Appendix M

Wildlife Survey Reports

1. Eagle and Raptor Nest Survey Reports
2. Sharp-tailed Grouse Lek Survey Reports
3. Avian Use Surveys
4. Grassland Assessment
5. Whooping Crane Desktop Assessment
6. Bat Acoustic Activity Survey
7. Northern Long-eared and Little Brown Bat Desktop Habitat Assessment

Appendix M.6

Bat Acoustic Activity Survey

Bat Acoustic Activity Survey
for the Proposed Homestead Wind Project
Williams County, North Dakota

Final

April 3 – November 2, 2025

Prepared for:

Homestead Wind, LLC

Prepared by:

Western EcoSystems Technology, Inc.

4007 State Street, Suite 109
Bismarck, North Dakota, 58503.

January 23, 2026

WEST

EXECUTIVE SUMMARY

Homestead Wind, LLC (Homestead) is developing the proposed Homestead Wind Project (Project) located in Williams County, North Dakota. Western EcoSystems Technology, Inc. (WEST), completed a bat acoustic activity survey for the Project. The objectives for this survey were to collect data on the spatial and temporal bat activity within the Project area during the bat active season and to review data for the potential presence of federal-listed bat species or bat species under review for listing. This survey was completed from April 3 – November 2, 2025, following the recommendations in the US Fish and Wildlife Service *Land-Based Wind Energy Guidelines, Methods, Kunz et al.*, *Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document*, and the North Dakota Game and Fish Department's (NDGFD) *Best Management Practices for bat acoustic activity surveys*.

The activity survey was completed at three meteorological (MET) tower locations in cultivated crops land cover type, the main land cover type in the Project area and potentially representative of future turbine placement. SM3BAT ultrasonic detectors were paired (ground and raised microphones) at these MET towers with one microphone placed approximately 10 feet above ground level (AGL) and the second microphone was placed within the proposed rotor-swept zone at approximately 148 feet AGL.

Survey stations (one detector and one microphone) recorded a combined mean (± standard error) of 1.66 ± 0.20 bat passes per detector-night. The ground station microphones recorded a combined mean of 1.67 ± 0.19 bat passes per detector-night and raised station microphones recorded a combined mean of 1.66 ± 0.25 bat passes per detector-night. Activity was fairly consistent among each station, only varying slightly in bat passes per night.

Bat activity at all stations varied among seasons, with higher activity in the summer. Bat activity peaked between August 12 and 18, 2025 at the Project, with an overall average of 10.17 bat passes per detector-night during that week. Bat activity recorded during the Fall Migration Period (July 30 – October 14) was 3.54 ± 0.45 bat passes per detector-night for ground detectors and 2.81 ± 0.44 bat passes per detector-night for raised detectors.

Kaleidoscope Pro 5.7.0 (Kaleidoscope) identified passes of seven of the nine bat species that potentially occur at the Project. Big brown, hoary, and silver-haired bats were the main species identified by Kaleidoscope on 26–44% of detector nights. Northern long-eared bats were not confirmed as present during the survey.

There were no publicly available studies with data that can be compared to the data collected at the Project due to a variety of reasons including differences in geography, habitat types, detector technology, varying sampling effort, microphone heights, and survey periods.

REPORT PARTICIPANTS

Kevin Shelley	Project Manager
Nicole Pierro	Report Writer
Richard Novy	Bat Biologist/Data Analyst
Teeranard (Beau) Promsuwan	Project Coordinator
Chad LeBeau	Client Liaison
Jeanette Haddock	Standards Reviewer
Andy Valencia	Technical Editor

REPORT REFERENCE

Western EcoSystems Technology, Inc. (WEST). Bat Acoustic Activity Survey for the Proposed Homestead Wind Project, Williams County, North Dakota. Final. April 3 – November 2, 2025. Prepared for Homestead Wind, LLC., Charlottesville, Virginia. Prepared by WEST, Bismarck, North Dakota. January 23, 2026.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

Homestead Wind, LLC (Homestead) is developing the proposed Homestead Wind Project (Project) located in Williams County, North Dakota (Figure 1). Western Ecosystems Technology, Inc. (WEST), completed a bat acoustic activity survey (activity survey) from April 3 – November 2, 2025, for the Project. The objectives of the activity survey were to collect data on spatial and temporal bat activity within the Project area during the bat active season and to review acoustic data for the potential presence of federally listed bat species or bat species under review for listing (US Fish and Wildlife Service [USFWS] 2022, 2023). The surveys were completed following the recommendations of the USFWS *Land-Based Wind Energy Guidelines* (2012), *Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document* (Kunz et al. 2007), and the North Dakota Game and Fish Department (NDGFD) *Best Management Practices* (BMPs*) for bat acoustic activity surveys* (NDGFD 2021).

PROJECT DESCRIPTION

The Project area is located within the Northwestern Glaciated Plains Level III Ecoregion (US Environmental Protection Agency [USEPA] 2012, 2013). The Northwestern Glaciated Plains Ecoregion features a moderately high prevalence of grasslands, semi-permanent and seasonal wetlands. The primary land use is agriculture and livestock grazing (USEPA 2012, 2013; Figure 1).

The main land cover type within the Project area is cultivated crops (81.2%), followed by herbaceous (14.2%), and developed (3.6%; NLCD 2024; Table 1, Figure 2). The remaining land cover types account for less than 1.1% of the Project area (Table 1, Figure 2). Woody wetlands (<0.1%) and deciduous forest (<0.1%) could provide natural roosting substrate for bats using the Project area.

Table 1. Land cover types, coverage, and percent (%) composition within the proposed Homestead Wind Project in Williams County, North Dakota.

Land Cover Type	Coverage (Acres)	% Composition
Cultivated Crops	20,302	81.2
Herbaceous	3,553	14.2
Developed[1]	888	3.6
Hay/Pasture	139	0.6
Emergent Herbaceous Wetlands	67	0.3
Shrub/Scrub	16	0.1
Open Water	15	<0.1
Woody Wetlands	10	<0.1
Deciduous Forest	4	<0.1
Total	**24,994**	**100[2]**

1. Developed land cover types may include open space, low intensity, medium intensity, and high intensity.

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

Source: National Land Cover Database 2024

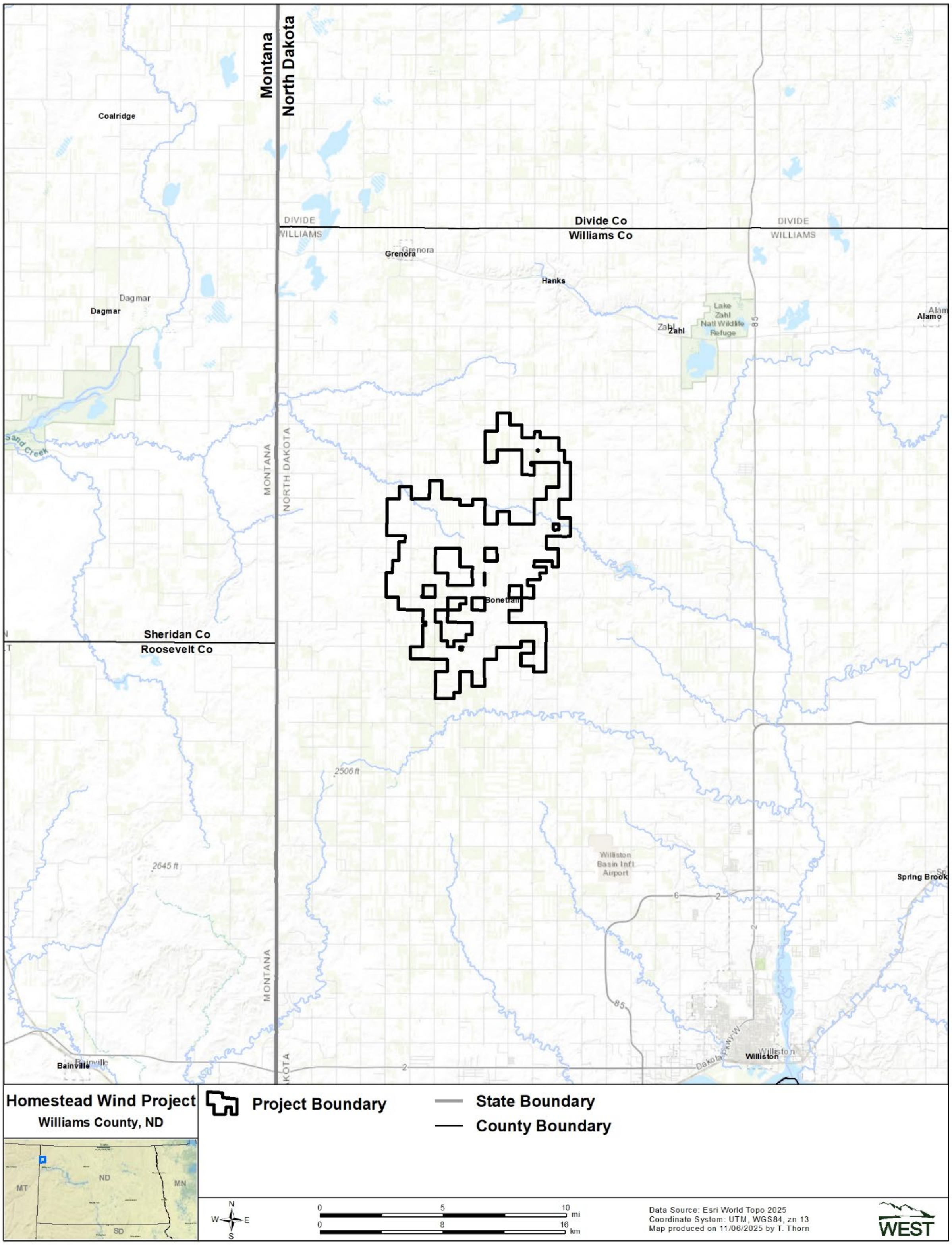

Figure 1. Location of the proposed Homestead Wind Project in Williams County, North Dakota.

