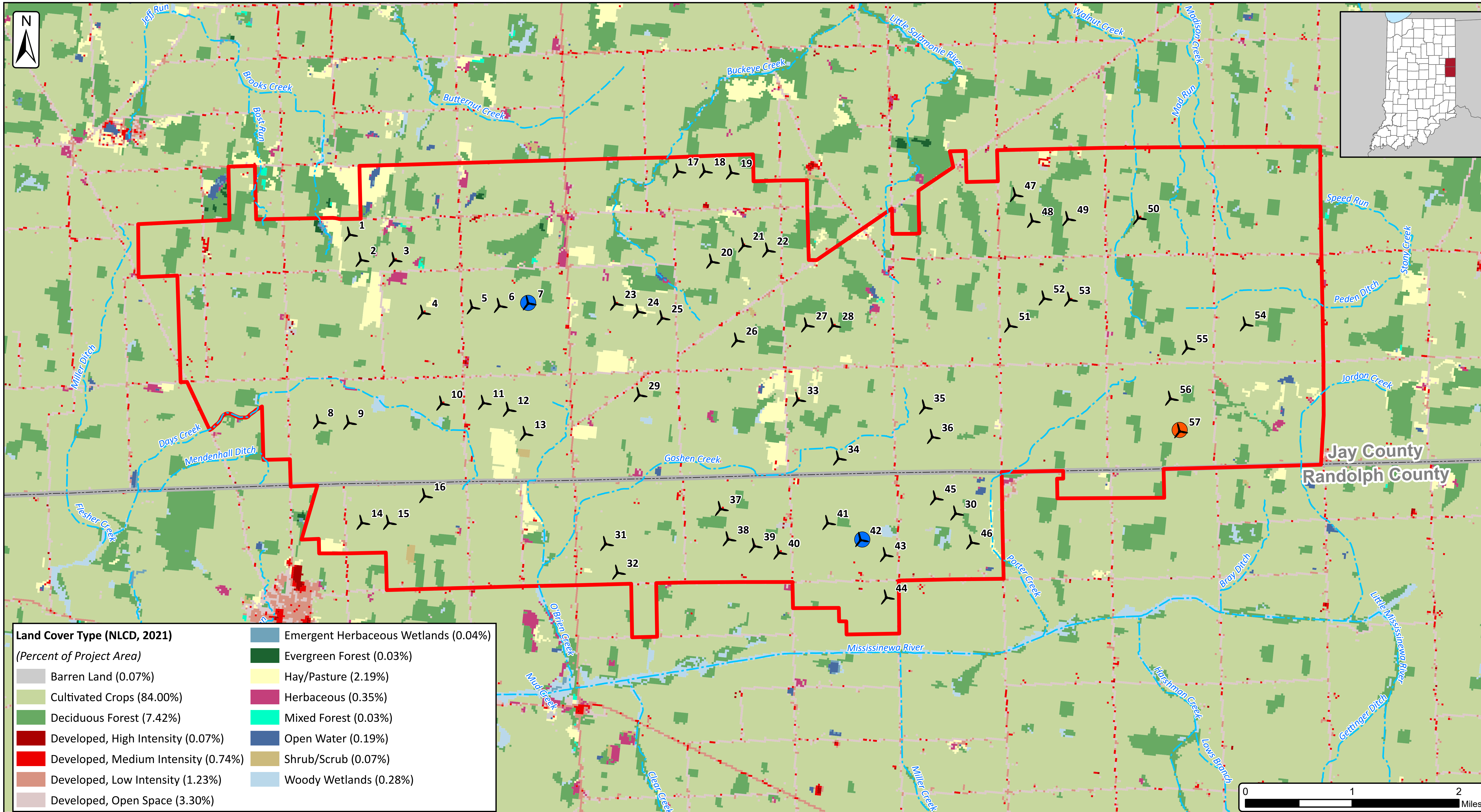

Bluff Point Wind Energy Center

Figure 6

Locations of Sensitive Bat Species

Jay & Randolph Counties, Indiana

Date: 1/15/2025

Client:

Bluff Point, LLC

Atwell, LLC Project: 20004829

Indiana bat (federally and state-listed endangered)

Evening bat (state-listed endangered)

As-Built Turbine Locations (10/24/2017)

Watercourse (NHD)

Source: USGS National Land Cover Database (2016)

ATWELL

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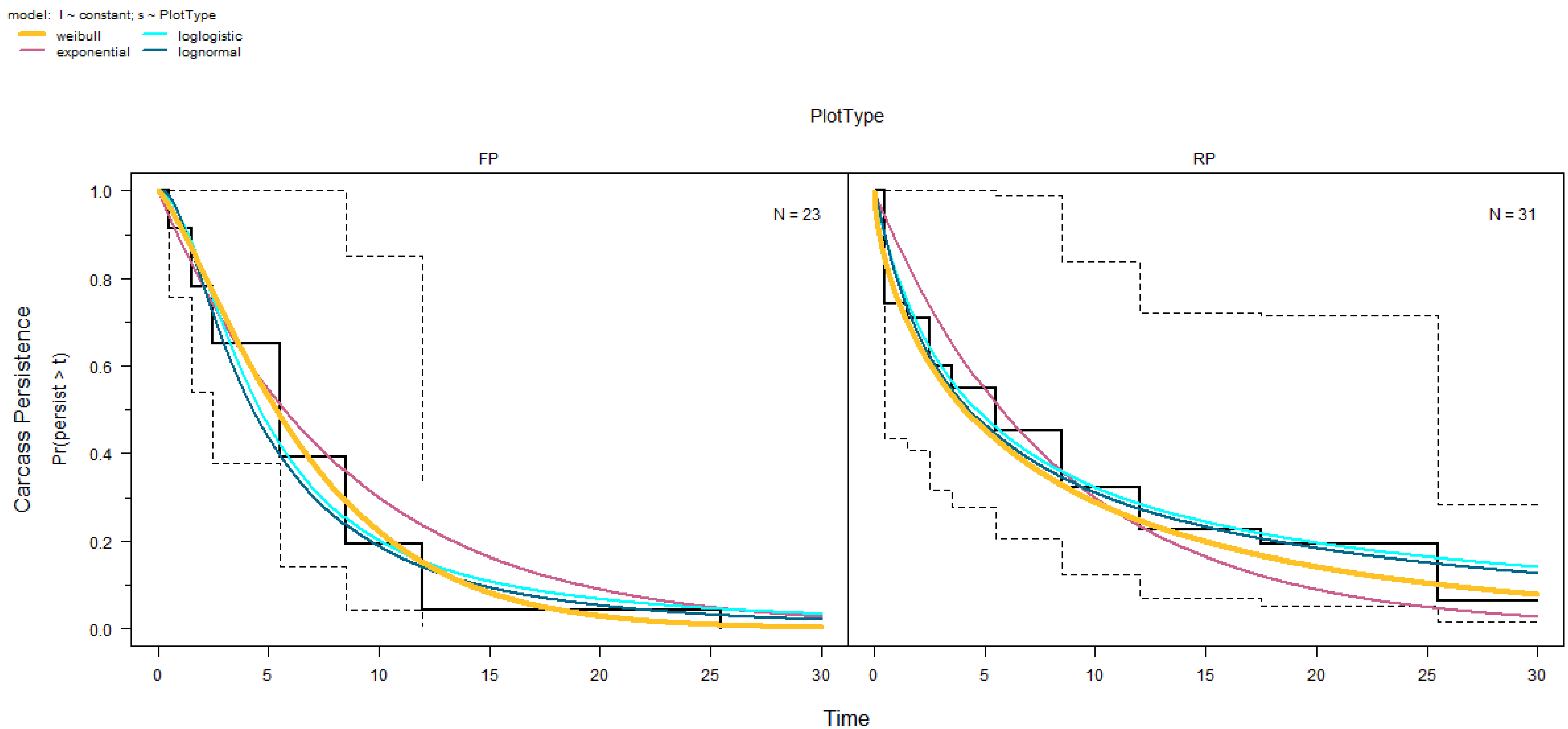


