Attachment E

Bat Acoustic Activity Survey

Bat Acoustic Activity Survey for the Longspur Wind Project in Morton County, North Dakota

Final Report

April 7 – November 2, 2025

Prepared for:

Minnesota Power

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January 8, 2026

WEST

Confidential Business Information

EXECUTIVE SUMMARY

Western EcoSystems Technology, Inc., completed a bat acoustic activity survey (activity survey) for the Longspur Wind Project (Project) in Morton County, North Dakota, from April 7 – November 2, 2025. The objectives for this activity survey were to 1) record bat acoustic activity to assess seasonal, spatial, and temporal variation at the Project; and 2) document any acoustic evidence of northern long-eared bat and little brown bat. The activity survey followed recommendations from the US Fish and Wildlife Service's *Land-Based Wind Energy Guidelines*, Kunz et al., and the North Dakota Game and Fish Department's *Key Wind Energy Development in North Dakota: Best Management Practices*.

Two Wildlife Acoustics full-spectrum Song Meter SM3BAT ultrasonic detectors (detectors) with ultrasonic microphones were deployed throughout the Project. Each microphone sampled a discrete airspace defined as a survey station. Two survey stations were located in an area representative of where a turbine would be placed (representative stations). Both survey stations were ground stations, one of which was at the base of a meteorological tower.

Detectors recorded an average (± standard error) of 1.08 ± 0.15 bat passes per detector-night at the representative stations. Both sites experienced relatively little activity overall, and the LO1g site recorded slightly more activity (1.50 ± 0.25) compared to the LO2g site (0.66 ± 0.10).

Bat acoustic activity varied among seasons at representative stations, with summer and fall being the most active times. Bat acoustic activity peaked from mid-July through the end of September. Bat acoustic activity during the fall migration period (July 30 – October 14) averaged 2.10 ± 0.34 bat passes per night.

Approximately 74% of passes were classified as low-frequency bats (e.g., big brown, hoary, and silver-haired bats) and 26% of passes were classified as high-frequency bats (e.g., eastern red and little brown bats).

Northern long-eared bats have the potential to occur at the Project, but none were confirmed in the Project area. Little brown bat passes were qualitatively confirmed at both survey stations.

REPORT PARTICIPANTS

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REPORT REFERENCE

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INTRODUCTION

Minnesota Power contracted Western EcoSystems Technology, Inc. (WEST), to complete a bat acoustic activity survey (activity survey) at the proposed Longspur Wind Project (Project) in Morton County, North Dakota (Figure 1). The objectives for this activity survey were to 1) record bat acoustic activity to assess seasonal, spatial, and temporal variation at the Project; and 2) document any acoustic evidence of northern long-eared bat (*Myotis septentrionalis*; NLEB) and little brown bat (*M. lucifugus*; LBBA). The activity survey followed recommendations from the US Fish and Wildlife Service's (USFWS's) *Land-Based Wind Energy Guidelines* (2012), Kunz et al. (2007), and the North Dakota Game and Fish Department's *Key Wind Energy Development in North Dakota: Best Management Practices* (2021). The Project area (Figure 1) was provided by Minnesota Power on October 10, 2024.

BACKGROUND

Eight bat species have the potential to occur within the Project area including NLEB and LBBA (BCI 2025, IUCN 2025, USFWS 2025; Table 1). Of the eight bat species that may occur in the Project area, one (NLEB) is federally listed. NLEB was federally listed as endangered effective March 31, 2023 (USFWS 2023). LBBA is currently under review by the USFWS for listing under the Endangered Species Act of 1973, with a listing decision anticipated in 2026 (USFWS 2024).

Table 1. Bat species with potential to occur at the Longspur Wind Project in Morton County, North Dakota.

Common Name	Scientific Name	Status (federal; state[1])
High Frequency (≥30 kHz)[2]		
eastern red bat	*Lasiurus borealis*	-; SGCN
little brown bat	*Myotis lucifugus*	under review for federal listing; SGCN
long-legged myotis bat	*Myotis volans*	-;-
northern long-eared bat	*Myotis septentrionalis*	federally endangered; SGCN
western small-footed bat	*Myotis ciliolabrum*	-;-
Low Frequency (≤30 kHz)[2]		
big brown bat	*Eptesicus fuscus*	-; SGCN
hoary bat	*Lasiurus cinereus*	-; SGCN
silver-haired bat	*Lasionycteris noctivagans*	-; SGCN

1. North Dakota Game and Fish Department Species of Greatest Conservation Need (2025).

2. Bats may produce pulses outside their typical frequency range.

kHz = kilohertz.