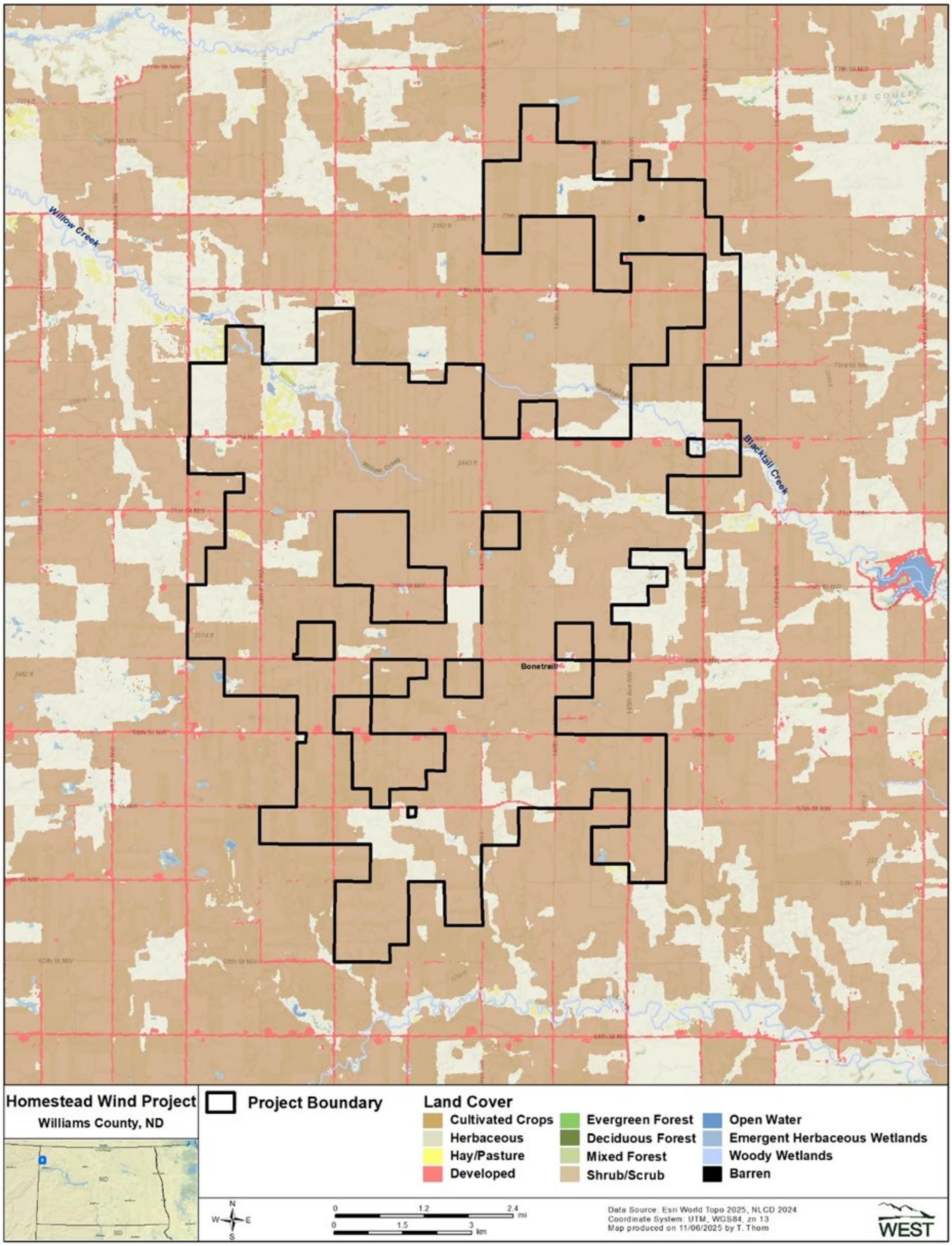

Figure 2. Land cover types within the proposed Homestead Wind Project in Williams County, North Dakota.

OVERVIEW OF BAT DIVERSITY

Ten bat species have been documented in North Dakota (NDGFD 2021, 2025). Nine of these species have the potential to occur within the Project area (International Union for Conservation of Nature 2025; Table 2). Northern long-eared bat (*Myotis septentrionalis*) is federally endangered (effective March 31, 2023; USFWS 2023), and little brown bat (*Myotis lucifugus*) is currently under review for listing by the USFWS with the final agency decision still pending (USFWS 2025).

Table 2. Bat species categorized by echolocation pulse frequency, with potential to occur within the proposed Homestead Wind Project in Williams County, North Dakota.

Common Name	Scientific Name	Status
High Frequency (≥30 kHz)		
eastern red bat [1,2]	*Lasiurus borealis*	–
little brown bat	*Myotis lucifugus*	Under review
western long-eared bat	*Myotis evotis*	–
long-legged bat	*Myotis volans*	–
northern long-eared bat	*Myotis septentrionalis*	Federally endangered
western small-footed bat [1]	*Myotis ciliolabrum*	–
Low Frequency (≤30 kHz)		
big brown bat [1]	*Eptesicus fuscus*	–
hoary bat [1]	*Lasiurus cinereus*	–
silver-haired bat [1]	*Lasionycteris noctivagans*	–

1. Species with documented fatalities at wind energy facilities (American Wind Wildlife Institute 2020).

2. Long-distance migrant.

Sources: US Fish and Wildlife Service 2023, 2025; International Union for Conservation of Nature 2025; North Dakota Game and Fish Department.

kHz = kilohertz.

METHODS

The activity survey was divided into three periods: spring (April 3 – 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 08:00 to capture bat acoustic activity throughout each night. If more than 30 minutes of the night were missed at a station, the station was classified as “non-operational” for that night.

Survey Stations

Two meteorological (MET) towers within the Project area (HS1 and HS2) and one MET tower south of the Project area (HS3) were surveyed using three full-spectrum Song Meter SM3BAT ultrasonic detectors (detectors; Wildlife Acoustics, Inc. [Wildlife Acoustics], Maynard, Massachusetts). MET towers were located in cultivated crops, the main land cover type (Table 1) and is potentially representative of future turbine locations (Figure 3).

One detector was placed at each MET tower location (HS1, HS2, and HS3; Figure 3). For each detector, one microphone (survey station) was placed approximately 10 feet above ground level (AGL; ground station). The other microphone was elevated to be within the proposed rotor-swept zone, (148 feet AGL; raised station). Ground station microphones were secured atop a polyvinyl chloride (commonly, PVC) pole with a metal grounding wire. Raised microphones were elevated on MET towers using a pulley system.

Data Collection

The full-spectrum bat detectors record complete acoustic waveforms by sampling sound waves at a rate of 256 kilohertz (kHz). This high sampling rate enables 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.

