Bat Acoustic
Monitoring Report

Bat Acoustic Survey Report

Brady Wind Energy Center

Stark County, North Dakota

Prepared for:

Brady Wind, LLC

NEXTera ENERGY RESOURCES

February 2016

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1.0 INTRODUCTION

Brady Wind, LLC (Brady Wind), a wholly-owned, indirect subsidiary of NextEra Energy Resources, LLC is planning to develop the Brady Wind Energy Center (Project) in Stark County, North Dakota (Figure 1). The Project will have a nameplate capacity of approximately 150 megawatts (MW), consisting of up to 87 wind turbines using both General Electric (GE) 1.715 MW Xle and GE 1.79 MW Xle wind turbine generators. Additional facilities include access roads, electrical collection systems and cabling, a collection substation, an operation and maintenance (O&M) building, meteorological towers, a construction laydown area, and a temporary turbine storage area. The Project also includes an approximately 19-mile, 230-kilovolt (kV) overhead transmission line to connect the Project to the Belfield-Rhame 230-kV transmission line, in Section 29 of Township 137 North, Range 98 West, approximately 19 miles southwest of the city of Dickinson, and will transmit power into the Basin Electric Power Cooperative (Basin) transmission system.

Brady Wind contracted Tetra Tech, Inc. (Tetra Tech) to perform acoustic monitoring surveys for northern long-eared bat (NLEB, *Myotis septentrionalis*) and other bat species in the Project Area during the summer and fall of 2015. This report provides background information on the habitats and bats that occur in the Project Area (Tetra Tech 2015), and the results of the acoustic surveys, and identifies potential impacts the proposed Project may have on bats.

2.0 BACKGROUND

This section summarizes findings from the Brady Wind Energy Center Desktop Bat Habitat Assessment (Tetra Tech 2015), presents background information on bats of the region, and discusses the legal and regulatory framework applicable to bats.

2.1 Habitat Assessment

Prior to acoustic surveys, Tetra Tech evaluated the potential for all bats known to occur in North Dakota to use the Project Area, with a special focus on NLEB. Tetra Tech considered the suitability of the habitats within the Project Area plus a 1.5-mile buffer to develop the list of species expected to occur in the Project Area and vicinity. The results of that assessment indicated that there is little suitable roosting or foraging habitat for NLEB in the Project Area, because the landscape is dominated by cultivated crops and grassland/herbaceous areas (> 80 percent). Mature forests with greater than 50 percent canopy coverage, which are preferred habitats of NLEB, are limited in the Project Area (USFWS 2015a). The majority of cover within the Project Area is cultivated crops (54.8 percent) and grassland/herbaceous (24.8 percent), as is the majority of cover within the 1.5-mile buffer (59.0 percent cultivated crops and 26.9 percent grassland/herbaceous). Suitable bat habitat (open water, emergent herbaceous wetlands, deciduous forest, evergreen forest, mixed forest, shrub/scrub, and woody wetlands) comprises 2.0 percent of the total Project Area and 1.8 percent of the 1.5-mile buffer (Tetra Tech 2015).

2.2 Bat Species Expected to Occur in the Project Vicinity

Eleven bat species are known to occur in North Dakota (Gullickson n.d.). Of these 11 species, available information about species-specific suitable habitat, known distribution ranges, and documented occurrences indicate that five species (big brown bat [*Eptesicus fuscus*], little brown bat [*Myotis lucifugus*], eastern red bat [*Lasiurus borealis*], hoary bat [*Lasiurus cinereus*], and silver-haired bat [*Lasionycteris noctivagans*]) are expected to have a moderate or high potential to occur within the vicinity of the Project Area. The remaining six species (fringed bat [*Myotis thysanodes*], long-eared bat [*Myotis evotis*], long-legged bat [*Myotis volans*], Townsend's Big eared bat [*Corynorhinus townsendii*], western small-footed bat [*Myotis ciliolabrum*], and NLEB) are expected to have a low potential of occurrence.

Little brown bats are thought to be the most common bat in North Dakota (Gullickson n.d.) In addition, big brown bats are known to forage in agricultural lands (Whitaker 1995; Rogers et al. 2006). Roosting colonies of big brown bat and little brown bat have a high probability of occurring within the Project Area because of their known association with human-made structures.

Eastern red bat, hoary bat, and silver-haired bat are all tree-roosting species that migrate long distances between summer and winter habitats (Cryan 2003). Roosting habitats of the eastern red bat, hoary bat, and silver-haired bat are all associated with forested areas (Harvey et al. 2011). Each of these species is found in North Dakota from May through September (Cryan and Veilleux 2007). This group of species has a moderate likelihood of occurring in the Project area, particularly during migration.

The remaining species found in North Dakota (Townsend's big-eared bat, fringed bat, long-eared bat, long-legged bat, western small-footed bat, and NLEB) are expected to have a low likelihood of occurrence in the Project area based upon species range, known habitat associations, and lack of suitable habitats within the Project Area.