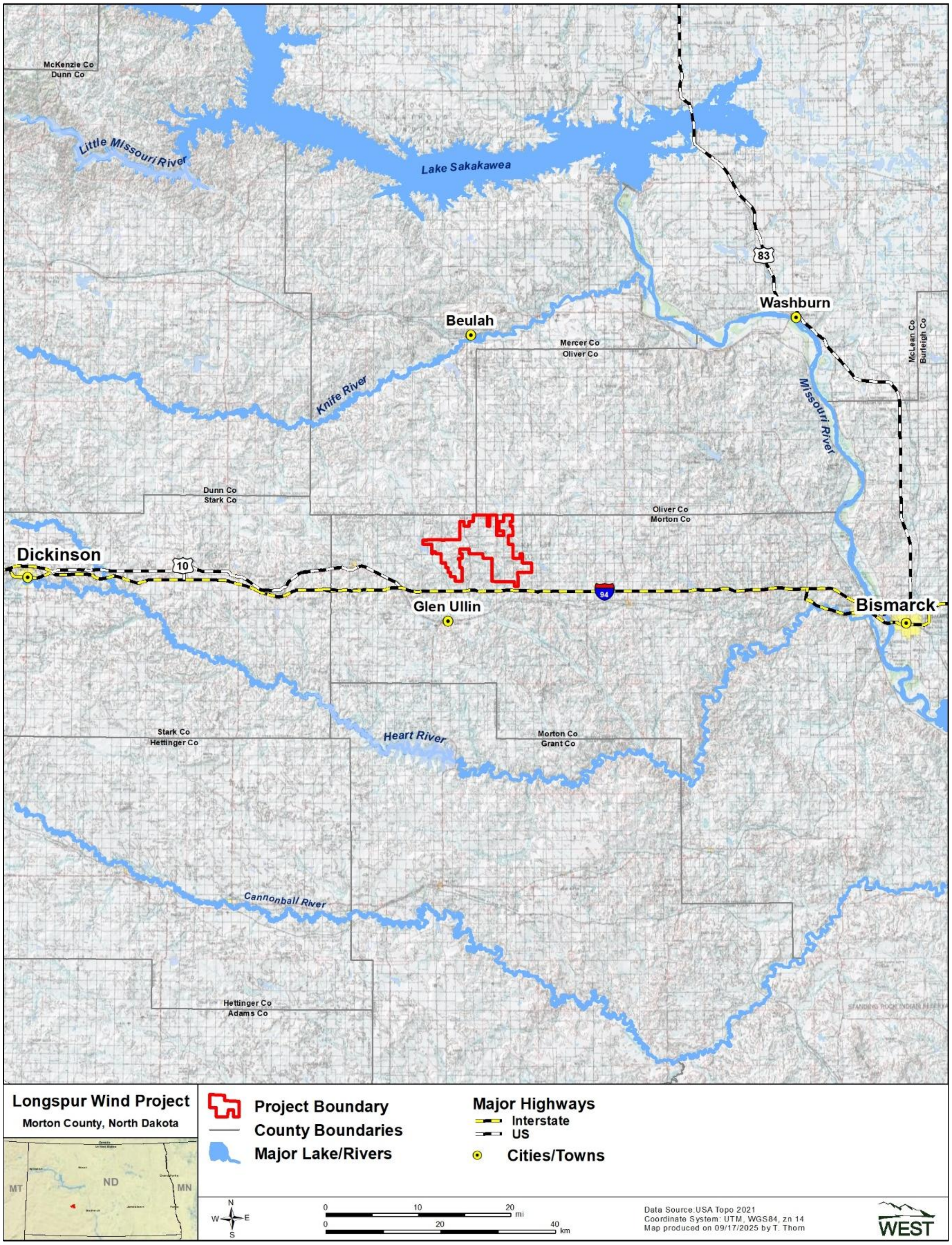

Figure 1. Location of the Longspur Wind Project in Morton County, North Dakota.

PROJECT DESCRIPTION

The proposed 25,933-acre Project is located in south-western North Dakota approximately four miles north of Glen Ullin in Morton County (Figure 1). The Project lies within the Level III Northwestern Great Plains Ecoregion (US Environmental Protection Agency 2012, 2013). According to the National Land Cover Database (2024), the main land cover types within the Project area are cultivated crops (55%), grassland/herbaceous (42%), developed (2%), and hay/pasture (1%; Table 2, Figure 2). The remaining land cover types each make up less than 1% of the Project area (Table 2).

Table 2. Land cover types, coverage, and percent (%) composition at the Longspur Wind Project in Morton County, North Dakota.

Land Cover Types	Coverage (acres)	% Composition
Cultivated Crops	14,165	55
Grassland/Herbaceous	10,904	42
Developed[1]	562	2
Hay/Pasture	205	1
Wetland/Open Water	64	<1
Shrub/Scrub	18	<1
Forest	14	<1
Barren	2	<1
Total	**25,933**	**100**

1. Developed Includes open space, low, medium, high intensity.

Sums of values may not equal totals shown due to rounding.

Source: National Land Cover Database (2024).