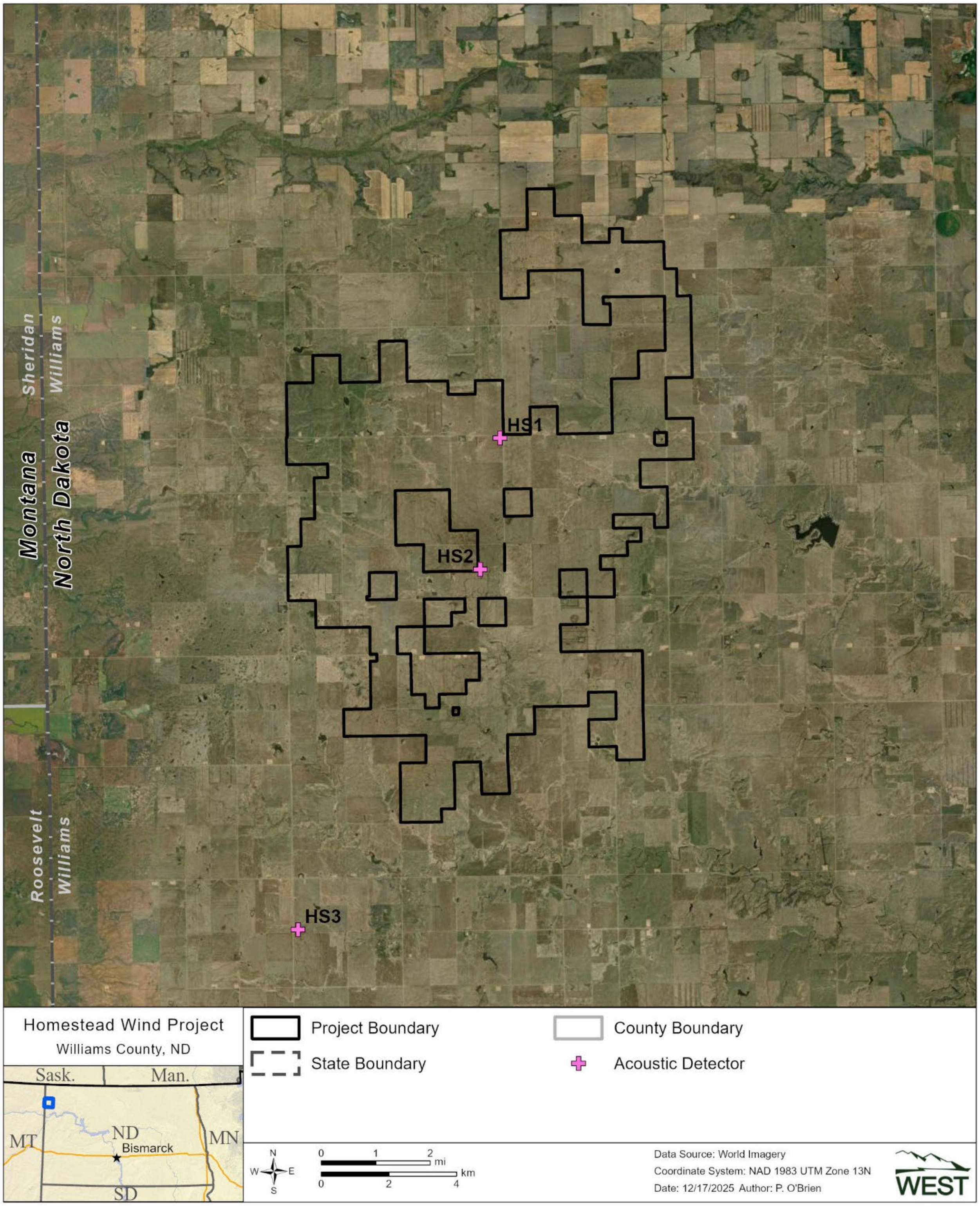

Figure 3. Bat survey stations within the proposed Homestead Wind Project in Williams County, North Dakota.

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 2 were included in the Kaleidoscope identification model. Additionally, full-spectrum data were run through SonoBat (version 30.2; SonoBat 2025) to help differentiate potential northern long-eared bat data from other *Myotis* species (e.g. *M. evotis*) having similar call parameters and a likelihood to co-occur in the Project area. (version 4.4.5; output in Appendix A).

During the automated classification, full-spectrum data were also transformed into zero-crossing data using Kaleidoscope, which allowed data to be viewed in Analook software (2015) 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 pulse characteristics that often cannot be distinguished. Therefore, automated pulse 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 species present within the Project area. Therefore, additional analysis of the data was completed, as described below.

For each survey station, bat passes were sorted into two groups based on the minimum pulse frequency. High-frequency (HF) bats, such as the eastern red bat (*Lasiurus borealis*) and little brown bat (*Myotis lucifugus*), have minimum frequencies (Fmin) usually greater than or equal to 30 kHz. Low-frequency (LF) bats, such as big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), and hoary bat (*Lasiurus cinereus*), typically emit echolocation pulses with Fmin 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 determined the number of bat passes using Analook. A list of species by pulse frequency group that could potentially occur within the Project area is presented in Table 2.

The Kaleidoscope output was used to generate a preliminary list of species that may have been present in the Project area. An experienced acoustic analyst reviewed all bat files preliminarily identified as federally endangered bat species flagged by either Kaleidoscope or SonoBat (Table

2), via visual comparison of echolocation pulse metrics (e.g., Fmin, slope, and duration) to reference pulses of known species bat passes (O'Farrell and Gannon 1999, Murray et al. 2001, Yates and Muzika 2006). If pulse sequences were not characteristic of the automated identification, contained distinct pulses produced by a different species, or were of insufficient quality, the pulse sequences were reclassified.

Data Management

Data Compilation and Storage

A Microsoft SQL Server database was specifically developed 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 the Project Manager. 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, client standards review, Client Liaison 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 was 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 all bats, 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.

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 so other private (non-public) wind project data analyzed during the same time period were used to cross-check Project bat acoustic activity results.

RESULTS

Bat acoustic activity was monitored at six survey stations for 1,114 detector nights (Table 3) from April 3 – November 2, 2025. Detectors and microphones were operating for 99% of the sampling period (Figure 4). Detectors from all stations recorded 1,853 bat passes and a mean (± standard error) of 1.66 ± 0.20 bat passes per detector-night (Table 3).

Table 3. Results of the bat acoustic activity survey conducted at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

		Bat Passes				Mean Bat
Station	**Location**	**High Frequency**	**Low Frequency**	**All Bats**	**Detector nights**	**Passes/Detector-night (± Standard Error)[1]**
HS1g	ground	105	251	356	209	1.70 ± 0.23
HS1r	raised	65	218	283	159	1.78 ± 0.28
HS2g	ground	67	282	349	214	1.63 ± 0.20
HS2r	raised	40	211	251	159	1.58 ± 0.25
HS3g	ground	76	280	356	214	1.66 ± 0.23
HS3r	raised	43	215	258	159	1.62 ± 0.24
Ground Total (%)		**248 (23.4%)**	**813 (76.6%)**	**1,061**	**637**	**1.67 ± 0.19**
Raised Total (%)		**148 (18.7%)**	**644 (81.3%)**	**792**	**477**	**1.66 ± 0.25**
Total (%)		**396 (21.4%)**	**1,457 (78.6%)**	**1,853**	**1,114**	**1.66 ± 0.20**

[1] ± bootstrapped standard error.

Statistical Analysis

Spatial Analysis

Bat activity within the Project area was similar among survey stations (Table 3, Figure 5). Overall bat activity was largely driven by LF species (Table 3, Figure 5). The highest mean bat passes/detector night were recorded at HS1 (ground and raised stations; Table 3, Figure 6). The ground and raised stations recorded similar combined mean bat passes per detector-night (1.67 ± 0.19 and 1.66 ± 0.25, respectively; Table 3, Figure 6).

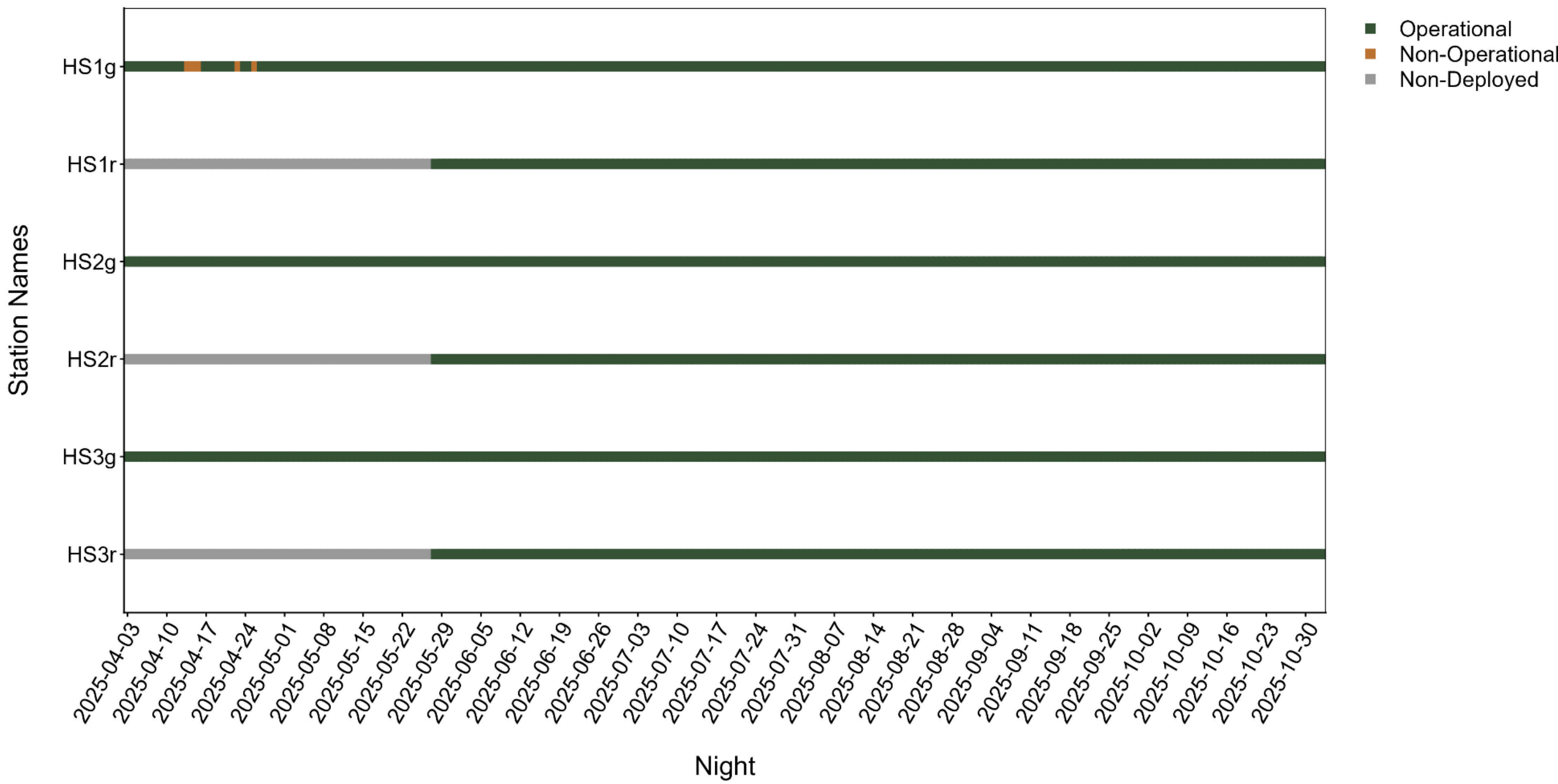

Figure 4. Operational status of the survey stations at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