Figure generated from GenEst v1.4.9

2024 PCMM Assessment Report
Bluff Point Wind Energy Center
January 2025

Spring Carcass Persistence Rates

Figure 7a

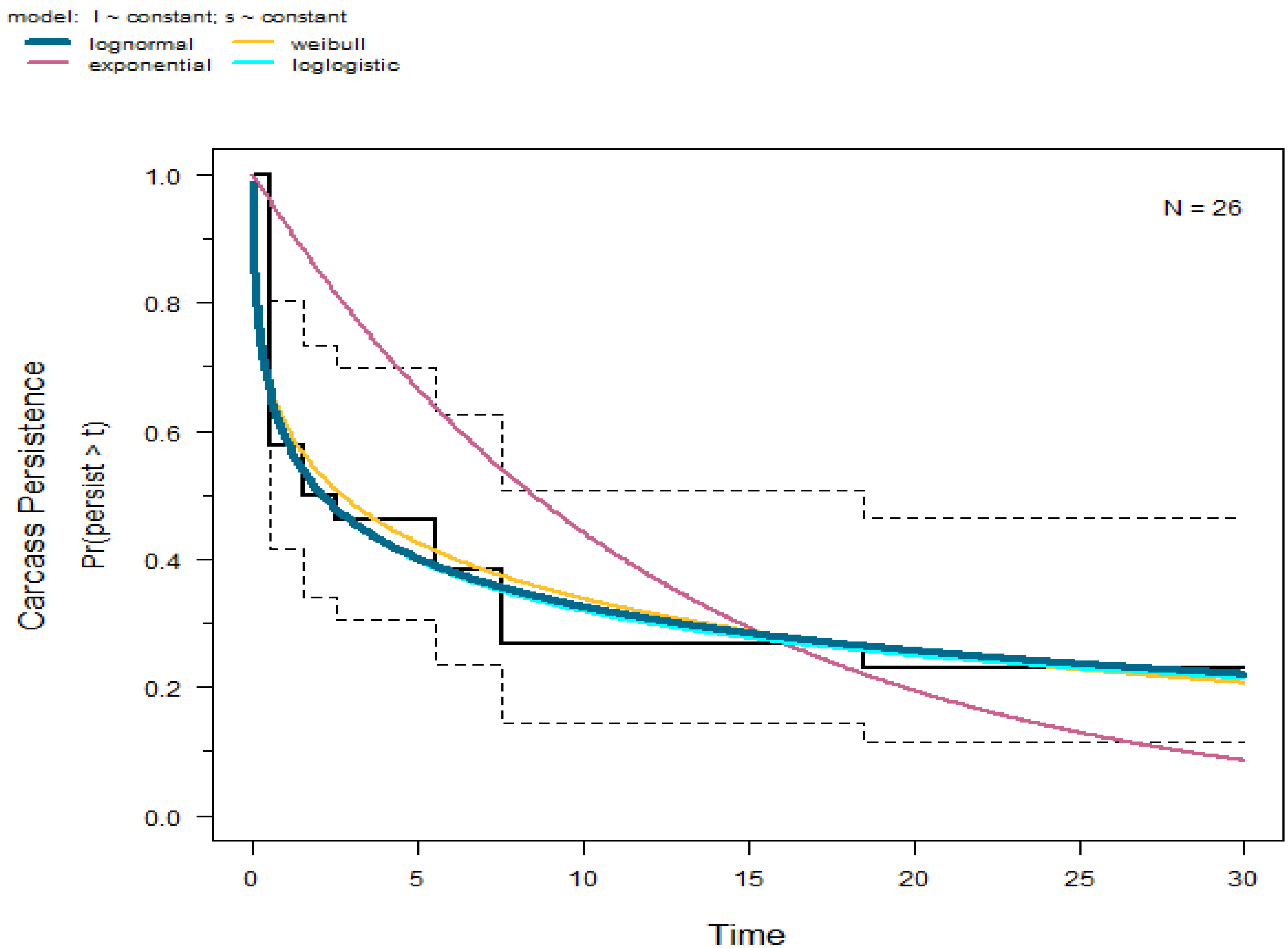


Figure generated from GenEst v1.4.9

Summer Carcass Persistence Rates

Figure 7b

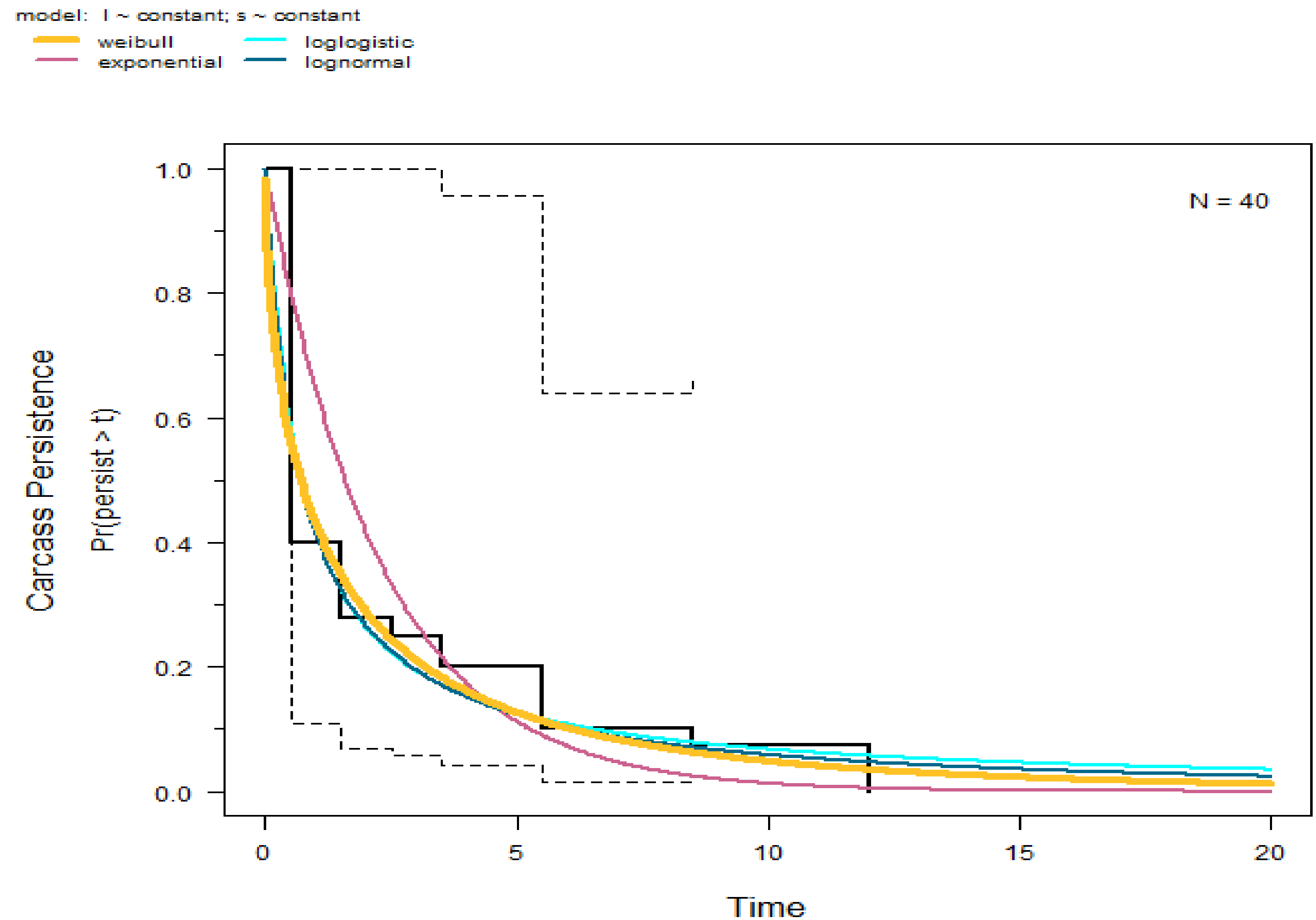


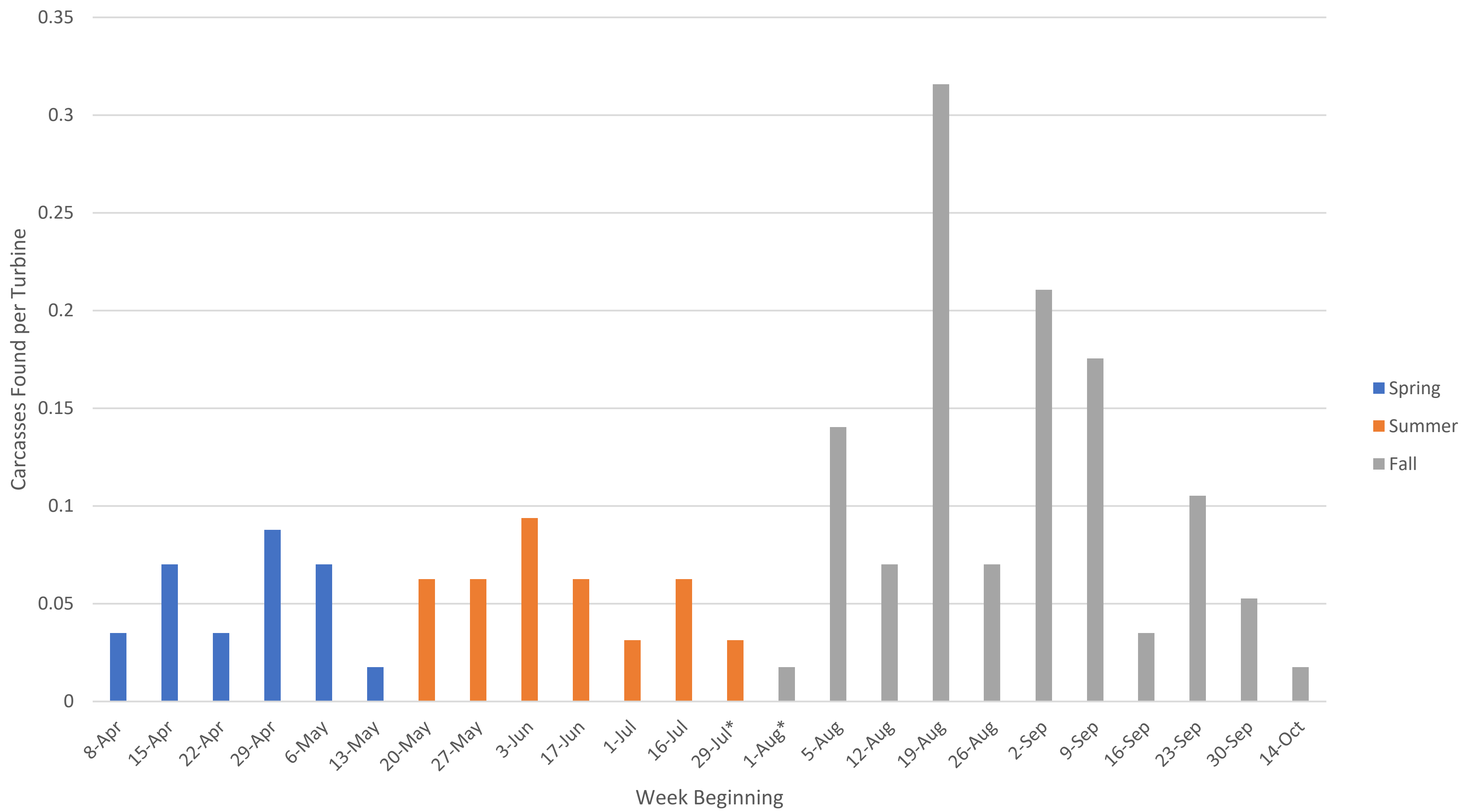
Figure generated from GenEst v1.4.9

ATWELL

2024 PCMM Assessment Report
Bluff Point Wind Energy Center
January 2025

Fall Carcass Persistence Rates

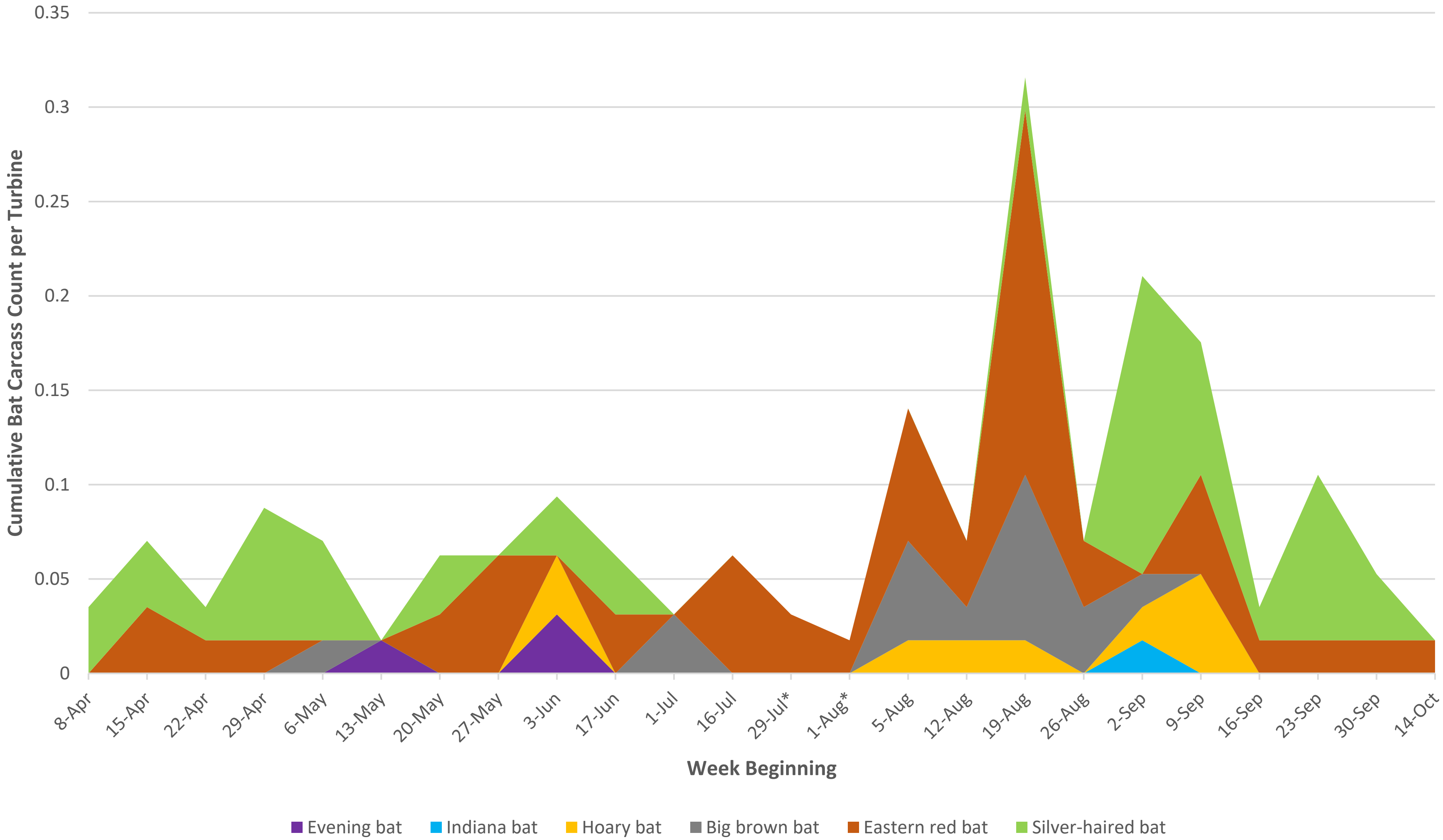
Figure 7c



1-Apr to 15-May = spring season (3.0 m/s cut-in; 57 turbines searched weekly)
16-May to 31-Jul = summer season (6.0 m/s cut-in; 32 turbines searched weekly)
1-Aug to 15-Oct = fall season (5.0 m/s cut-in; 57 turbines searched twice weekly)
*The "Week Beginning" 29-Jul is three days (i.e., the last three days of the summer season) where all 32 summer turbines were searched. As such, the "Week Beginning" 1-Aug was only four days long.

Total Bat Carcass Discoveries by Week at Bluff Point Wind Energy Center

Figure 8



1-Apr to 15-May = spring season (3.0 m/s cut-in; 57 turbines searched weekly)
16-May to 31-Jul = summer season (6.0 m/s cut-in; 32 turbines searched weekly)
1-Aug to 15-Oct = fall season (5.0 m/s cut-in; 57 turbines searched daily)
*The “Week Beginning” 29-Jul is three days (i.e., the last three days of the summer season) where all 32 summer turbines were searched. As such, the “Week Beginning” 1-Aug was only four days long.

Cumulative Bat Species Carcass Discoveries by Week at Bluff Point Wind Energy Center

Figure 9

APPENDICES

APPENDIX A-1

LIST OF BAT CARCASSES LOCATED DURING POST-CONSTRUCTION MONITORING SURVEYS AT BLUFF POINT WIND ENERGY CENTER

List of Bat Carcasses Located during Post-construction Monitoring Surveys at Bluff Point Wind Energy Center