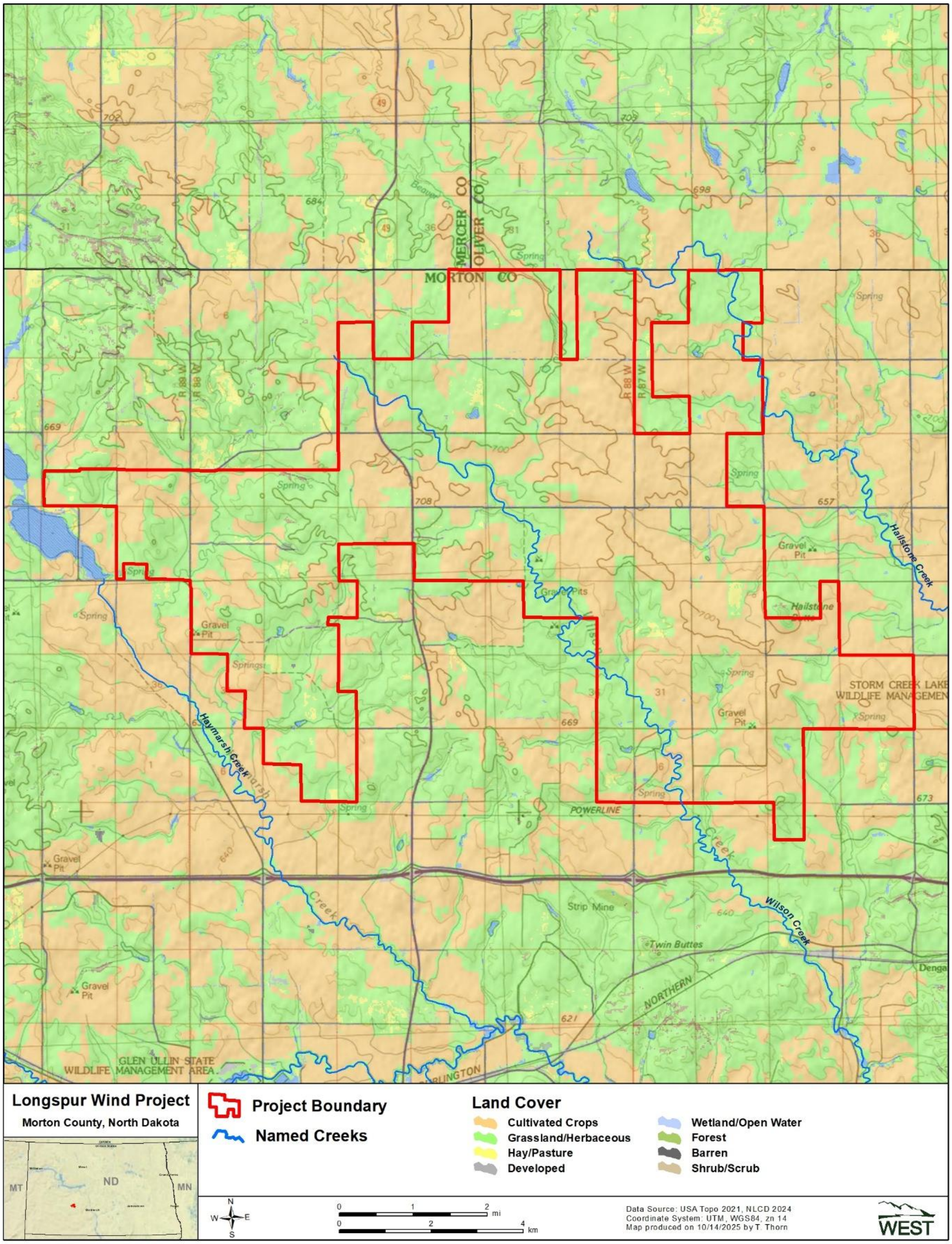

Figure 2. Land cover types within the Longspur Wind Project in Morton County, North Dakota.

METHODS

The activity survey was divided into three periods: spring (April 7 – May 14), summer (May 15 – August 15), and fall (August 16 – November 2) to highlight seasonal acoustic activity patterns. Detectors were programmed to turn on at 18:00 and off at 8:00 to capture bat acoustic activity throughout each night. If more than 30 minutes of the night was missed at a station, the station was classified as “non-operational” for that night.

Ultrasonic Detectors

The activity survey was completed using two full-spectrum Song Meter SM3BAT ultrasonic detectors (detectors; Wildlife Acoustics, Inc. [Wildlife Acoustics], Maynard, Massachusetts). The detectors were equipped with ultrasonic SMM-U1 microphones, which have a variable detection distance up to 98 feet (ft), influenced by atmospheric attenuation (e.g., changes with humidity, temperature, and air pressure), surrounding vegetation, and wind, as well as the bat’s pulse frequency, amplitude, and direction (Blumstein et al. 2011, Adams et al. 2012, Chaverria and Quirós 2017, Goerlitz 2018). Microphones were placed approximately 10 ft above ground level. The microphones were secured atop a PVC[1] pole and connected via audio cables to the detector.

Survey Stations

For this Project, both detectors were placed in locations and habitats similar to where turbines have been proposed (representative stations). Both detectors were ground-only stations, one of which was at the base of a meteorological tower (LO1g; Figure 3; Appendix A).

Data Collection

The full-spectrum bat detectors recorded complete acoustic waveforms by sampling sound waves at a rate of 256 kilohertz (kHz). This high sampling rate enabled the detector to make high-resolution recordings of sound amplitude data at all frequencies up to 128 kHz. Detectors were generally checked every two weeks throughout the survey period to ensure each detector was functioning properly. Summary files associated with each recording session were reviewed to ensure each detector was operational and each microphone was initiating a recording (triggering) throughout the recording period. The detectors were set using a trigger window of five seconds and a maximum file length of 15 seconds. All microphones were fitted with windscreens. Microphones were tested prior to their deployment using an ultrasonic calibrator from Wildlife Acoustics to confirm they met factory thresholds.

[1] PVC = polyvinyl chloride.