The Project Area is within the range of the federally-listed (threatened) NLEB, but the species is expected to have a low likelihood of occurrence within the Proposed Project Area during the summer residency period and during migration (Figure 2). The species' range includes Stark County (USFWS 2015a, BCI 2014), and it has been detected in Hettinger and Billings Counties (Gilliam and Barnhart 2011, WAPA and USFWS 2015). Few data are available on NLEB in North Dakota, but the species is believed to occur statewide in suitable habitats (Harvey et al. 2011; Gullickson n.d.). Surveys conducted in the summers of 2009, 2010, and 2011 confirmed the presence of NLEB in the Turtle Mountains, Missouri River Valley, and in the Badlands regions (USFWS 2015a). All recorded instances of NLEB in the Dakotas have been in ecoregions with more topographic relief and trees than the Missouri Plateau ecoregion of the Proposed Project Area. Recent amendments to distribution maps identify the primary range occurring in the Turtle Mountains, the Badlands, and along the Missouri River (NDGF 2015).

2.3 Regulatory Framework

2.3.1 Federal Protection

There are eight species of bats federally listed as endangered and protected under the Endangered Species Act (ESA), although NLEB is the only listed species known to occur in North Dakota (USFWS 2015b, Gillman and Barnhart 2011). On April 2, 2015, the U.S. Fish and Wildlife Service (USFWS) announced that the NLEB was listed as threatened with an interim Section 4(d) rule. The intent of the 4(d) rule is to provide the USFWS flexibility in implementing the ESA by modifying regulations necessary to provide for the conservation of a threatened species while not overburdening private landowners, state agencies, and others with blanket regulations that do not further the conservation of the species. The final 4(d) rule was released on January 14, 2016 (USFWS 2016a). The USFWS determined that White-Nose Syndrome (WNS) is the primary threat to NLEB and regulating other sources of mortality or harm, such as from habitat loss, will not effectively conserve this species. The final rule reduces the scope of incidental take of NLEB (USFWS 2016a), but protocols for implementing the rule are still being developed by USFWS Field Offices.

The final 4(d) rule prohibits all *purposeful take*[1] within the range of NLEB except: removal of NLEB from human structures, defense of human health (disease monitoring), or removal of hazardous trees for the protection of human life and property. All take incidental to otherwise lawful activities is allowed outside of the WNS zone designated by USFWS. The WNS zone includes all counties affected by WNS and an additional 150-mile buffer around these counties (Figure 2; USFWS 2016b).

For areas within the WNS zone, *incidental take*[2] is prohibited only if it occurs within a hibernaculum, if tree removal activities occur within a quarter-mile of a known, occupied hibernaculum at any time of year or within 150 feet of a known, occupied maternity roost tree from June 1 through July 31 (USFWS 2016a).

Under the final 4(d) rule, incidental take by wind turbines is not prohibited. Regulatory mechanisms for wind energy facilities were not included in the final 4(d) rule because the primary factor causing the rapid population decline in NLEB is WNS and the best available information suggests that NLEB fatalities caused by wind facilities are not contributing significantly to the species' decline. However, because harm to individual bats by turbines may occur, the Service recommends adopting voluntary protocols for best management practices, such as limiting

[1] "Purposeful take is when the reason for the activity or action is to conduct some form of take. For instance, conducting a research project that includes collecting and putting bands on bats is a form of purposeful take. Intentionally killing or harming bats is also purposeful take and is prohibited" (USFWS 2016c).

[2] "Incidental take is defined by the Endangered Species Act as take that is incidental to, and not the purpose of the carrying out of an otherwise lawful activity. For example, harvesting trees can kill bats that are roosting in the trees, but the purpose of the activity is not to kill bats" (USFWS 2016c).

operations of turbines in low-wind speed conditions during the fall bat migration season, to reduce impacts to bats (USFWS 2016a). The Project Area is outside of WNS zone and therefore no forms of incidental take are prohibited; however, this area may change in the future if new occurrences of WNS are discovered. The USFWS database and WNS Zone Map is updated on a monthly basis[3] (Figure 2).

2.3.2 State Protection

The protection and regulation of bat species not listed under the federal ESA is typically at the discretion of state wildlife agencies. North Dakota does not have a state endangered or threatened species list, but the North Dakota Game and Fish (NDGF) has identified 100 species of conservation priority, or those in greatest need of conservation in the state (Dyke 2014).

Species are categorized into three levels according to conservation need:

- Level I – species in greatest need of conservation;
- Level II – species in need of conservation, but have had support from other wildlife programs; and
- Level III – species in moderate need of conservation, but are believed to be on the edge of their range in North Dakota.