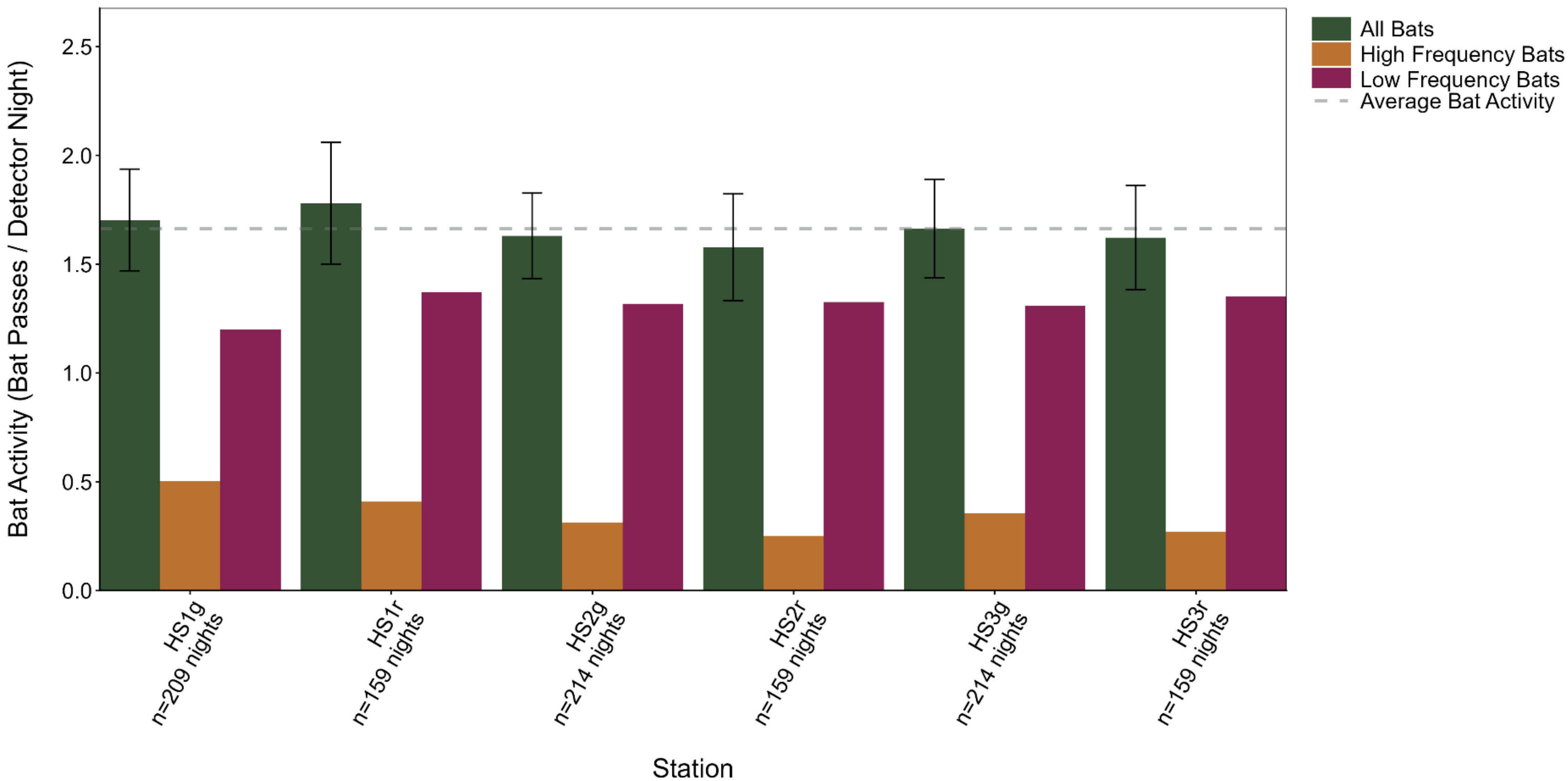

Figure 5. Number of high-frequency and low-frequency bat passes per detector-night recorded at bat monitoring stations within the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Note: The bootstrapped standard errors are represented by the black error bars on the “All Bats” columns.

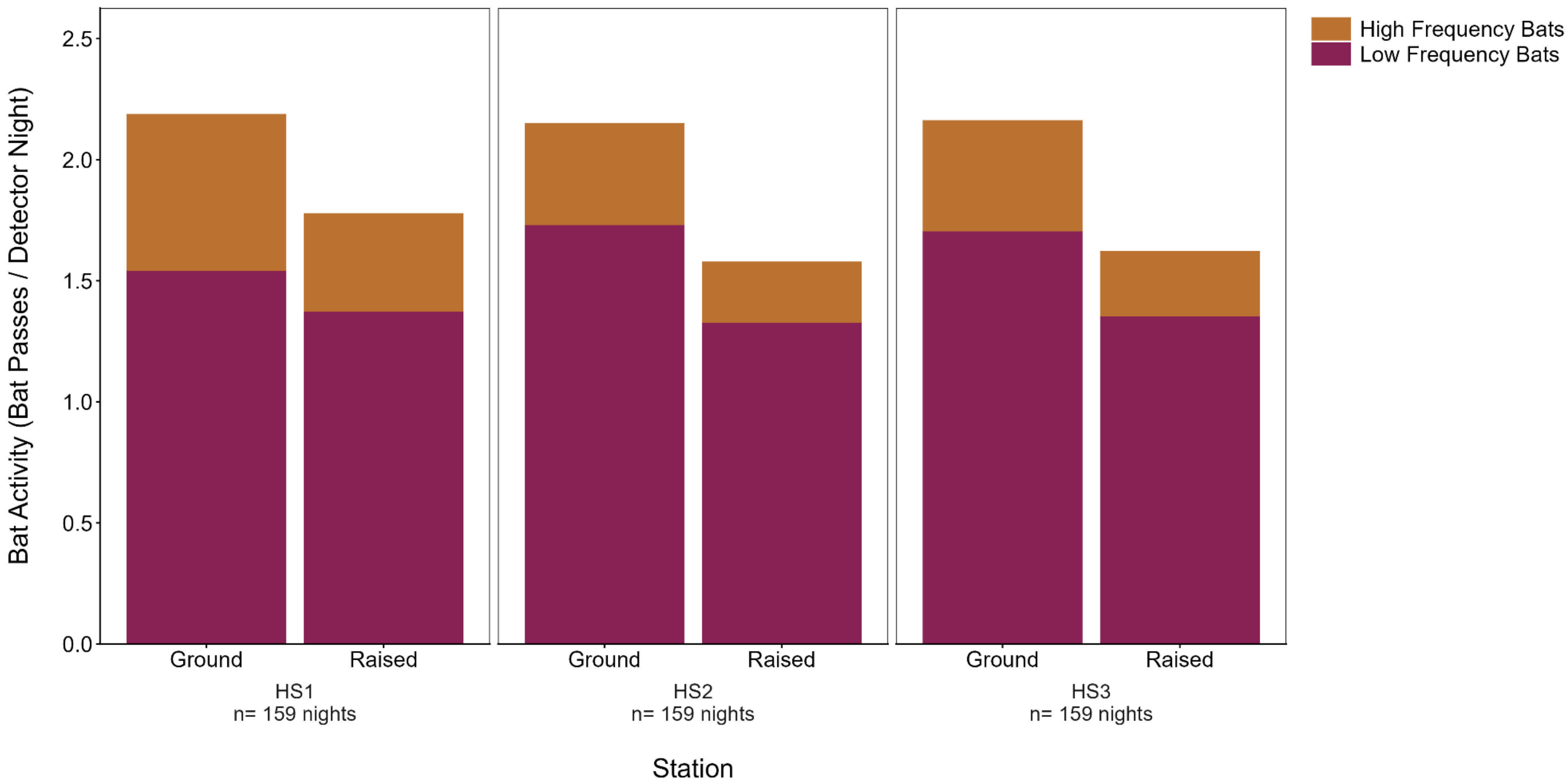

Figure 6. Number of high-frequency (HF) and low-frequency (LF) bat passes per detector night recorded at the meteorological towers when both paired stations were concurrently operational at the proposed Homestead Wind Project in Williams County, North Dakota, from May 28 – November 2, 2025.

Temporal Analysis

Overall bat activity across all stations varied during the summer and fall, but was on average, 21 times lower in the spring compared to the summer and fall (Figure 7, Table 4). Weekly acoustic activity at survey locations was relatively low between April 3 and July 22, except for a small increase in activity from late May to mid-June (Figure 8).