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Condition[b]	Forearm Length (mm)	Age[c]	Sex[d]	Incidental Find?
Silver-haired Bat	*Lasionycteris noctivagans*	20240409_SHBA_10_1	t10	FP	04/09/24	31	358	16T 669948 4465212	I	41.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240409_SHBA_10_2	t10	FP	04/09/24	53	305	16T 669906 4465210	I	39.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240416_ERBA_22_1	t22	FP	04/16/24	35	238	16T 674817 4467516	I	37.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240416_SHBA_22_1	t22	FP	04/16/24	7	66	16T 674852 4467538	I	41.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240417_SHBA_46_1	t46	RP	04/17/24	8	264	16T 677953 4463154	I	41.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240418_ERBA_57_1	t57	RP	04/18/24	7	56	16T 681091 4464865	I	39.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240422_ERBA_16_1	t16	RP	04/22/24	89	356	16T 669697 4463872	I	37.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240424_SHBA_46_1	t46	RP	04/24/24	50	329	16T 677934 4463197	I	41.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240429_SHBA_04_1	t04	RP	04/29/24	5	16	16T 669652 4466555	I	42.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240429_SHBA_09_1	t09	FP	04/29/24	38	6	16T 668551 4464917	I	41.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240429_SHBA_12_1	t12	FP	04/29/24	43	77	16T 670996 4465107	I	38.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240430_ERBA_39_1	t39	FP	04/30/24	30	140	16T 674706 4463050	I	41.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240506_SHBA_04_1	t04	RP	05/06/24	5	260	16T 669646 4466549	I	40.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240501_SHBA_49_1	t49	FP	05/01/24	45	12	16T 679379 4468094	I	41.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240506_SHBA_12_1	t12	FP	05/06/24	45	315	16T 670922 4465127	I	40.0	A	U	No
Big Brown Bat	*Eptesicus fuscus*	20240506_BBBA_14_1	t14	RP	05/06/24	32	251	16T 668732 4463361	I	47.0	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240508_SHBA_54_1	t54	RP	05/08/24	9	244	16T 682053 4466478	I	40.0	A	U	No
Evening Bat	*Nycticeius humeralis*	20240515_EVBA_42_1	t42	RP	05/15/24	4	123	16T 676291 4463176	I	37.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240520_ERBA_08_1	t08	RP	05/20/24	5	317	16T 668088 4464889	I	40.0	A	U	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Condition[b]	Forearm Length (mm)	Age[c]	Sex[d]	Incidental Find?
Silver-haired Bat	*Lasionycteris noctivagans*	20240521_SHBA_46_1	t46	RP	05/21/24	43	325	16T 677935 4463190	I	39.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240527_ERBA_17_1	t17	RP	05/27/24	3	223	16T 673482 4468715	I	40.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240528_ERBA_36_1	t36	FP	05/28/24	41	156	16T 677374 4464705	I	40.0	A	U	No
Evening Bat	*Nycticeius humeralis*	20240603_EVBA_07_1	t07	RP	06/03/24	23	261	16T 671220 4466703	I	36.0	A	F	No
Hoary Bat	*Lasiurus cinereus*	20240603_HOBA_19_1	t19	FP	06/03/24	12	292	16T 674277 4468710	I	54.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240605_SHBA_36_1	t36	FP	06/05/24	4	150	16T 677358 4464739	I	40.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240617_ERBA_22_1	t22	FP	06/17/24	25	20	16T 674854 4467559	D	39.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240619_SHBA_33_1	t33	RP	06/19/24	91	273	16T 675231 4465288	P	0.0	A	U	No
Big Brown Bat	*Eptesicus fuscus*	20240701_BBBA_03_1	t03	RP	07/01/24	25	179	16T 669215 4467316	I	49.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240716_ERBA_07_1	t07	RP	07/16/24	5	296	16T 671238 4466709	I	35.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240716_ERBA_10_1	t10	FP	07/16/24	34	105	16T 669983 4465173	I	35.0	U	F	No
Eastern Red Bat	*Lasiurus borealis*	20240729_ERBA_10_1	t10	FP	07/29/24	45	80	16T 669994 4465190	I	38.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240801_ERBA_14_1	t14	RP	08/01/24	20	335	16T 668753 4463390	I	38.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240806_ERBA_32_1	t32	RP	08/06/24	26	93	16T 672651 4462652	I	40.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240808_ERBA_09_1	t09	FP	08/08/24	26	45	16T 668566 4464898	I	38.0	U	U	No
Eastern Red Bat	*Lasiurus borealis*	20240808_ERBA_09_2	t09	FP	08/08/24	47	250	16T 668505 4464862	I	40.0	A	F	No
Hoary Bat	*Lasiurus cinereus*	20240808_HOBA_09_1	t09	FP	08/08/24	28	277	16T 668520 4464882	I	53.0	A	F	No
Big Brown Bat	*Eptesicus fuscus*	20240808_BBBA_10_1	t10	FP	08/08/24	49	247	16T 669905 4465161	I	47.0	A	F	No
Big Brown Bat	*Eptesicus fuscus*	20240808_BBBA_28_1	t28	RP	08/08/24	9	267	16T 675832 4466409	I	45.8	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240809_ERBA_42_1	t42	RP	08/09/24	61	230	16T 676242 4463138	I	39.7	A	F	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Condition[b]	Forearm Length (mm)	Age[c]	Sex[d]	Incidental Find?
Big Brown Bat	*Eptesicus fuscus*	20240809_BBBA_49_1	t49	FP	08/09/24	31	132	16T 679394 4468029	I	46.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240812_ERBA_10_1	t10	FP	08/12/24	5	353	16T 669949 4465186	I	42.6	U	U	No
Hoary Bat	*Lasiurus cinereus*	20240813_HOBA_44_1	t44	FP	08/13/24	38	66	16T 676718 4462330	I	53.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240815_ERBA_09_1	t09	FP	08/15/24	50	328	16T 668521 4464921	I	37.5	A	F	No
Big Brown Bat	*Eptesicus fuscus*	20240815_BBBA_18_1	t18	RP	08/15/24	6	119	16T 673889 4468719	I	48.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240819_ERBA_01_1	t01	RP	08/19/24	3	11	16T 668539 4467723	I	38.1	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240819_ERBA_08_1	t08	RP	08/19/24	13	279	16T 668079 4464887	P	0.0	U	U	No
Big Brown Bat	*Eptesicus fuscus*	20240819_BBBA_09_1	t09	FP	08/19/24	38	334	16T 668531 4464913	I	43.3	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240819_ERBA_12_1	t12	FP	08/19/24	24	269	16T 670931 4465095	I	39.0	A	M	No
Hoary Bat	*Lasiurus cinereus*	20240819_HOBA_12_1	t12	FP	08/19/24	18	218	16T 670944 4465082	I	51.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240819_ERBA_21_1	t21	RP	08/19/24	5	87	16T 674487 4467608	I	42.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240819_ERBA_27_1	t27	RP	08/19/24	33	134	16T 675467 4466387	I	40.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240820_ERBA_33_1	t33	RP	08/20/24	3	126	16T 675325 4465283	I	41.6	J	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240820_SHBA_33_1	t33	RP	08/20/24	5	262	16T 675317 4465284	I	41.7	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240820_ERBA_39_1	t39	FP	08/20/24	45	126	16T 674723 4463047	A	0.0	U	U	No
Eastern Red Bat	*Lasiurus borealis*	20240820_ERBA_40_1	t40	FP	08/20/24	13	111	16T 675068 4462972	I	37.0	A	M	No