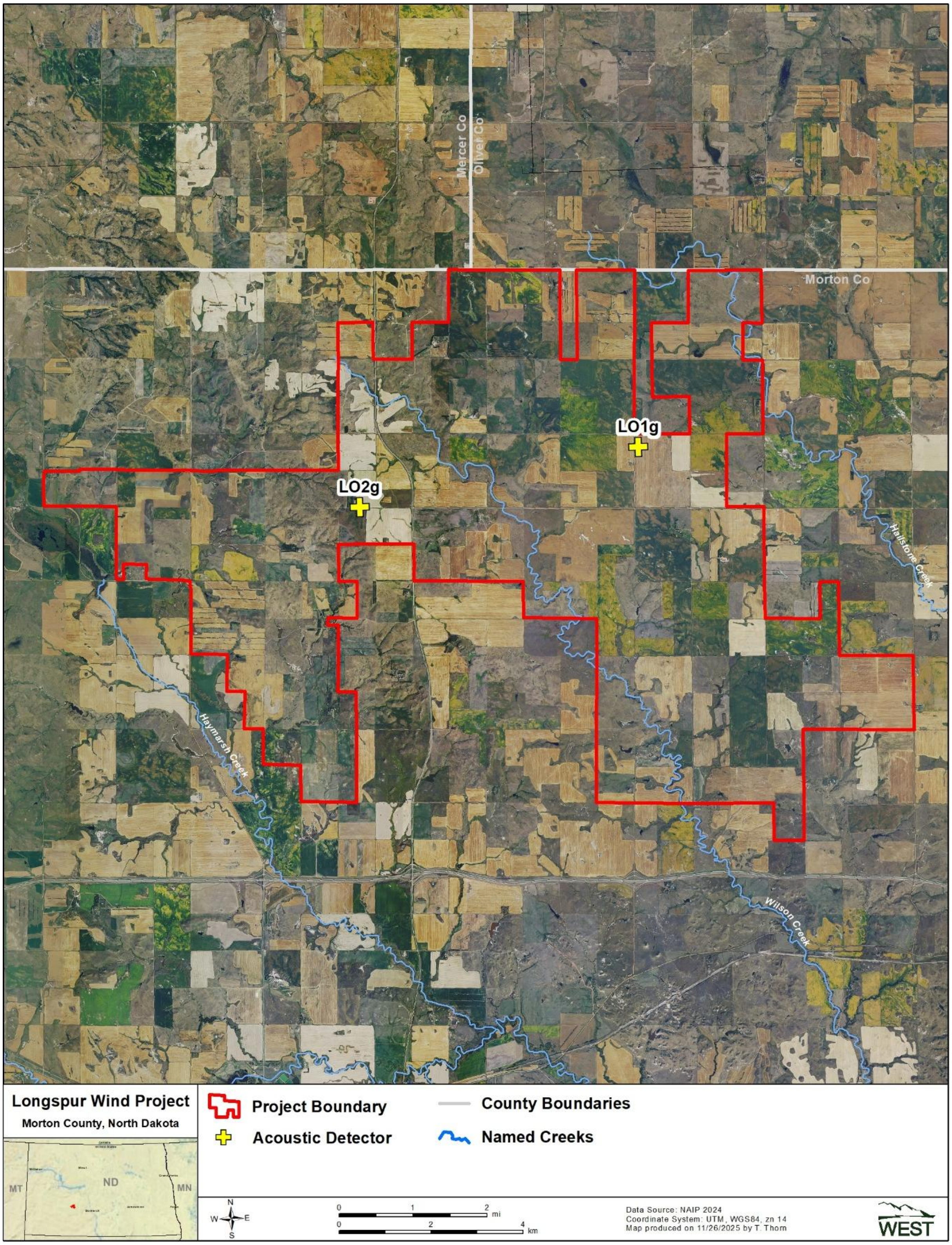

Figure 3. Location of survey stations within the Longspur Wind Project in Morton County, North Dakota.

Acoustic Analysis

Full-spectrum data were run through the automated identification feature in the program Kaleidoscope Pro 5.7.0 (Kaleidoscope; Wildlife Acoustics 2025) using the Bats of North America classifier 5.7.0 at a “0 balanced (neutral)” sensitivity setting. Kaleidoscope uses Hidden Markov Models and other statistical methods known for applications in temporal pattern recognition (Agranat 2012). Only the potentially occurring bat species listed in Table 1 were included in the Kaleidoscope identification model.

During the automated classification, full-spectrum data were also transformed into zero-crossing data using Kaleidoscope, allowing data to be viewed in Analook[2] software as digital sonograms that show changes in echolocation pulse frequency over time. Frequency versus time displays were used to separate bat pulses from other types of ultrasonic noise (e.g., wind, rain, insects) and to determine pulse frequency category. A bat pass was defined as a sequence of at least two echolocation pulses produced by an individual bat with no pause between pulses of more than one second, unless determined to be a single individual by an experienced acoustic analyst (Fenton 1980, Gannon et al. 2003).

Despite the capabilities of Kaleidoscope, many bat passes cannot be identified to species with absolute certainty, either because only pulse fragments were recorded due to the distance between the bat and microphone, or because many bat species produce similar pulses with overlapping characteristics that often cannot be distinguished. Therefore, automated bat identification is imperfect, and each identification has an associated error rate (Clement et al. 2014, Lemen et al. 2015, Russo and Voigt 2016, Rydell et al. 2017). The results of the Kaleidoscope analysis are termed “preliminary” for the reasons noted above and should not be considered an accurate depiction of the species present within the Project area.

For each survey station, bat passes were sorted into two groups based on the minimum pulse frequency. High-frequency (HF) bats (such as the NLEB and LBBA) have minimum frequencies (Fmin) usually greater than or equal to 30 kHz. Low-frequency (LF) bats (such as big brown [*Eptesicus fuscus*], silver-haired [*Lasionycteris noctivagans*], and hoary [*Lasiurus cinereus*] bats) typically emit echolocation pulses with Fmin from 15 to less than or equal to 30 kHz. Due to the flexible nature of bat echolocation, these frequency groups may overlap. While individual pulses may be above or below the cutoffs, the average Fmin for the whole bat pass is used for classification.

A qualified bat biologist with extensive acoustic identification experience in the Great Plains qualitatively reviewed all passes that Kaleidoscope identified as potential NLEB and LBBA. The bat biologist qualitatively identified echolocation passes through visual comparison of echolocation pulse metrics (e.g., Fmin, slope, and duration) to reference passes of known bats (O'Farrell and Gannon 1999, Murray et al. 2001, Yates and Muzika 2006). A second qualified bat biologist with extensive acoustic identification experience reviewed a subset of qualitative pulse

[2] AnaLook. Bat call analysis program. © 2004, C. Corben.

labels for quality assurance. If passes were not characteristic of the automated identification, or contained distinct pulses produced by a different species, or were of insufficient quality; the passes were reclassified.

Data Management

Data Compilation and Storage

A WEST-developed Microsoft® SQL Server database was used to store, organize, and retrieve survey data. Project data were keyed into the electronic database using a pre-defined format to facilitate subsequent quality assurance and quality control (QA/QC) and data analysis. WEST retained all data forms and electronic data files for reference.

Quality Assurance and Quality Control

WEST implemented QA/QC measures at all stages of the study, including in the field, during data entry and analysis, and report writing. Multiple reviews were conducted as QA/QC measures throughout the study-life cycle. Following surveys, bat biologists were responsible for inspecting data forms for completeness, accuracy, and legibility. If errors or anomalies were found within the data, follow-up measures were implemented including discussions and review of field data with field technicians and/or Project Managers. If any errors, omissions, or problems were identified in later stages of analysis or report writing, they were traced back to the raw data forms where appropriate changes and measures were implemented and documented.

Reporting and Review Process

WEST's reporting and review process included technical editing, senior technical review, and a final review by the Project Manager before delivery to the client.

Statistical Analysis

The standard metric used for measuring bat acoustic activity is the number of bat passes per detector-night. A detector-night was defined as one microphone at one detector operating for one entire night. This metric was used as an index of bat acoustic activity in the Project area and does not represent numbers of individuals. The use of bat passes per detector-nights as a metric for calculating bat acoustic activity controlled for differences in the sampling effort among individual detectors and provided unbiased estimates for the deployed nights. A bootstrap analysis was performed to assess variability in the metrics calculated. Bat passes per detector-night were calculated for HF and LF bats.