Bat activity at the Project began increasing in late July, and peaked between August 12 – 18, with an overall average of 10.17 bat passes per detector night (Table 5). Overall bat activity sharply decreased in late September and remained relatively low for the remainder of the survey period. HF bat species activity peaked from July 31 – August 6, with an average of 2.40 bat passes per detector night (Table 5). LF bat species activity peaked from August 12 – 18, with an average of 8.62 bat passes per detector night (Table 5). Bat activity recorded during the FMP was 3.54 ± 0.45 bat passes per detector-night for ground detectors and 2.81 ± 0.44 bat passes per detector-night for raised detectors (Table 4).

Table 4. Seasonal bat activity (average number of bat passes per detector-night) at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Station	Pulse Frequency	Spring April 3 – May 14	Summer May 15 – August 15	Fall August 16 – November 2	Fall Migratory Period July 30 – October 14
HS1g	HF	0	0.92	0.24	0.94
	LF	0.11	1.37	1.52	2.62
	AB	0.11	2.29	1.76	3.56
HS1r	HF	NA	0.56	0.25	0.56
	LF	NA	1.39	1.35	2.45
	AB	NA	1.95	1.61	3.01
HS2g	HF	0	0.54	0.22	0.62
	LF	0.10	1.44	1.82	2.79
	AB	0.10	1.98	2.04	3.42
HS2r	HF	NA	0.39	0.11	0.38
	LF	NA	1.20	1.46	2.25
	AB	NA	1.59	1.57	2.62
HS3g	HF	0	0.66	0.19	0.66
	LF	0.07	1.46	1.78	2.97
	AB	0.07	2.12	1.97	3.64
HS3r	HF	NA	0.40	0.14	0.42
	LF	NA	1.36	1.34	2.39
	AB	NA	1.76	1.48	2.81
Ground Totals	**HF**	**0 ± 0**	**0.71 ± 0.13**	**0.22 ± 0.05**	**0.74 ± 0.14**
	LF	**0.09 ± 0.04**	**1.42 ± 0.23**	**1.71 ± 0.34**	**2.80 ± 0.38**
	AB	**0.09 ± 0.04**	**2.13 ± 0.33**	**1.92 ± 0.36**	**3.54 ± 0.45**
Raised Totals	**HF**	**NA**	**0.45 ± 0.10**	**0.17 ± 0.04**	**0.45 ± 0.09**
	LF	**NA**	**1.32 ± 0.26**	**1.38 ± 0.33**	**2.36 ± 0.39**
	AB	**NA**	**1.77 ± 0.33**	**1.55 ± 0.36**	**2.81 ± 0.44**
Total	**HF**	**0 ± 0**	**0.58 ± 0.11**	**0.19 ± 0.04**	**0.60 ± 0.10**
	LF	**0.09 ± 0.03**	**1.37 ± 0.23**	**1.55 ± 0.30**	**2.58 ± 0.37**
	AB	**0.09 ± 0.03**	**1.95 ± 0.32**	**1.74 ± 0.32**	**3.18 ± 0.44**

Table 4. Seasonal bat activity (average number of bat passes per detector-night) at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

		Spring	Summer	Fall	Fall Migratory Period
Station	Pulse Frequency	April 3 – May 14	May 15 – August 15	August 16 – November 2	July 30 – October 14

Note: Seasonal bat activity is separated by pulse frequency: high-frequency (HF), low-frequency (LF), and all bats (AB).

Table 5. Periods of peak activity for high-frequency, low-frequency, and all bats, at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Species Group	Start Date of Peak Activity	End Date of Peak Activity	Bat Passes per Detector-Night
High-frequency	July 31	August 6	2.40
Low-frequency	August 12	August 18	8.62
All Bats	August 12	August 18	10.17

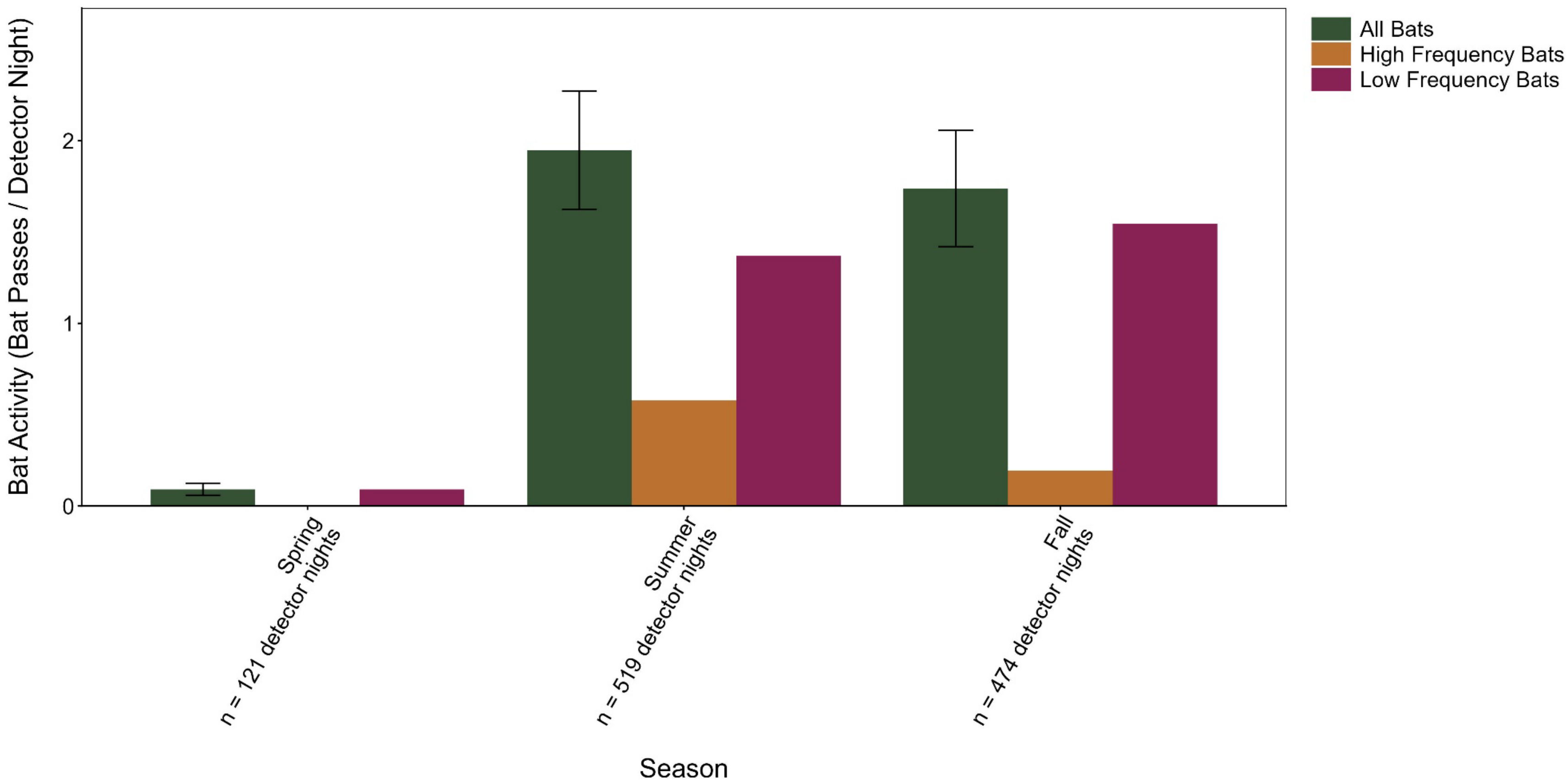

Figure 7. Mean seasonal bat activity by frequency, for bat acoustic monitoring stations, at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Note: The bootstrapped standard errors are represented on the "All Bats" columns.