Big Brown Bat	*Eptesicus fuscus*	20240820_BBBA_50_1	t50	RP	08/20/24	27	153	16T 680448 4468051	I	43.7	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240820_ERBA_50_1	t50	RP	08/20/24	9	260	16T 680426 4468073	I	40.6	U	U	No
Big Brown Bat	*Eptesicus fuscus*	20240822_BBBA_02_1	t02	RP	08/22/24	21	297	16T 668695 4467348	D	46.0	U	U	No
Eastern Red Bat	*Lasiurus borealis*	20240822_ERBA_10_1	t10	FP	08/22/24	38	73	16T 669986 4465193	I	39.0	A	U	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Condition[b]	Forearm Length (mm)	Age[c]	Sex[d]	Incidental Find?
Big Brown Bat	*Eptesicus fuscus*	20240822_BBBA_12_1	t12	FP	08/22/24	10	225	16T 670948 4465089	I	47.2	J	F	No
Big Brown Bat	*Eptesicus fuscus*	20240823_BBBA_36_1	t36	FP	08/23/24	26	154	16T 677368 4464719	I	47.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240823_ERBA_55_1	t55	RP	08/23/24	18	48	16T 681201 4466131	I	39.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240826_ERBA_09_1	t09	FP	08/26/24	1	148	16T 668549 4464878	I	39.3	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240826_ERBA_10_1	t10	FP	08/26/24	48	118	16T 669993 4465159	I	40.3	U	U	No
Big Brown Bat	*Eptesicus fuscus*	20240827_BBBA_48_1	t48	RP	08/27/24	5	280	16T 678832 4468017	I	45.3	A	M	No
Big Brown Bat	*Eptesicus fuscus*	20240829_BBBA_09_1	t09	FP	08/29/24	16	334	16T 668541 4464893	I	46.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240902_SHBA_06_1	t06	RP	09/02/24	23	180	16T 670807 4466640	I	41.0	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240903_SHBA_48_1	t48	RP	09/03/24	29	238	16T 678812 4468000	I	38.0	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240905_SHBA_10_1	t10	FP	09/05/24	34	133	16T 669975 4465158	I	38.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240905_SHBA_10_2	t10	FP	09/05/24	12	86	16T 669962 4465182	I	38.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240905_SHBA_12_1	t12	FP	09/05/24	44	275	16T 670911 4465099	I	41.1	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240906_SHBA_40_1	t40	FP	09/06/24	24	97	16T 675080 4462974	I	39.8	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240906_SHBA_40_2	t40	FP	09/06/24	28	334	16T 675043 4463001	I	40.1	A	M	No
Big Brown Bat	*Eptesicus fuscus*	20240906_BBBA_43_1	t43	RP	09/06/24	5	9	16T 676663 4462959	P	44.6	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240906_SHBA_43_1	t43	RP	09/06/24	5	222	16T 676659 4462950	I	41.5	A	M	No
Hoary Bat	*Lasiurus cinereus*	20240906_HOBA_44_1	t44	FP	09/06/24	17	270	16T 676667 4462313	I	54.6	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240906_SHBA_44_1	t44	FP	09/06/24	38	346	16T 676674 4462350	I	40.4	A	M	No
Indiana Bat	*Myotis sodalis*	20240906_INBA_57_1	t57	RP	09/06/24	23	298	16T 681065 4464871	I	36.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240909_SHBA_09_1	t09	FP	09/09/24	48	112	16T 668593 4464862	I	41.7	A	F	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Condition[b]	Forearm Length (mm)	Age[c]	Sex[d]	Incidental Find?
Hoary Bat	*Lasiurus cinereus*	20240909_HOBA_13_1	t13	RP	09/09/24	6	297	16T 671208 4464737	I	NA	U	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240910_SHBA_32_1	t32	RP	09/10/24	53	91	16T 672678 4462653	I	39.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240910_ERBA_33_1	t33	RP	09/10/24	4	172	16T 675323 4465281	P	0.0	U	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240910_SHBA_34_1	t34	RP	09/10/24	29	95	16T 675971 4464403	I	38.0	A	U	No
Hoary Bat	*Lasiurus cinereus*	20240912_HOBA_06_1	t06	RP	09/12/24	9	171	16T 670808 4466654	I	53.0	A	F	No
Eastern Red Bat	*Lasiurus borealis*	20240912_ERBA_14_1	t14	RP	09/12/24	4	223	16T 668759 4463369	I	39.0	A	F	No
Hoary Bat	*Lasiurus cinereus*	20240913_HOBA_49_1	t49	FP	09/13/24	43	239	16T 679334 4468026	I	54.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240913_SHBA_49_1	t49	FP	09/13/24	20	259	16T 679351 4468045	I	40.0	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240913_ERBA_57_1	t57	RP	09/13/24	3	339	16T 681084 4464864	I	38.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240916_SHBA_09_1	t09	FP	09/16/24	51	256	16T 668499 4464866	I	40.6	U	U	No
Eastern Red Bat	*Lasiurus borealis*	20240920_ERBA_35_1	t35	RP	09/20/24	6	259	16T 677227 4465186	P	0.0	A	U	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240923_SHBA_19_1	t19	FP	09/23/24	39	128	16T 674319 4468683	I	42.0	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240923_SHBA_20_1	t20	RP	09/23/24	3	314	16T 674000 4467361	I	37.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240924_SHBA_54_1	t54	RP	09/24/24	33	264	16T 682029 4466478	I	40.6	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240926_SHBA_10_1	t10	FP	09/26/24	38	264	16T 669912 4465176	I	40.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240926_SHBA_24_1	t24	RP	09/26/24	23	161	16T 672909 4466573	I	39.7	A	M	No
Eastern Red Bat	*Lasiurus borealis*	20240927_ERBA_49_1	t49	FP	09/27/24	31	252	16T 679341 4468039	I	39.0	A	F	No
Silver-haired Bat	*Lasionycteris noctivagans*	20240930_SHBA_19_1	t19	FP	09/30/24	51	304	16T 674245 4468733	I	39.0	A	M	No
Silver-haired Bat	*Lasionycteris noctivagans*	20241001_SHBA_37_1	t37	RP	10/01/24	46	326	16T 674141 4463665	A	0.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20241004_ERBA_34_1	t34	RP	10/04/24	10	91	16T 675952 4464405	I	39.0	A	M	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Condition[b]	Forearm Length (mm)	Age[c]	Sex[d]	Incidental Find?
Eastern Red Bat	*Lasiurus borealis*	20241014_ERBA_12_1	t12	FP	10/14/24	15	217	16T 670946 4465084	I	37.0	A	U	No
Eastern Red Bat	*Lasiurus borealis*	20240327_ERBA_23_1	t23	RP	03/27/24	4	219	16T 672555 4466709	I	39.0	A	F	Yes
Silver-haired Bat	*Lasionycteris noctivagans*	20230410_SHBA_49_1	t49	FP	04/10/24	9	37	16T 679376 4468057	I	40.0	A	F	Yes
Eastern Red Bat	*Lasiurus borealis*	20240731_ERBA_11_1	t11	RP	07/31/24	7	285	16T 670572 4465199	I	40.0	A	U	Yes
Eastern Red Bat	*Lasiurus borealis*	20240731_ERBA_12_1	t12	FP	07/31/24	33	196	16T 670946 4465064	I	38.0	A	M	Yes
Hoary Bat	*Lasiurus cinereus*	20240731_HOBA_13_1	t13	RP	07/31/24	12	351	16T 671211 4464746	I	55.0	A	F	Yes
Big Brown Bat	*Eptesicus fuscus*	20240731_BBBA_16_1	t16	RP	07/31/24	8	347	16T 669703 4463791	I	46.0	A	F	Yes
Hoary Bat	*Lasiurus cinereus*	20240731_HOBA_40_1	t40	FP	07/31/24	4	50	16T 675059 4462979	I	52.9	A	F	Yes
Eastern Red Bat	*Lasiurus borealis*	20240808_ERBA_05_1	t05	RP	08/08/24	23	187	16T 670394 4466615	I	36.0	J	M	Yes
Eastern Red Bat	*Lasiurus borealis*	20240809_ERBA_30_1	t30	RP	08/09/24	23	191	16T 677714 4463567	I	39.8	A	U	Yes
Silver-haired Bat	*Lasionycteris noctivagans*	20240916_SHBA_06_1	t06	RP	09/16/24	35	238	16T 670777 4466644	I	40.5	A	F	Yes