An experienced bat acoustic analyst determined the number of bat passes using AnaLook. Mean bat acoustic activity was calculated by station, season, week (pre-determined 7-day intervals beginning January 1), and overall. Overall averages were calculated as an unweighted average of total bat acoustic activity at each individual station and averaged within station type (i.e., overall representative).

Mean bat acoustic activity was calculated for a standardized Fall Migration Period (FMP), defined by WEST as July 30 – October 14. The FMP contains portions of both summer and fall seasons and is used to compare bat acoustic activity with other wind projects with data collected and analyzed during the same time period.

RESULTS

Bat acoustic activity was monitored at two survey stations for 375 detector-nights from April 7 – November 2, 2025 (Table 3). Detectors and microphones were operating for 91% of the sampling period (Figure 4). The primary cause of lost data was an intermittently malfunctioning detector at LO1g.

Spatial Bat Activity

Bat acoustic activity within the Project area varied between stations (Table 3, Figure 5). Detectors at representative stations recorded a mean (± standard error) of 1.08 ± 0.15 bat passes per detector-night (Table 3). Station LO1g recorded slightly more bat passes per detector-night (1.50 ± 0.25) than station LO2g (0.66 ± 0.10), but activity was low at both stations overall (Table 3, Figure 5).

Table 3. Results of bat acoustic activity surveys completed at survey stations within the Longspur Wind Project in Morton County, North Dakota from April 7 – November 2, 2025.

Station	# of HF Bat Passes (%)	# of LF Bat Passes (%)	Total Bat Passes	Detector-Nights	Bat Passes/ Detector-Night[1]
LO1g	63 (24)	196 (76)	259	173	1.50 ± 0.25
LO2g	38 (28)	96 (72)	134	202	0.66 ± 0.10
Total (%)	**101 (26)**	**292 (74)**	**393**	**375**	**1.08 ± 0.15**

1. Calculated by total bat passes divided by total operational detector nights; ± bootstrapped standard error.
2. All bat passes were manually labelled as the appropriate group using AnaLook. A Label may be Noise, HF, LF, or a species code.

Note: Passes are separated by pulse frequency: high-frequency (HF; ≥30 kilohertz [kHz]) and low-frequency (LF; ≤30 kHz).

Seasonal Bat Activity

Bat acoustic activity varied among seasons at representative stations, with summer and fall being the most active times. Summer and fall activity were higher than in spring, but activity levels were generally low throughout the monitoring period (Figures 6 and 7, Table 4). Overall bat acoustic activity was highest (2.10 ± 0.34 bat passes/detector-night) during the FMP (Table 4). Weekly bat acoustic activity peaked from mid-July through the end of September for both HF and LF species (Figure 7). LF bat activity was generally higher than HF activity throughout the monitoring period (Figures 6 and 7).

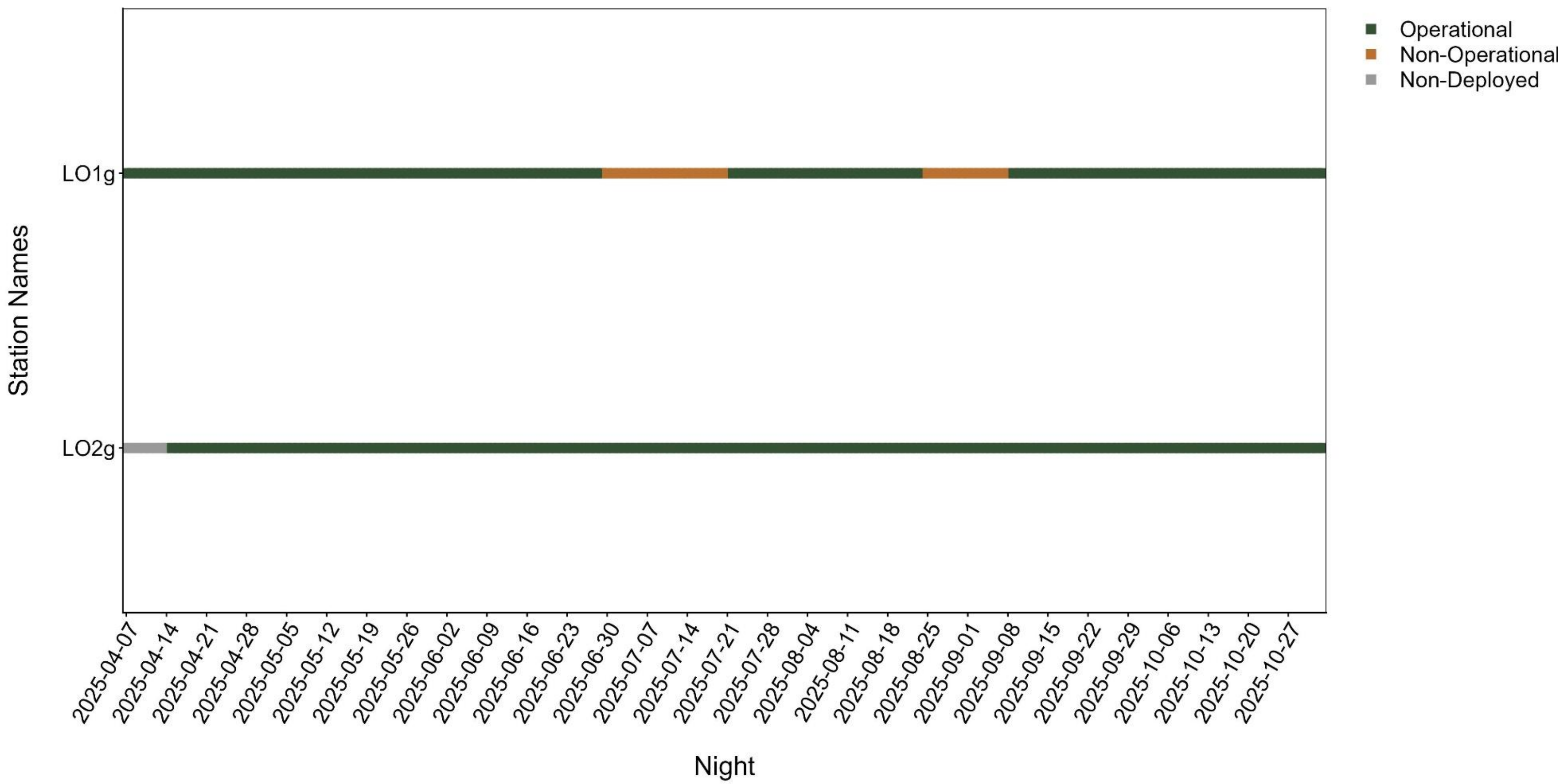

Figure 4. Operational status of survey stations at the Longspur Wind Project in Morton County, North Dakota, from April 7 – November 2, 2025.