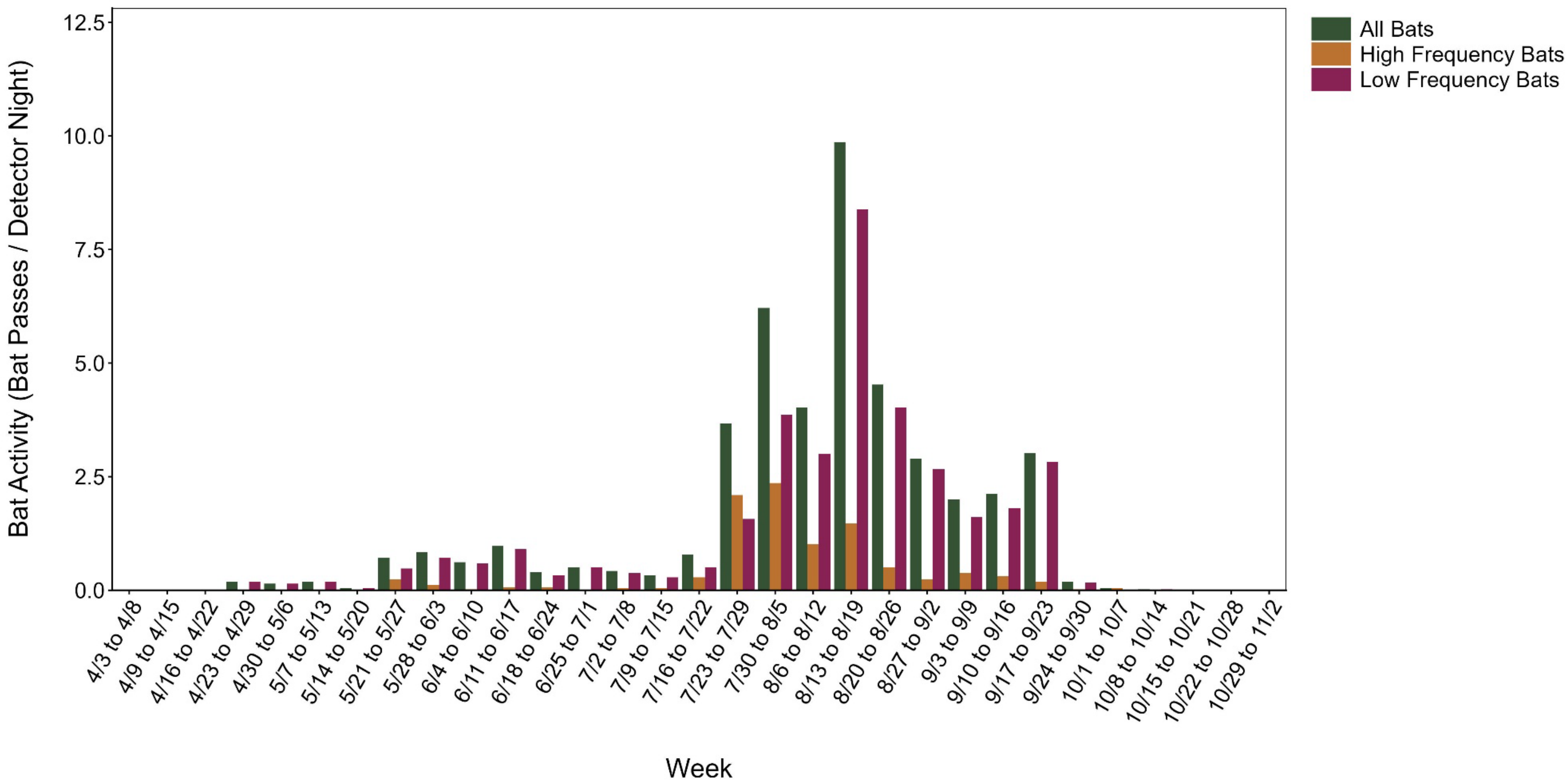

Figure 8. Mean weekly bat activity by frequency, for bat acoustic monitoring stations at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Species Composition

Data from Kaleidoscope indicated that bat passes were present for seven of the nine bat species that have the potential to occur within the Project area (Tables 2 and 6). The silver-haired bat was the most frequently identified species (identified during 44% of calendar nights; Table 6). Other species identified by Kaleidoscope as frequently occurring included the hoary bat (31%), big brown bat (26%), eastern red bat (22%), little brown bat (16%), western small-footed bat (*Myotis ciliolabrum*; 5%), and long-legged bat (*Myotis volans*; 1%; Table 6). No northern long-eared bats were identified by Kaleidoscope. However, one call file was initially classified by SonoBat as a northern long-eared bat but was reclassified as noise following qualitative review (HS1, July 7, 2025; Appendix A). Similar to Kaleidoscope, silver-haired, hoary, and big brown bats were the most commonly identified species by SonoBat (Appendix A).

Table 6. The number of nights and percent of calendar nights that bat species were detected using Kaleidoscope Pro 5.7.0 at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Common Name	HS1g	HS1r	HS2g	HS2r	HS3g	HS3r	Project Total[2]
High Frequency (≥30 kHz)							
eastern red bat [1]	23 (11%)	26 (16%)	23 (11%)	18 (11%)	22 (10%)	20 (13%)	48 (22%)
little brown bat[1]	23 (11%)	1 (1%)	6 (3%)	0 (0%)	11 (5%)	1 (1%)	35 (16%)
long-legged bat [1]	1 (<1%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	0 (0%)	3 (1%)
western small-footed bat [1]	5 (2%)	1 (1%)	2 (1%)	0 (0%)	2 (1%)	0 (0%)	10 (5%)
Low Frequency (≤30 kHz)							
big brown bat[1]	26 (12%)	12 (8%)	26 (12%)	7 (4%)	24 (11%)	11 (7%)	56 (26%)
hoary bat[1]	23 (11%)	35 (22%)	31 (14%)	33 (21%)	33 (15%)	39 (25%)	66 (31%)
silver-haired bat[1]	47 (22%)	35 (22%)	47 (22%)	43 (27%)	47 (22%)	37 (23%)	94 (44%)

1. These species were identified by Kaleidoscope Pro 5.7.0 but were not confirmed by any acoustic analyst.
2. Project total differs from detector nights because a specific calendar night was only counted once regardless of the number of stations deployed at the Project. For each species, the percentage is based on whether that species was detected anywhere in the Project on each given calendar night.

g = ground; r = raised, kHz = kilohertz.

Note: The Project total represents the number of nights (percent) a species was detected within the Project.

DISCUSSION

Bat activity was similar among survey stations and activity was driven largely by LF bat activity (Table 6). Bats begin moving toward wintering areas, and many species of bats initiate reproductive behaviors during the FMP (Cryan 2008). Bat activity was highest during the FMP and included the highest season peak as expected.

Bat activity peaked in late July and early August for HF bats (Figure 8) suggesting FMP activity, rather than a resident HF bat population. Activity patterns from resident bats are generally characterized by longer periods of activity throughout the summer. By comparison, LF bat activity remained consistently low throughout the bat active season and then increased in late July through late September (Figure 8), suggesting potential consistent summer activity by resident LF species, such as the big brown bat and hoary bats.

Eastern red, big brown, hoary, and silver-haired bats were ubiquitous throughout the Project area at both ground and raised stations (Table 6). Long-legged bats and western small-footed bats were the rarest species with detections on just 1% and 5% of the calendar nights, respectively (Table 6). Little brown bats were detected at most of the survey stations but at modest rates compared with other species and no northern long-eared bats were identified by Kaleidoscope (Table 6) or SonoBat (Appendix A).

There are no publicly available pre-construction bat acoustic activity data from wind energy facilities in North Dakota; therefore, the ability to compare acoustic data at the Project with data from other sites to define "high" or "low" activity is not possible at this time. Comparisons with publicly available data from other states are also limited due to a variety of reasons including differences in geography, habitat types, detector technology, varying sampling effort, microphone heights, and survey periods.

REFERENCES

Agranat, I. 2012. Bat Species Identification from Zero Crossing and Full Spectrum Echolocation Calls Using HMMs, Fisher Scores, Unsupervised Clustering and Balanced Winnow Pairwise Classifiers. Wildlife Acoustics, Inc., Concord, Massachusetts. Available online: http://condor.wildlifeacoustics.com/batid.pdf

American Wind Wildlife Institute (AWWI). 2020. AWWI Technical Report 2nd Edition: Summary of Bat Fatality Monitoring Data Contained in AWWIC. American Wind Wildlife Information Center (AWWIC) database. AWWI, Washington, D.C. November 24, 2020. Available online: https://rewi.org/resources/awwic-bat-technical-report/

AnalookW. 2015. Bat call analysis program. Titley Scientific, Columbia, Missouri. Available online: https://www.titley-scientific.com/us/downloads-support/firmware-software

Clement, M. J., K. L. Murray, D. I. Solick, and J. C. Gruver. 2014. The Effect of Call Libraries and Acoustic Filters on the Identification of Bat Echolocation. Ecology and Evolution 4(17): 3482-3493. doi: 10.1002/ece3.1201.

Cryan, P. M. 2008. Mating Behavior as a Possible Cause of Bat Fatalities at Wind Turbines. Journal of Wildlife Management 72(3): 845-849. doi: 10.2193/2007-371.

Esri. 2025. World Imagery and Aerial Photos (World Topo). ArcGIS Resource Center. Environmental Systems Research Institute (Esri), producers of ArcGIS software, Redlands, California. Accessed November and December 2025. Available online: https://www.arcgis.com/home/webmap/viewer.html?useExisting=1&layers=10df2279f9684e4a9f6a7f08febac2a9

Fenton, M. B. 1980. Adaptiveness and Ecology of Echolocation in Terrestrial (Aerial) Systems. Pp. 427-446. In: R. G. Busnel and J. F. Fish, eds. Animal Sonar Systems. Plenum Press, New York.

Gannon, W. L., R. E. Sherwin, and S. Haymond. 2003. On the Importance of Articulating Assumptions When Conducting Acoustic Studies of Habitat Use by Bats. Wildlife Society Bulletin 31: 45-61.

International Union for Conservation of Nature (IUCN). 2025. The IUCN Red List of Threatened Species. Version 2025-2. Accessed December 2025. Available online: https://www.iucnredlist.org/

Kunz, T. H., E. B. Arnett, B. M. Cooper, W. P. Erickson, R. P. Larkin, T. Mabee, M. L. Morrison, M. D. Strickland, and J. M. Szewczak. 2007. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. Journal of Wildlife Management 71(8): 2449-2486. doi: 10.2193/2007-270.

Lemen, C., P. W. Freeman, J. A. White, and B. R. Andersen. 2015. The Problem of Low Agreement among Automated Identification Programs for Acoustical Surveys of Bats. Western North American Naturalist 75(2): 218-225. doi: 10.3398/064.075.0210.