[a] Plot Type: FP = cleared full plot; RP = road and pad plot

[b] Condition: I = Intact; P = Partial; D = Dismembered; A = Alive

[c] Age: A = Adult; J = Juvenile; U = Unknown

[d] Sex: M = Male; F = Female; U = Unknown

APPENDIX A-2

LIST OF AVIAN CARCASSES LOCATED DURING POST-CONSTRUCTION MONITORING SURVEYS AT BLUFF POINT WIND ENERGY CENTER

List of Avian Carcasses Located during Post-construction Monitoring Surveys at Bluff Point Wind Energy Center

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Incidental Find?[b]
Horned Lark	*Eremophila alpestris*	20230404_HOLA_12_1	12	FP	4/4/23	45	270	16T 670910 4465095	No
Northern Flicker	*Colaptes auratus*	20230408_NOFL_35_1	35	FP	4/8/23	27	53	16T 677254 4465204	No
European Starling	*Sturnus vulgaris*	20230419_EUST_18_1	18	RP	4/19/23	3	220	16T 673882 4468719	No
Horned Lark	*Eremophila alpestris*	20230425_HOLA_08_1	8	FP	4/25/23	5	119	16T 668096 4464883	No
Northern Bobwhite	*Colinus virginianus*	20230512_NOBO_01_1	1	RP	5/12/23	4	147	16T 668541 4467717	No
Killdeer	*Charadrius vociferus*	20230512_KILL_08_1	8	FP	5/12/23	21	34	16T 668103 4464903	No
Indigo Bunting	*Passerina cyanea*	20230517_INBU_19_1	19	FP	5/17/23	13	263	16T 674275 4468704	No
Indigo Bunting	*Passerina cyanea*	20230518_INBU_10_1	10	FP	5/18/23	7	11	16T 669951 4465188	No
Brown-headed Cowbird	*Molothrus ater*	20230519_BHCO_36_1	36	FP	5/19/23	11	315	16T 677348 4464750	No
Northern Bobwhite	*Colinus virginianus*	20230711_NOBO_02_1	2	RP	7/11/23	2	39	16T 668715 4467341	No
Killdeer	*Charadrius vociferus*	20230711_KILL_10_1	10	FP	7/11/23	25	169	16T 669955 4465156	No
Killdeer	*Charadrius vociferus*	20230717_KILL_26_1	26	RP	7/17/23	4	331	16T 674388 4466176	No
Mourning Dove	*Zenaida macroura*	20230801_MODO_04_1	4	RP	8/1/23	4	204	16T 669649 4466546	No
Northern Bobwhite	*Colinus virginianus*	20230801_NOBO_25_1	25	RP	8/1/23	5	281	16T 673258 4466501	No
Northern Bobwhite	*Colinus virginianus*	20230801_NOBO_25_2	25	RP	8/1/23	4	284	16T 673259 4466501	No
Killdeer	*Charadrius vociferus*	20230804_KILL_08_1	8	FP	8/4/23	39	23	16T 668106 4464921	No
Northern Bobwhite	*Colinus virginianus*	20230804_NOBO_25_1	25	RP	8/4/23	6	239	16T 673258 4466497	No
Killdeer	*Charadrius vociferus*	20230805_KILL_09_1	9	FP	8/5/23	30	284	16T 668519 4464886	No
Killdeer	*Charadrius vociferus*	20230807_KILL_22_1	22	FP	8/7/23	30	19	16T 674855 4467564	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Incidental Find?[b]
Red-tailed Hawk	*Buteo jamaicensis*	20230808_RTHA_02_1	2	RP	8/8/23	6	50	16T 668718 4467343	No
Horned Lark	*Eremophila alpestris*	20230809_HOLA_54_1	54	FP	8/9/23	10	5	16T 682062 4466492	No
Unknown Small bird	*Aves sp. (small)*	20230810_XXSB_40_1	40	FP	8/10/23	36	167	16T 675065 4462942	No
Horned Lark	*Eremophila alpestris*	20230811_HOLA_39_1	39	FP	8/11/23	32	261	16T 674655 4463067	No
Horned Lark	*Eremophila alpestris*	20230813_HOLA_10_1	10	FP	8/13/23	44	136	16T 669981 4465150	No
Unknown Bird Sp.	*Aves sp.*	20230814_XXBI_25_1	25	RP	8/14/23	2	94	16T 673265 4466500	No
Horned Lark	*Eremophila alpestris*	20230821_HOLA_10_1	10	FP	8/21/23	32	336	16T 669936 4465210	No
Horned Lark	*Eremophila alpestris*	20230821_HOLA_10_2	10	FP	8/21/23	31	329	16T 669933 4465207	No
Unknown Passerine	*Passeriformes sp.*	20230822_XXPA_06_1	6	RP	8/22/23	94	256	16T 670716 4466638	No
Turkey Vulture	*Cathartes aura*	20230825_TUVU_30_1	30	RP	8/25/23	3	182	16T 677718 4463587	No
Horned Lark	*Eremophila alpestris*	20230825_HOLA_54_1	54	FP	8/25/23	50	34	16T 682088 4466524	No
Killdeer	*Charadrius vociferus*	20230829_KILL_22_1	22	FP	8/29/23	17	148	16T 674855 4467521	No
Killdeer	*Charadrius vociferus*	20230830_KILL_15_1	15	FP	8/30/23	18	221	16T 669151 4463361	No
Red-tailed Hawk	*Buteo jamaicensis*	20230831_RTHA_06_1	6	RP	8/31/23	21	177	16T 670808 4466642	No
Horned Lark	*Eremophila alpestris*	20230904_HOLA_32_1	32	FP	9/4/23	3	108	16T 672628 4462652	No
Horned Lark	*Eremophila alpestris*	20230905_HOLA_22_1	22	FP	9/5/23	64	318	16T 674802 4467582	No
Killdeer	*Charadrius vociferus*	20230905_KILL_22_1	22	FP	9/5/23	14	79	16T 674859 4467538	No
Horned Lark	*Eremophila alpestris*	20230906_HOLA_09_1	9	FP	9/6/23	22	310	16T 668531 4464893	No
Unknown Shorebird	*Charadriiformes sp.*	20230910_XXSH_42_1	42	RP	9/10/23	64	225	16T 676243 4463132	No
Turkey Vulture	*Cathartes aura*	20230911_TUVU_48_1	48	FP	9/11/23	32	180	16T 678837 4467984	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Incidental Find?[b]
Horned Lark	*Eremophila alpestris*	20230913_HOLA_12_1	12	FP	9/13/23	35	293	16T 670922 4465109	No
Horned Lark	*Eremophila alpestris*	20230913_HOLA_48_1	48	FP	9/13/23	34	269	16T 678803 4468015	No
Horned Lark	*Eremophila alpestris*	20230914_HOLA_10_1	10	FP	9/14/23	18	339	16T 669943 4465197	No
Horned Lark	*Eremophila alpestris*	20230915_HOLA_48_1	48	FP	9/15/23	35	312	16T 678810 4468039	No
Red-eyed Vireo	*Vireo olivaceus*	20230918_REVI_54_1	54	FP	9/18/23	8	247	16T 682054 4466479	No
Horned Lark	*Eremophila alpestris*	20230919_HOLA_17_1	17	RP	9/19/23	52	124	16T 673528 4468689	No
Blackburnian Warbler	*Setophaga fusca*	20230919_BLBW_22_1	22	FP	9/19/23	57	212	16T 674817 4467486	No
Horned Lark	*Eremophila alpestris*	20230919_HOLA_39_1	39	FP	9/19/23	26	75	16T 674711 4463080	No
Horned Lark	*Eremophila alpestris*	20230920_HOLA_10_1	10	FP	9/20/23	25	212	16T 669937 4465159	No
Turkey Vulture	*Cathartes aura*	20230924_TUVU_35_1	35	FP	9/24/23	34	288	16T 677200 4465197	No
Horned Lark	*Eremophila alpestris*	20230925_HOLA_10_1	10	FP	9/25/23	34	249	16T 669918 4465168	No
Northern Parula	*Setophaga americana*	20230925_NOPA_20_1	20	FP	9/25/23	50	294	16T 673956 4467378	No
Magnolia Warbler	*Setophaga magnolia*	20230929_MAWA_48_1	48	FP	9/29/23	10	300	16T 678828 4468021	No
Killdeer	*Charadrius vociferus*	20231003_KILL_35_1	35	FP	10/3/23	58	126	16T 677281 4465154	No
Chimney Swift	*Chaetura pelagica*	20231005_CHSW_54_1	54	FP	10/5/23	41	348	16T 682052 4466522	No
Turkey Vulture	*Cathartes aura*	20231007_TUVU_48_1	48	FP	10/7/23	16	183	16T 678836 4468000	No
Horned Lark	*Eremophila alpestris*	20231012_HOLA_54_1	54	FP	10/12/23	38	216	16T 682040 4466451	No
Turkey Vulture	*Cathartes aura*	20231013_TUVU_09_1	9	FP	10/13/23	44	252	16T 668507 4464865	No
Unknown Sparrow	*Passerellidae sp. (sparrow sp.)*	20231013_XXSP_37_1	37	FP	10/13/23	52	36	16T 674198 4463670	No
Golden-crowned Kinglet	*Regulus satrapa*	20231013_GCKI_42_1	42	RP	10/13/23	61	229	16T 676242 4463137	No

Common Name	Scientific Name	Carcass ID	Turbine No.	Plot Type[a]	Date	Distance from Turbine (m)	Bearing from Turbine (degrees)	Coordinates (UTM)	Incidental Find?[b]
Golden-crowned Kinglet	*Regulus satrapa*	20231013_GCKI_47_1	47	RP	10/13/23	41	209	16T 678555 4468368	No
Chimney Swift	*Chaetura pelagica*	20231013_CHSW_56_1	56	RP	10/13/23	39	146	16T 680966 4465319	No
Killdeer	*Charadrius vociferus*	20231014_KILL_08_1	8	FP	10/14/23	21	100	16T 668112 4464882	No
Golden-crowned Kinglet	*Regulus satrapa*	20231015_GCKI_35_1	35	FP	10/15/23	44	280	16T 677190 4465194	No
Killdeer	*Charadrius vociferus*	20230329_KILL_10_1	10	FP	3/29/23	28	81	16T 669977 4465186	Yes
Turkey Vulture	*Cathartes aura*	20230511_TUVU_21_1	21	RP	5/11/23	45	216	16T 674456 4467571	Yes
Turkey Vulture	*Cathartes aura*	20230519_TUVU_50_1	50	RP	5/19/23	11	75	16T 680446 4468078	Yes
Red-tailed Hawk	*Buteo jamaicensis*	20230522_RTHA_50_1	50	RP	5/22/23	25	134	16T 680453 4468058	Yes
Unknown Bird Sp.	*Aves sp.*	20230727_XXBI_12_1	12	FP	7/27/23	12	92	16T 670967 4465096	Yes
Horned Lark	*Eremophila alpestris*	20230808_HOLA_11_1	11	RP	8/8/23	73	91	16T 670652 4465198	Yes
Killdeer	*Charadrius vociferus*	20230926_KILL_22_1	22	FP	9/26/23	53	194	16T 674834 4467483	Yes
Killdeer	*Charadrius vociferus*	20231009_KILL_04_1	4	RP	10/9/23	33	70	16T 669681 4466562	Yes

[a] Plot Type: FP = cleared full plot; RP = road and pad plot

[b] For avian species, non-incidental finds are those that were located within the search plot during standardized surveys. However, avian species were not included in fatality estimate analysis.

APPENDIX B

MODELS EVALUATED TO DETERMINE THE BEST DISTRIBUTION AND EXPLANATORY VARIABLES FOR ESTIMATING CARCASS PERSISTENCE TIME

Models Evaluated to Determine the Best Distribution and Explanatory Variables for Estimating Carcass Persistence Time