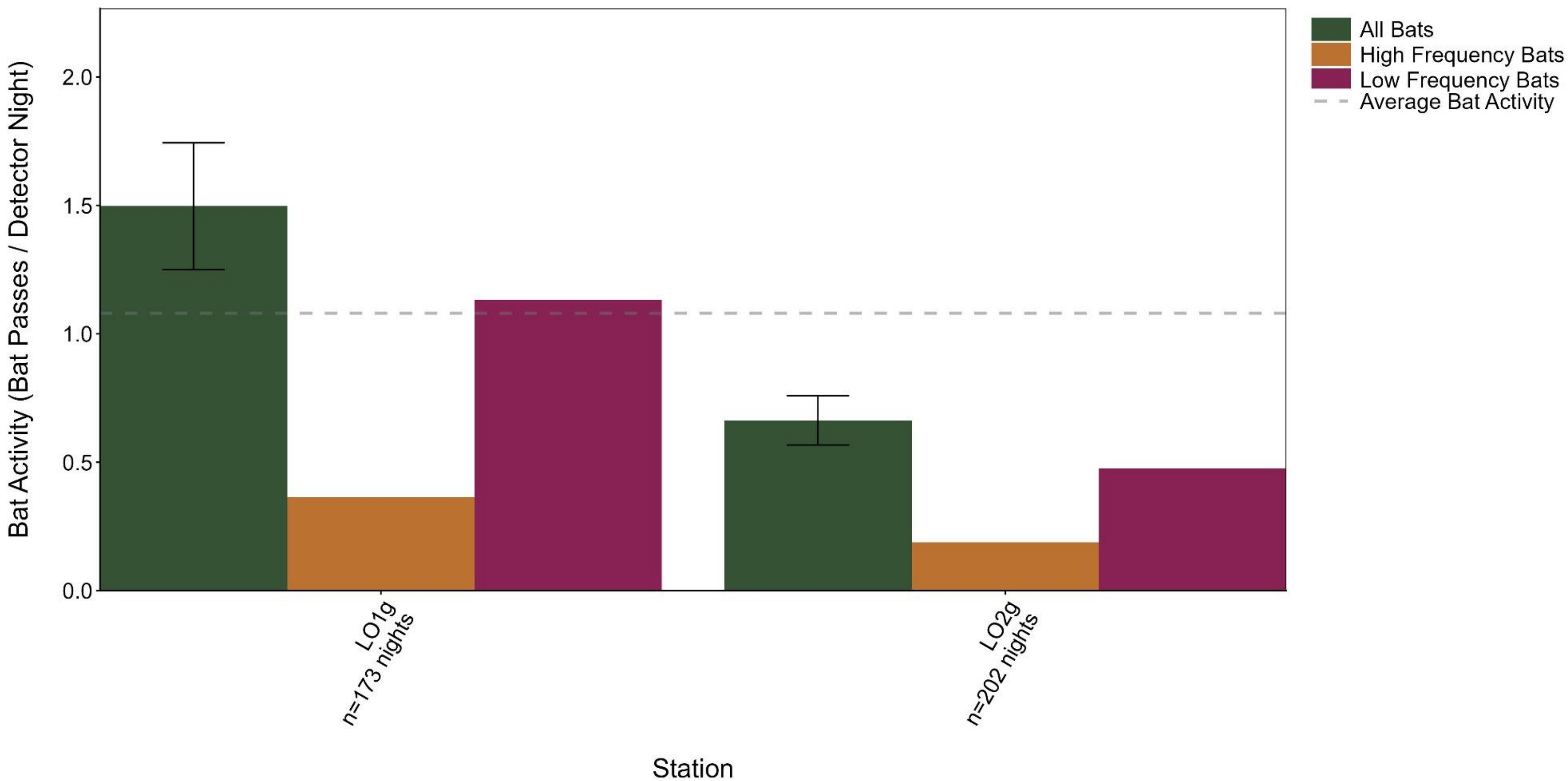

Figure 5. Number of high-frequency, low-frequency, and all bat passes per detector-night recorded at representative stations within the Longspur Wind Project in Morton County, North Dakota, from April 7 – November 2, 2025.