Multi-Resolution Land Characteristics Consortium (MRLC). 2023. 2023 Land Cover (CONUS). MRLC: the US Geological Survey (USGS) in partnership with several federal agencies. June 2025. Accessed November 2025. Available online: https://www.mrlc.gov/downloads/sciweb1/shared/mrlc/metadata/Annual_NLCD_LndCov_2023_CU_C1V1.xml

Murray, K. L., E. R. Britzke, and L. W. Robbins. 2001. Variation in the Search-Phase Calls of Bats. Journal of Mammalogy 82(3): 728-737. doi: 10.1644/1545-1542(2001)082<0728:VISPCO>2.0.CO;2.

National Land Cover Database (NLCD). 2024. Annual National Land Cover Database: Annual NLCD Collection 1.1: 2024 Land Cover of Conus. US Geological Survey, Sioux Falls, South Dakota. Published October 2024. Revised June 25, 2025. doi: 10.5066/P94UXNTS. Available online: https://www.sciencebase.gov/catalog/item/655ceb8ad34ee4b6e05cc51a

North Dakota Game and Fish Department (NDGFD). 2021. Key Wind Energy Development in North Dakota: Best Management Practices. June 2021. Available online: https://gf.nd.gov/sites/default/files/publications/wind-energy-development-bmp.pdf

North Dakota Game and Fish Department (NDGFD). 2025. North Dakota Bats. NDGFD, Bismarck, North Dakota. Accessed December 2025. Available online: https://gf.nd.gov/wildlife/id/bats

O'Farrell, M. J. and W. L. Gannon. 1999. A Comparison of Acoustic Versus Capture Techniques for the Inventory of Bats. Journal of Mammalogy 80(1): 24-30.

Russo, D. and C. C. Voigt. 2016. The Use of Automated Identification of Bat Echolocation Calls in Acoustic Monitoring: A Cautionary Note for a Sound Analysis. Ecological Indicators 66: 598-602. doi: 10.1016/j.ecolind.2016.02.036.

Rydell, J., S. Nyman, J. Eklöf, G. Jones, and D. Russo. 2017. Testing the Performances of Automated Identification of Bat Echolocation Calls: A Request for Prudence. Ecological Indicators 78 (July 2017): 416-420. doi: 10.1016/j.ecolind.2017.03.023.

SonoBat. 2025. Sonobat 30 - Software for Bat Call Analysis. Updated September 2025. Accessed November 2025. Available online: https://sonobat.com/

US Environmental Protection Agency (USEPA). 2012. Level III and Level IV Ecoregions of North Dakota. Ecoregions of the United States. USEPA Office of Research and Development - National Health and Environmental Effects Research Laboratory, Corvallis, Oregon. May 8, 2012. Accessed December 2025. Available online: https://www.epa.gov/eco-research/ecoregion-download-files-state-region-8#pane-32

US Environmental Protection Agency (USEPA). 2013. Level III and Level IV Ecoregions of the Continental United States. Ecosystems Research, USEPA. April 16, 2013. Accessed December 2025. Available online: https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states

US Fish and Wildlife Service (USFWS). 2012. Land-Based Wind Energy Guidelines. March 23, 2012. 82 pp. Available online: https://www.fws.gov/sites/default/files/documents/WEG_final.pdf

US Fish and Wildlife Service (USFWS). 2022. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Tricolored Bat; Proposed Rule. 87 Federal Register (FR) 177: 56381-56393. Department of the Interior Fish and Wildlife Service. September 14, 2022.

US Fish and Wildlife Service (USFWS). 2023. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Northern Long-Eared Bat; Final Rule; Delay of Effective Date. Department of the Interior, Fish and Wildlife Service. 50 CFR Part 17. 88 Federal Register 4908. January 26, 2023. Available online: https://www.govinfo.gov/content/pkg/FR-2023-01-26/pdf/2023-01656.pdf

US Fish and Wildlife Service (USFWS). 2025. Little Brown Bat (*Myotis Lucifigus*). Environmental Conservation Online System (ECOS), USFWS, Washington, D.C. Accessed December 2025. Available online: https://ecos.fws.gov/ecp/species/9051

Wildlife Acoustics, Inc. 2025. Kaleidoscope Pro® Version 5.7.0 (Acoustic Analysis Computer Software) and Bats of US and Canada (Bat Pass Classifier Computer Software). Wildlife Acoustics, Maynard, Massachusetts. March 3, 2025. Available online: www.wildlifeacoustics.com

Yates, M. and R. M. Muzika. 2006. Effect of Forest Structure and Fragmentation on Site Occupancy of Bat Species in Missouri Ozark Forests. Journal of Wildlife Management 70: 1238-1248.

Appendix A. SonoBat (Version 30.2) Output at the proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Appendix A. SonoBat output for proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Station	Filename	HiF	LoF	SppAccp	Prob	# Maj	# Accp	Fc mean	Fc StdDev
HS1	f0051712.wav		1	Epfu	1	5	5	27.97	0.49
HS1	SM306134__1__20250815_034422.wav		1	Epfu	0.9976	2	2	27.16	0.54
HS1	SM306134__1__20250815_034429.wav		1	Epfu	0.9767	1	3	26.42	0.71
HS1	SM306134__1__20250815_041033.wav		1	Epfu	0.9092	1	2	26.41	0.31
HS1	SM306134_0+1_20250816_232103.wav		1	Epfu	0.9237	1	3	26.45	0.59
HS1	SM306134_0+1_20250822_033248.wav		1	Epfu	0.995	2	2	28.69	2.31
HS1	SM306134_0+1_20250804_000142.wav	1	1	HiF	0.9642	1	1	24.6	
HS1	SM306134__1__20250723_032632.wav	1		Labo	0.9995	3	3	39.22	0.82
HS1	SM306134__1__20250728_002946.wav	1		Labo	0.9994	2	2	40.98	2.92
HS1	SM306134__1__20250729_225234.wav	1		Labo	0.9994	2	2	37.32	8.51
HS1	SM306134__1__20250804_001429.wav	1		Labo	0.9994	3	4	41.44	2.2
HS1	SM306134_0+1_20250725_232642.wav	1		Labo/Mylu	0.61/0.39	1	2	38.49	1.57
HS1	SM306134_0+1_20250726_012017.wav		1	Laci	0.9975	3	3	25.09	0.79
HS1	SM306134_0+1_20250811_041628.wav		1	Laci	0.9276	1	1	23.69	
HS1	SM306134_0+1_20250811_041704.wav		1	Laci	0.9996	3	3	20.79	1.16
HS1	SM306134_0+1_20250812_234825.wav		1	Laci	0.9945	2	2	20.91	0.87
HS1	SM306134_0+1_20250814_230434.wav		1	Laci	0.9626	4	6	20.97	0.37
HS1	SM306134_0+1_20250818_000340.wav		1	Laci/Epfu	0.50/0.50	1	2	26.2	0.72
HS1	SM306134__0__20250528_052419.wav		1	Laci/Lano	0.42/0.58	1	2	22.09	0.52
HS1	SM306134_0+1_20250816_220613.wav		1	Laci/Lano	0.52/0.48	1	2	23.9	4.26
HS1	SM306134__0__20250405_002547.wav		1	Lano	0.9935	2	2	27.96	0.56
HS1	f0040960.wav		1	Lano	1	13	22	26.85	1.01
HS1	f0157184.wav		1	Lano	0.9986	2	2	27.67	1.31
HS1	f0182528.wav		1	Lano	0.971	1	1	26.4	
HS1	f0293120.wav		1	Lano	1	10	13	24.89	0.41
HS1	SM306134_0+1_20250619_223923.wav		1	Lano	0.99	2	2	26.25	2.33
HS1	SM306134__1__20250815_031743.wav		1	Lano	0.9682	3	5	26.06	0.28
HS1	SM306134_0+1_20250824_031249.wav		1	Lano	0.9953	2	2	26.08	0.03
HS1	SM306134__1__20250903_213638.wav		1	Lano	0.9845	2	2	27.03	0.51
HS1	SM306134__1__20250910_040034.wav		1	Lano	0.9106	2	3	27.63	0.51
HS1	SM306134__1__20250911_222221.wav		1	Lano	0.9919	2	2	25.91	0.9
HS1	SM306134_0+1_20250909_050808.wav		1	Lano/	1.00/0.00	1	1	26.42	
HS1	SM306134_0+1_20250916_235748.wav		1	Lano/Coto	0.57/0.43	2	3	25.32	0.86
HS1	SM306134__0__20250526_031304.wav		1	Lano/Epfu	0.49/0.51	1	2	25.19	0.3
HS1	SM306134__1__20250815_033204.wav		1	Lano/Epfu	0.60/0.40	2	4	26.12	0.76
HS1	SM306134_0+1_20250818_002904.wav		1	Lano/Epfu	0.43/0.57	1	2	26.16	0.79
HS1	SM306134__1__20250819_002955.wav		1	Lano/Epfu	0.31/0.69	1	2	26.9	1.94