Distribution	Location Formula	Scale Formula	AICc	ΔAICc
Spring				
weibull	l ~ constant	s ~ PlotType	234.51	0.00
weibull	l ~ PlotType	s ~ PlotType	236.62	2.11
weibull	l ~ constant	s ~ constant	239.19	4.68
exponential	l ~ constant	-	239.33	4.82
exponential	l ~ PlotType	-	239.42	4.91
lognormal	l ~ constant	s ~ PlotType	239.90	5.39
weibull	l ~ PlotType	s ~ constant	240.14	5.63
loglogistic	l ~ constant	s ~ PlotType	240.76	6.25
lognormal	l ~ PlotType	s ~ PlotType	242.15	7.64
loglogistic	l ~ PlotType	s ~ PlotType	243.03	8.52
lognormal	l ~ constant	s ~ constant	243.75	9.24
loglogistic	l ~ constant	s ~ constant	244.24	9.73
lognormal	l ~ PlotType	s ~ constant	245.99	11.48
loglogistic	l ~ PlotType	s ~ constant	246.48	11.97
Summer				
lognormal	l ~ constant	s ~ constant	97.66	0.00
loglogistic	l ~ constant	s ~ constant	97.96	0.30
lognormal	l ~ PlotType	s ~ constant	98.64	0.98
loglogistic	l ~ PlotType	s ~ constant	98.92	1.26
weibull	l ~ constant	s ~ constant	99.26	1.60
lognormal	l ~ constant	s ~ PlotType	100.18	2.52
weibull	l ~ PlotType	s ~ constant	100.29	2.63
loglogistic	l ~ constant	s ~ PlotType	100.46	2.80
lognormal	l ~ PlotType	s ~ PlotType	101.45	3.79
loglogistic	l ~ PlotType	s ~ PlotType	101.73	4.07
weibull	l ~ constant	s ~ PlotType	101.82	4.16
weibull	l ~ PlotType	s ~ PlotType	103.07	5.41
exponential	l ~ PlotType	-	128.79	31.13
exponential	l ~ constant	-	129.65	31.99
Fall				
weibull	l ~ constant	s ~ constant	117.44	0.00
lognormal	l ~ constant	s ~ constant	118.79	1.35
weibull	l ~ constant	s ~ PlotType	119.66	2.22
weibull	l ~ PlotType	s ~ constant	119.75	2.31
loglogistic	l ~ constant	s ~ constant	120.30	2.86
lognormal	l ~ constant	s ~ PlotType	121.09	3.65

Distribution	Location Formula	Scale Formula	AICc	ΔAICc
lognormal	l ~ PlotType	s ~ constant	121.13	3.69
weibull	l ~ PlotType	s ~ PlotType	122.13	4.69
loglogistic	l ~ constant	s ~ PlotType	122.63	5.19
loglogistic	l ~ PlotType	s ~ constant	122.64	5.20
lognormal	l ~ PlotType	s ~ PlotType	123.56	6.12
loglogistic	l ~ PlotType	s ~ PlotType	125.10	7.66
exponential	l ~ constant	-	129.54	12.10
exponential	l ~ PlotType	-	131.54	14.10

APPENDIX C

EOA OUTPUTS FOR TAKE ESTIMATES OF COVERED SPECIES

```
Summary statistics for multiple class estimate [Indiana bat]
================================================================================
Input: Detection probability, by search class
  Search coverage = 0.2174

  Class          DWP     X    Ba     Bb   ghat    95% CI
  unsearched   0.783     0   ---    ---    0   [    0,     0]
  Spring_FP    0.0062     0  13.64  26.03 0.344 [0.206, 0.496]
  Spring_RP    0.0024     0  25.15  18.59 0.575 [0.428, 0.716]
  Summer_FP     0.05     0  9.169  8.559 0.517 [0.292, 0.739]
  Summer_FP    0.0167     0  6.628  10.77 0.381 [0.175, 0.613]
  Fall_FP      0.103     0  9.386  21.26 0.306 [0.159, 0.477]
  Fall_FP      0.0392     1  12.03  19.53 0.381 [0.223, 0.554]
================================================================================
Results for full site
________________________________________________________________________________

Detection probability
  Estimated g = 0.082, 95% CI = [0.062, 0.105]
  Fitted beta distribution parameters for estimated g: Ba = 51.8592, Bb = 579.1199

Mortality
  M* = 14 for credibility 1 - alpha = 0.5, i.e., P(M <= 14) >= 50%
  Estimated annual fatality rate: lambda = 18.7, 95% CI = [ 1.32, 59.56]

Test of assumed relative weights (rho)
  Class          Assumed   Fitted (95% CI)
  unsearched      0.783      NA
  Spring_FP       0.006    [0.000, 0.113]
  Spring_RP       0.002    [0.000, 0.089]
  Summer_FP       0.050    [0.000, 0.106]
  Summer_FP       0.017    [0.000, 0.127]
  Fall_FP         0.103    [0.000, 0.134]
  Fall_FP         0.039    [0.008, 0.187]
  p = 0.64484 for likelihood ratio test of H0: assumed rho = true rho

Mortality rates (lambda) by class
  Class          Median       IQR           95% CI
  unsearched     ---          ---          ---
  Spring_FP        0.69    [ 0.15,  2.03]  [ 0.00,  8.11]
  Spring_RP        0.40    [ 0.09,  1.17]  [ 0.00,  4.53]
  Summer_FP        0.46    [ 0.10,  1.36]  [ 0.00,  5.48]
  Summer_FP        0.65    [ 0.14,  1.94]  [ 0.00,  8.23]
  Fall_FP          0.79    [ 0.18,  2.35]  [ 0.00,  9.68]
  Fall_FP          3.24    [ 1.64,  5.77]  [ 0.29, 14.21]

Posterior distribution of M
m     p(M = m) p(M > m)
0      0.0000   1.0000
1      0.0222   0.9778
```

2	0.0312	0.9466
3	0.0362	0.9105
4	0.0389	0.8716
5	0.0403	0.8312
6	0.0408	0.7904
7	0.0406	0.7498
8	0.0400	0.7098
9	0.0390	0.6707
10	0.0379	0.6329
11	0.0365	0.5964
12	0.0350	0.5613
13	0.0335	0.5278
14	0.0320	0.4958
15	0.0304	0.4654
16	0.0289	0.4365
17	0.0274	0.4092
18	0.0259	0.3833
19	0.0244	0.3588
20	0.0230	0.3358
21	0.0217	0.3141
22	0.0204	0.2936
23	0.0192	0.2744
24	0.0180	0.2564
25	0.0169	0.2395
26	0.0159	0.2236
27	0.0149	0.2087
28	0.0140	0.1947
29	0.0131	0.1817
30	0.0122	0.1694
31	0.0114	0.1580
32	0.0107	0.1473
33	0.0100	0.1373
34	0.0093	0.1280
35	0.0087	0.1192
36	0.0081	0.1111
37	0.0076	0.1035
38	0.0071	0.0964
39	0.0066	0.0897
40	0.0062	0.0836
41	0.0058	0.0778
42	0.0054	0.0724
43	0.0050	0.0674
44	0.0047	0.0627
45	0.0044	0.0584
46	0.0041	0.0543
47	0.0038	0.0505
48	0.0035	0.0470
49	0.0033	0.0437
50	0.0031	0.0406
51	0.0029	0.0378

52	0.0027	0.0351
53	0.0025	0.0326
54	0.0023	0.0303
55	0.0021	0.0282
56	0.0020	0.0262
57	0.0019	0.0243
58	0.0017	0.0226
59	0.0016	0.0210
60	0.0015	0.0195
61	0.0014	0.0181
62	0.0013	0.0167
63	0.0012	0.0155
64	0.0011	0.0144
65	0.0011	0.0133
66	0.0010	0.0124
67	0.0009	0.0114
68	0.0009	0.0106
69	0.0008	0.0098
70	0.0007	0.0091
71	0.0007	0.0084
72	0.0006	0.0077
73	0.0006	0.0071
74	0.0006	0.0066
75	0.0005	0.0061
76	0.0005	0.0056
77	0.0004	0.0051
78	0.0004	0.0047
79	0.0004	0.0043
80	0.0004	0.0040
81	0.0003	0.0036
82	0.0003	0.0033
83	0.0003	0.0030
84	0.0003	0.0028
85	0.0003	0.0025
86	0.0002	0.0023
87	0.0002	0.0020
88	0.0002	0.0018
89	0.0002	0.0016
90	0.0002	0.0015
91	0.0002	0.0013
92	0.0002	0.0011
93	0.0001	0.0010
94	0.0001	0.0009
95	0.0001	0.0007
96	0.0001	0.0006
97	0.0001	0.0005
98	0.0001	0.0004
99	0.0001	0.0003
100	0.0001	0.0002
101	0.0001	0.0001

102	0.0001	0.0001
103	0.0001	0.0000

```
Summary statistics for multiple class estimate [northern long-eared bat]
================================================================================
Input: Detection probability, by search class
  Search coverage = 0.2174

  Class          DWP     X    Ba     Bb   ghat    95% CI
  unsearched   0.783     0   ---    ---    0   [    0,     0]
  Spring_FP    0.0062     0  13.64  26.03 0.344 [0.206, 0.496]
  Spring_RP    0.0024     0  25.15  18.59 0.575 [0.428, 0.716]
  Summer_FP     0.05     0  9.169  8.559 0.517 [0.292, 0.739]
  Summer_FP    0.0167     0  6.628  10.77 0.381 [0.175, 0.613]
  Fall_FP      0.103     0  9.386  21.26 0.306 [0.159, 0.477]
  Fall_FP      0.0392     0  12.03  19.53 0.381 [0.223, 0.554]
================================================================================
Results for full site
________________________________________________________________________________

Detection probability
  Estimated g = 0.082, 95% CI = [0.062, 0.105]
  Fitted beta distribution parameters for estimated g: Ba = 51.8592, Bb = 579.1199

Mortality
  M* = 2 for credibility 1 - alpha = 0.5, i.e., P(M <= 2) >= 50%
  Estimated annual fatality rate: lambda = 6.25, 95% CI = [ 0.00604, 31.68]

Test of assumed relative weights (rho)
  Class          Assumed   Fitted (95% CI)
  unsearched      0.783      NA
  Spring_FP       0.006    [0.000, 0.156]
  Spring_RP       0.002    [0.000, 0.121]
  Summer_FP       0.050    [0.000, 0.126]
  Summer_FP       0.017    [0.000, 0.156]
  Fall_FP         0.103    [0.000, 0.154]
  Fall_FP         0.039    [0.000, 0.150]
  p = 1 for likelihood ratio test of H0: assumed rho = true rho

Mortality rates (lambda) by class
  Class          Median       IQR           95% CI
  unsearched     ---          ---           ---
  Spring_FP        0.69    [ 0.15,  2.03]  [ 0.00,  8.11]
  Spring_RP        0.40    [ 0.09,  1.17]  [ 0.00,  4.53]
  Summer_FP        0.46    [ 0.10,  1.36]  [ 0.00,  5.48]
  Summer_FP        0.65    [ 0.14,  1.94]  [ 0.00,  8.23]
  Fall_FP          0.79    [ 0.18,  2.35]  [ 0.00,  9.68]
  Fall_FP          0.62    [ 0.14,  1.84]  [ 0.00,  7.38]

Posterior distribution of M
m     p(M = m) p(M > m)
0      0.3166   0.6834
1      0.1203   0.5631
```