NOTE: The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

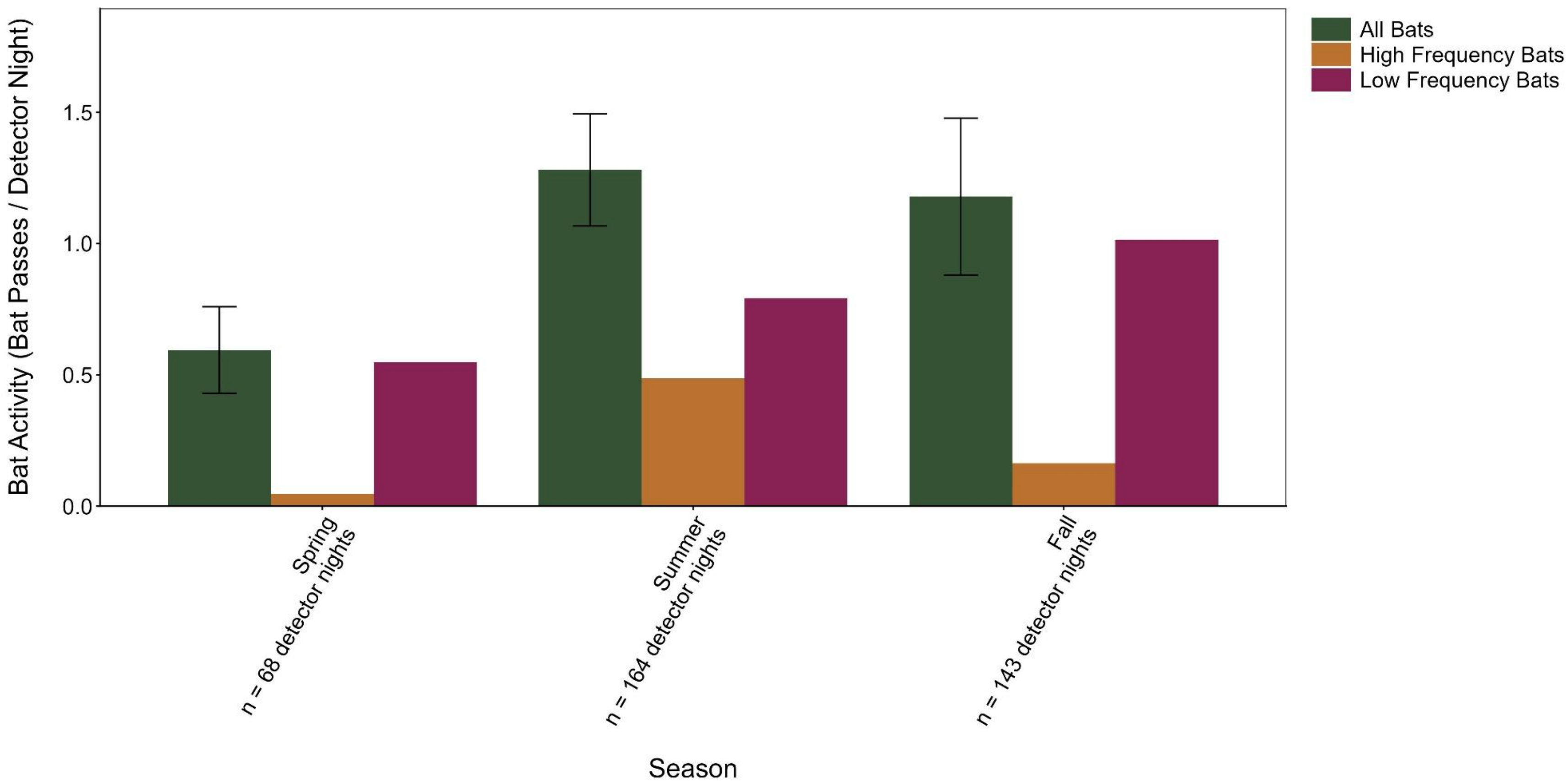

Figure 6. Seasonal bat acoustic activity by high-frequency, low-frequency, and all bats at representative stations at the Longspur Wind Project in Morton County, North Dakota, from April 7 – November 2, 2025.

NOTE: The bootstrapped standard errors are represented on the 'All Bats' columns.