Appendix A. SonoBat output for proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Station	Filename	HiF	LoF	SppAccp	Prob	# Maj	# Accp	Fc mean	Fc StdDev
HS1	SM306134__1__20250823_235616.wav		1	Lano/Epfu	0.53/0.47	1	2	27.15	0.33
HS1	SM306134__0__20250526_061306.wav		1	Lano/Epfu/Laci	0.39/0.32/0.29	1	3	22.76	3.61
HS1	SM306134_0+1_20250818_002925.wav	1	1	Lano/Epfu/Myth	0.43/0.38/0.19	3	6	27.12	1.12
HS1	SM306134__0__20250528_024834.wav	1		Mylu	1	18	18	39.45	0.86
HS1	SM306134_0+1_20250811_041648.wav		1	Myth	0.9776	2	3	24.68	0.49
HS1	SM306134_0+1_20250818_000358.wav	1	1	Myth/Epfu	0.59/0.41	2	3	28.26	1.6
HS1	SM306134_0+1_20250909_050824.wav		1	Myth/Lano	0.62/0.38	1	2	27.63	0.53
HS1	SM306134__1__20250725_235135.wav	1		Myvo/Myse[1]/Labo	0.44/0.28/0.28	2	4	42.38	1.41
HS2	SM306180__1__20250815_033040.wav		1	Coto/Lano	0.55/0.45	1	3	27.34	0.66
HS2	SM306180__0__20250425_230057.wav		1	Epfu	1	4	4	23.79	0.51
HS2	SM306180_0+1_20250731_000637.wav	1	1	Epfu	0.997	3	4	27.56	1.64
HS2	SM306180_0+1_20250731_031106.wav		1	Epfu	0.9994	2	2	25.88	0.55
HS2	SM306180_0+1_20250810_231735.wav		1	Epfu	0.9994	2	2	27.16	0.84
HS2	SM306180_0+1_20250820_013845.wav		1	Epfu	0.9861	2	2	25.02	1.21
HS2	SM306180_0+1_20250903_221515.wav	1	1	Epfu	0.9968	3	8	26.52	1.16
HS2	SM306180_0+1_20250908_033650.wav	1		Epfu	0.9761	1	1	26.46	
HS2	SM306180_0+1_20250910_232849.wav		1	Epfu	0.9939	2	4	27.77	1.49
HS2	SM306180_0+1_20250801_231835.wav	1		Labo	0.9949	2	4	42.82	1.33
HS2	SM306180_0+1_20250822_220651.wav		1	Laci	1	4	4	21.68	0.99
HS2	SM306180_0+1_20250822_220707.wav		1	Laci	0.9945	2	2	19.85	0.78
HS2	SM306180_0+1_20250811_051424.wav		1	Laci/Epfu	0.45/0.55	1	2	26.43	1.95
HS2	SM306180__0__20250425_231532.wav		1	Lano	1	14	26	25.76	0.36
HS2	SM306180__0__20250511_031058.wav		1	Lano	1	10	10	24.04	0.47
HS2	SM306180__0__20250523_012244.wav		1	Lano	1	32	32	25.82	0.35
HS2	SM306180__0__20250523_015228.wav		1	Lano	1	16	17	26.46	0.98
HS2	SM306180__0__20250526_024922.wav		1	Lano	1	5	8	27.23	0.29
HS2	SM306180__1__20250605_005302.wav		1	Lano	0.9968	2	2	25.69	0.25
HS2	SM306180_0+1_20250807_021230.wav		1	Lano	0.9432	1	1	29.79	
HS2	SM306180__1__20250815_033051.wav		1	Lano	0.9482	2	3	27.02	0.7
HS2	SM306180_0+1_20250816_010946.wav		1	Lano	0.9351	1	2	26.29	0.76
HS2	SM306180__1__20250824_040813.wav	1	1	Lano	0.988	2	2	27.01	1.12
HS2	SM306180_0+1_20250903_220943.wav		1	Lano	0.9929	2	2	25.37	0.2
HS2	SM306180_0+1_20250917_232733.wav		1	Lano	0.9432	1	1	27.49	
HS2	SM306180__1__20250909_033339.wav		1	Lano	0.9268	1	1	26.05	
HS2	SM306180__1__20250619_015832.wav	1		Lano/	1.00/0.00	1	1	23.96	
HS2	SM306180_0+1_20250816_005509.wav		1	Lano/Epfu	0.66/0.34	1	2	26.19	0.67
HS2	SM306180_0+1_20250817_220059.wav		1	Lano/Epfu	0.43/0.57	1	2	26.6	0.73

Appendix A. SonoBat output for proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Station	Filename	HiF	LoF	SppAccp	Prob	# Maj	# Accp	Fc mean	Fc StdDev
HS2	SM306180_0+1_20250823_041314.wav		1	Lano/Epfu	0.51/0.49	1	2	28.85	2.04
HS2	SM306180__1__20250825_014653.wav		1	Lano/Epfu	0.60/0.40	2	4	28.74	2.83
HS2	SM306180_0+1_20250830_043725.wav		1	Lano/Epfu	0.57/0.43	2	4	27.45	1.88
HS2	SM306180_0+1_20250912_025254.wav		1	Lano/Epfu/Laci	0.37/0.31/0.32	1	3	25.92	0.39
HS2	SM306180_0+1_20250825_044951.wav	1	1	Lano/Epfu/Laci/Coto	0.23/0.33/0.29/0.15	2	8	31.72	10.51
HS2	SM306180__1__20250825_014709.wav	1		Myev	0.9066	1	1	29.46	
HS2	SM306180_0+1_20250726_035912.wav		1	Myth	0.998	3	4	22.13	0.32
HS2	SM306180_0+1_20250804_030201.wav		1	Myth	0.9998	4	6	24	1.71
HS2	SM306180_0+1_20250824_040756.wav	1	1	Myth	0.9958	3	6	28.09	1.91
HS2	SM306180__1__20250825_014637.wav		1	Myth	0.9955	2	2	26.92	2.92
HS2	SM306180__1__20250903_235205.wav		1	Myth	0.9793	2	3	24.66	0.69
HS2	SM306180__1__20250903_235221.wav		1	Myth/Coto/Lano	0.40/0.41/0.19	2	5	26.16	2.65
HS2	SM306180_0+1_20250811_044756.wav		1	Myth/Lano	0.51/0.49	1	2	27.76	0.77
HS3	SM306174__0__20250430_003248.wav		1	Epfu	1	30	32	25.08	1.78
HS3	SM306174__0__20250524_231156.wav		1	Epfu	1	13	30	25.78	0.59
HS3	SM306174__1__20250617_034129.wav		1	Epfu	0.9985	3	6	26.66	0.8
HS3	SM306174_0+1_20250804_225740.wav		1	Epfu	0.9993	3	4	24.53	1.33
HS3	SM306174__1__20250801_231841.wav		1	Epfu	0.986	2	2	28	3.07
HS3	SM303284_0+1_20250814_222132.wav		1	Epfu	0.9999	3	3	28.35	1.79
HS3	SM303284_0+1_20250817_013617.wav		1	Epfu	0.9761	1	1	27.31	
HS3	SM306174__0__20250421_065315.wav		1	Laci	0.93	1	1	17.94	
HS3	SM306174__0__20250421_065324.wav		1	Laci	0.9941	2	2	19.44	1.71
HS3	SM306174__0__20250423_073457.wav		1	Laci	0.9207	2	3	21.01	5.3
HS3	SM306174__0__20250423_074303.wav		1	Laci	0.93	1	1	16.33	
HS3	SM306174__0__20250429_074935.wav		1	Laci	0.93	1	1	16.4	
HS3	SM306174__0__20250506_071921.wav		1	Laci	0.9945	2	2	22.18	0.7
HS3	SM306174__0__20250511_213224.wav		1	Laci	0.9077	1	1	20.66	
HS3	SM306174__0__20250514_212108.wav		1	Laci	0.93	1	1	18.55	
HS3	SM306174__0__20250521_183229.wav		1	Laci	0.9995	3	3	19.98	0.28
HS3	SM306174__0__20250523_054214.wav		1	Laci	0.93	1	1	16.82	
HS3	SM306174__0__20250523_054643.wav		1	Laci	0.93	1	1	19.08	
HS3	SM306174__0__20250527_184317.wav		1	Laci	0.93	1	1	18.68	

Appendix A. SonoBat output for proposed Homestead Wind Project in Williams County, North Dakota, from April 3 – November 2, 2025.

Station	Filename	HiF	LoF	SppAccp	Prob	# Maj	# Accp	Fc mean	Fc StdDev
HS3	SM306174__0__20250528_053917.wav		1	Laci	0.9945	2	2	21.38	0.63
HS3	SM306174__0__20250528_055639.wav		1	Laci	0.9859	3	6	22.72	1.88
HS3	SM306174__0__20250528_055655.wav		1	Laci	0.9998	6	8	20.98	2.7
HS3	SM306174__0__20250528_071002.wav		1	Laci	0.9996	3	3	18.47	0.72
HS3	SM306174_0+1_20250725_005930.wav		1	Laci	0.9996	3	3	20.04	1.57

[1.] SonoBat result auto-classification as MYSE at HS1 was determined to be noise.

HiF = high-frequency species (≥30 kilohertz [kHz]); LoF = low-frequency species (≤30 kHz).

SppAccp = Auto-classification accepted species that have passed SonoBat quality control and decision acceptance thresholds. The Black Hills SonoBat classifier subregion was used, which contained species that were not on the list of potential species for the project (MYTH, PESU, and COTO), but was deemed appropriate for the region

Prob = Probability that the species ID is correct.

#Maj = Of the pulses accepted to contribute to the sequence decision, the number in the majority species.

Accp = Number of pulses accepted to contribute to the sequence decision.

Fc mean = characteristic frequency.

StdDev = standard deviation.