2	0.0848	0.4783
3	0.0656	0.4127
4	0.0531	0.3596
5	0.0441	0.3156
6	0.0372	0.2783
7	0.0318	0.2465
8	0.0275	0.2191
9	0.0239	0.1952
10	0.0209	0.1744
11	0.0183	0.1560
12	0.0161	0.1399
13	0.0143	0.1256
14	0.0127	0.1129
15	0.0113	0.1017
16	0.0100	0.0916
17	0.0090	0.0826
18	0.0080	0.0746
19	0.0072	0.0674
20	0.0065	0.0610
21	0.0058	0.0551
22	0.0052	0.0499
23	0.0047	0.0452
24	0.0042	0.0410
25	0.0038	0.0372
26	0.0035	0.0337
27	0.0031	0.0306
28	0.0028	0.0277
29	0.0026	0.0252
30	0.0023	0.0229
31	0.0021	0.0207
32	0.0019	0.0188
33	0.0017	0.0171
34	0.0016	0.0155
35	0.0014	0.0141
36	0.0013	0.0128
37	0.0012	0.0116
38	0.0011	0.0105
39	0.0010	0.0095
40	0.0009	0.0086
41	0.0008	0.0078
42	0.0007	0.0071
43	0.0007	0.0064
44	0.0006	0.0058
45	0.0006	0.0052
46	0.0005	0.0047
47	0.0005	0.0042
48	0.0004	0.0038
49	0.0004	0.0034
50	0.0004	0.0030
51	0.0003	0.0027

52	0.0003	0.0024
53	0.0003	0.0021
54	0.0003	0.0019
55	0.0002	0.0017
56	0.0002	0.0014
57	0.0002	0.0012
58	0.0002	0.0011
59	0.0002	0.0009
60	0.0002	0.0008
61	0.0001	0.0006
62	0.0001	0.0005
63	0.0001	0.0004
64	0.0001	0.0003
65	0.0001	0.0002
66	0.0001	0.0001
67	0.0001	0.0000

Summary statistics for mortality estimates through 4 years [Indiana bat]

Results

M* = 24 for 1 - α = 0.5, i.e., P(M <= 24) >= 50%
Estimated overall detection probability: g = 0.17, 95% CI = [0.157, 0.183]
Ba = 541, Bb = 2646.6
Estimated baseline fatality rate (for rho = 1): lambda = 6.643, 95% CI = [1.99, 14.1]

Cumulative Mortality Estimates

Year	X	g	M*	median	95% CI	mean lambda	95% CI
2021	0	0.124	1	1	[0, 14]	4.076	[0.003964, 20.57]
2022	1	0.196	6	6	[1, 18]	7.674	[0.5507, 23.97]
2023	3	0.199	16	16	[5, 35]	17.64	[4.246, 40.46]
2024	4	0.170	24	24	[9, 51]	26.57	[7.948, 56.33]

Annual Mortality Estimates

Year	X	g	M*	median	95% CI	mean lambda	95% CI
2021	0	0.124	1	1	[0, 14]	4.0760	[0.0040, 20.5700]
2022	1	0.268	4	4	[1, 13]	5.6210	[0.4031, 17.5700]
2023	2	0.205	10	10	[3, 28]	12.3300	[2.0310, 31.9500]
2024	1	0.082	14	14	[2, 56]	18.7400	[1.3200, 59.5600]

Test of assumed relative weights (rho) and potential bias

Assumed rho	Fitted rho 95% CI
1	[0.002, 1.748]
1	[0.040, 1.726]
1	[0.209, 2.758]
1	[0.220, 3.314]

p = 0.46661 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 0.896

==
Input

Year (or period)	rho	X	Ba	Bb	ghat	95% CI
2021	1.000	0	104.5	737.1	0.124	[0.103, 0.147]
2022	1.000	1	267.7	731.5	0.268	[0.241, 0.296]
2023	1.000	2	126.6	492.2	0.205	[0.174, 0.237]
2024	1.000	1	51.86	579.1	0.082	[0.062, 0.105]

Summary statistics for mortality estimates through 4 years [northern long-eared bat] ----------------------------------
Results

M* = 1 for 1 - α = 0.5, i.e., P(M <= 1) >= 50%
Estimated overall detection probability: g = 0.17, 95% CI = [0.157, 0.183]
Ba = 541, Bb = 2646.6
Estimated baseline fatality rate (for rho = 1): lambda = 0.738, 95% CI = [0.00072, 3.71]

Cumulative Mortality Estimates

Year	X	g	M*	median	95% CI	mean lambda	95% CI
2021	0	0.124	1	1	[0, 14]	4.076	[0.003964, 20.57]
2022	0	0.196	1	1	[0, 8]	2.558	[0.002528, 12.86]
2023	0	0.199	1	1	[0, 8]	2.519	[0.002452, 12.67]
2024	0	0.170	1	1	[0, 10]	2.952	[0.002881, 14.84]

Annual Mortality Estimates

Year	X	g	M*	median	95% CI	mean lambda	95% CI
2021	0	0.124	1	1	[0, 14]	4.0760	[0.0040, 20.5700]
2022	0	0.268	0	0	[0, 6]	1.8740	[0.0018, 9.4260]
2023	0	0.205	1	1	[0, 8]	2.4660	[0.0024, 12.4300]
2024	0	0.082	2	2	[0, 23]	6.2470	[0.0060, 31.6800]

Test of assumed relative weights (rho) and potential bias

Assumed rho	Fitted rho 95% CI
1	[0.006, 3.506]
1	[0.003, 2.849]
1	[0.005, 3.321]
1	[0.015, 3.716]

p = 1 for likelihood ratio test of H0: assumed rho = true rho
Quick test of relative bias: 0.815

==
Input

Year (or period)	rho	X	Ba	Bb	ghat	95% CI
2021	1.000	0	104.5	737.1	0.124	[0.103, 0.147]
2022	1.000	0	267.7	731.5	0.268	[0.241, 0.296]
2023	1.000	0	126.6	492.2	0.205	[0.174, 0.237]
2024	1.000	0	51.86	579.1	0.082	[0.062, 0.105]

Short-term trigger: Test of average fatality rate (lambda) over 3 years [Indiana bat]
Years: 2022 - 2024
==
Results
Estimated overall detection probability: g = 0.185, 95% CI = [0.169, 0.201]
Ba = 433.7, Bb = 1911.9

Estimated annual fatality rate over the past 3 years: lambda = 8.135, 95% CI = [2.43, 17.3]

P(lambda > 5.5) = 0.73
Compliance: Cannot infer lambda > 5.5 with 99% credibility

Input
Threshold for short-term rate (tau) = 5.5 per year

Period	rel_wt	X	Ba	Bb	ghat	95% CI
2022	1.000	1	267.7	731.5	0.268	[0.241, 0.296]
2023	1.000	2	126.6	492.2	0.205	[0.174, 0.237]
2024	1.000	1	51.86	579.1	0.082	[0.062, 0.105]

```
Short-term trigger: Test of average fatality rate (lambda) over 3 years [northern
long-eared bat]
Years: 2022 - 2024
================================================================================
Results
Estimated overall detection probability: g = 0.185, 95% CI = [0.169, 0.201]
   Ba = 433.7, Bb = 1911.9

Estimated annual fatality rate over the past 3 years: lambda = 0.9037, 95% CI =
[0.00088, 4.54]
   P(lambda > 2.8) = 0.0784
   Compliance: Cannot infer lambda > 2.8 with 99% credibility
________________________________________________________________________________
Input
Threshold for short-term rate (tau) =  2.8  per year

Period       rel_wt  X    Ba     Bb   ghat    95% CI
2022         1.000   0  267.7  731.5 0.268 [0.241, 0.296]
2023         1.000   0  126.6  492.2 0.205 [0.174, 0.237]
2024         1.000   0  51.86  579.1 0.082 [0.062, 0.105]
```