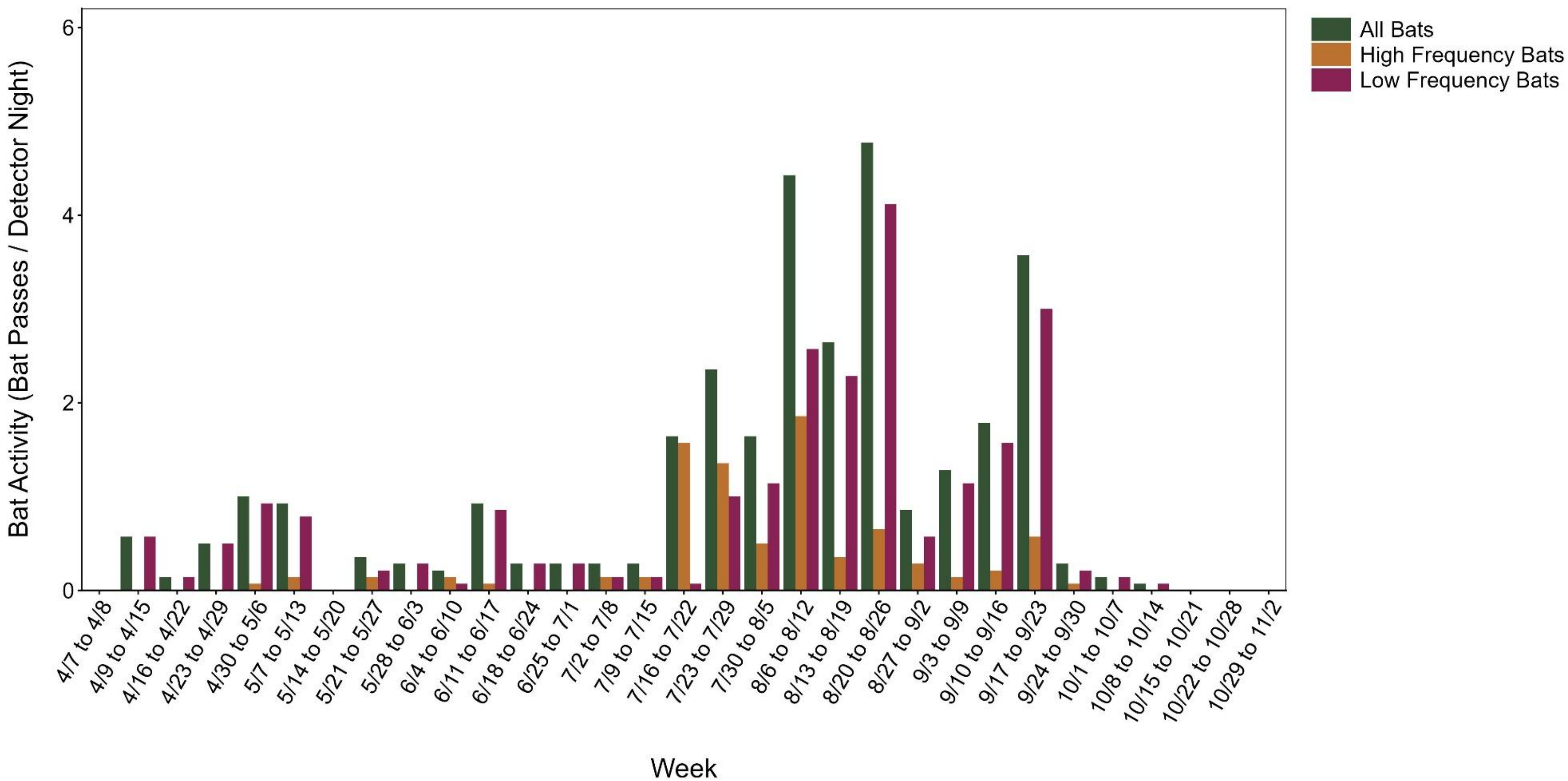

Figure 7. Weekly patterns of bat acoustic activity at representative stations by high-frequency, low-frequency, and all bats at the Longspur Wind Project in Morton County, North Dakota from, April 7 – November 2, 2025.

Table 4. The number of bat passes per detector-night during each season, separated by pulse frequency, recorded at representative stations within the Longspur Wind Project in Morton County, North Dakota from April 7 – November 2, 2025.

Station	Pulse Frequency[1]	Spring April 7 – May 14	Summer May 15 – Aug 15	Fall Aug 16 – Nov 2	Fall Migration Period Jul 30 – Oct 14
LO1gTotal	HF	0.03	0.76	0.13	0.65
	LF	0.26	1.34	1.42	2.61
	AB	0.29	2.10	1.55	3.26
LO2gTotal	HF	0.07	0.22	0.20	0.29
	LF	0.83	0.25	0.61	0.65
	AB	0.90	0.46	0.81	0.94
Overall	**HF**	**0.05 ± 0.02**	**0.49 ± 0.11**	**0.16 ± 0.05**	**0.47 ± 0.10**
	LF	**0.55 ± 0.16**	**0.79 ± 0.15**	**1.01 ± 0.26**	**1.63 ± 0.29**
	AB	**0.59 ± 0.17**	**1.28 ± 0.23**	**1.18 ± 0.29**	**2.10 ± 0.34**

1. high-frequency (HF), low-frequency (LF), and all bats (AB).

Error ranges indicate ± bootstrapped standard error.

Species Composition

NLEB were not identified within the Project area, and Kaleidoscope did not classify any passes as potential NLEB.

LBBA were identified within the Project area. Of the 10 potential bat passes, five passes were qualitatively identified as LBBA by a qualified bat biologist (Table 5). The remaining passes were reclassified from the original identification provided by Kaleidoscope, either to eastern red bat (*Lasiurus borealis*) or a frequency group (e.g., HF), because a diagnostic pulse characteristic was not present in the pass to determine the species that produced the pulse. Four of the confirmed LBBA passes were detected between August – September, and one was detected in June. Four of the LBBA were detected at the LO1g station and one at the LO2g station.

Of the total bat passes recorded at representative stations, approximately 74% were classified as LF (e.g., big brown, hoary, and silver-haired bats) during manual labeling, and approximately 26% were classified as HF (e.g., eastern red bats and LBBA; Table 3).

Table 5. Number of passes labeled as little brown bat by Kaleidoscope Pro 5.7.0 and after qualitative review at the Longspur Wind Project in Morton County, North Dakota from April 7 – November 2, 2025.

Station	# Little Brown Bat Passes Kaleidoscope	After Qualitative Review
LO1g	7	4
LO2g	3	1
Total	**10**	**5**

No northern long-eared bats were detected by Kaleidoscope Pro (Wildlife Acoustics, Inc., 2025).

DISCUSSION

Pre-construction acoustic activity surveys provide useful information about bat spatial use, seasonal activity peaks, and species composition for a project. Monitoring at representative stations can provide relative bat activity levels across a project area in locations similar to where turbines may be erected. Although these data should not be used to determine siting, acoustic activity provides useful information that may offer insight into the possible impacts of wind development and inform potential mitigation strategies (Kunz et al. 2007, Weller and Baldwin 2012, Britzke et al. 2013, Goldenberg et al. 2021, Huang et al. 2024).

During the FMP, bats begin moving toward wintering areas, and many species of bats initiate reproductive behaviors (Cryan 2008). This period of increased landscape-scale movement and mating behavior is often associated with increased levels of bat fatalities at operational wind energy facilities (Arnett et al. 2008, Cryan 2008, Arnett and Baerwald 2013, Barclay et al. 2017, WEST 2023). While acoustic activity remained comparatively low throughout the monitoring period, activity peaked the weeks of August 6 and August 20 and may have been attributable to the arrival of a small migratory population of bats traveling between their summer grounds and overwintering habitat. This corresponds to the period when juvenile bats begin flying, as well as increased acoustic activity associated with preparation for fall migration. The increase in activity throughout August and September was driven by small increases in both LF and HF species and suggests migratory activity rather than resident bat populations remaining active for longer periods in the summer.

Of the eight species that have the potential to occur at the Project, no federally-listed species were identified at the Project. Species of State concern (i.e., Species of Greatest Conservation Need [NDGFD 2025]) may be present with the Project area and may include eastern red bat, little brown bat, big brown bat, hoary bat, and silver-haired bat. Only one federally listed species, NLEB, has the potential to occur in the Project; however none were identified during activity surveys. LBBA, a species under review for federal listing, was confirmed at both survey stations.

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Appendix A. Station Photographs for Bat Acoustic Activity Surveys for the Longspur Wind Project in Morton County, North Dakota, from April 7 – November 2, 2025

Appendix A1. Photographs of acoustic station LO1g.

Appendix A2. Photographs of acoustic station LO2g.