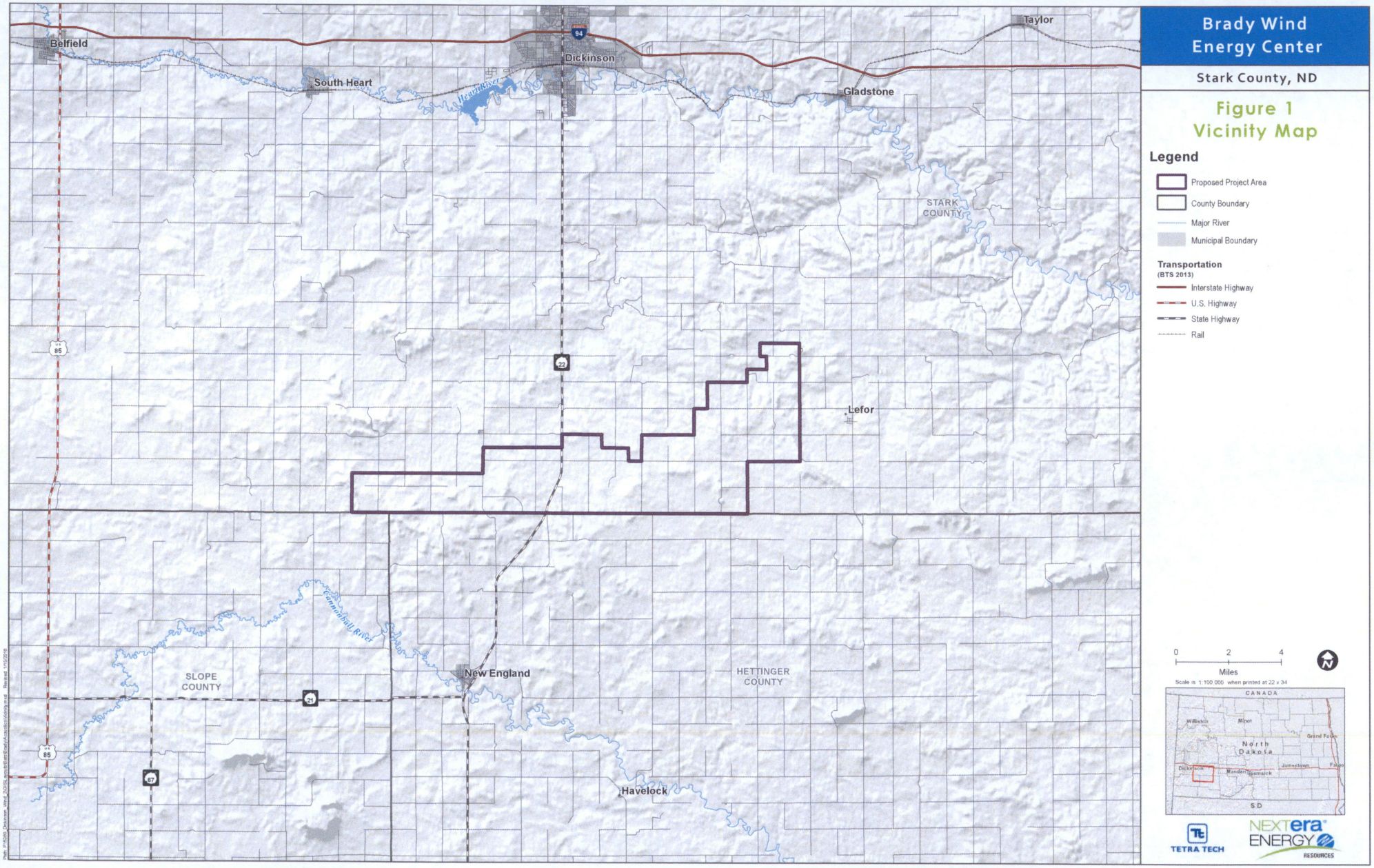
There are four bat species on the conservation priority list categorized as Level I: big brown bat, little brown bat, Townsend's big-eared bat, and NLEB. Big brown bat and little brown bat are common throughout the state, whereas Townsend's big-eared bat and NLEB are considered to be on the edge of their ranges, rare in the state.

There are no bat species on the conservation priority list categorized as Level II.

There are three bat species on the conservation priority list categorized as Level III: western small-footed bat, long-eared bat, and long-legged bat. These species are known to occur in western North Dakota (NDGF 2015).

The North Dakota State Wildlife Action Plan was updated and released in the fall of 2015 by NDGF and included Focus Areas for conservation efforts. Mammal species including the NLEB, western small-footed bat, long-legged bat, long-eared bat, little brown bat, and big brown bat are identified as Species of Conservation Priority within river, streams, and riparian areas (NDGF 2015). The nearest riparian area is the "Heart River Focus Area", which lies approximately 10 miles to the north of the Project Area. Based on species distribution and habitat preferences, all accept the little brown bat and big brown bat have a low likelihood of occurrence in the Project Area (NDGF 2015).

[3] http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf



Brady Wind Energy Center

Stark County, ND

Figure 1
Vicinity Map

Legend

- Proposed Project Area
- County Boundary
- Major River
- Municipal Boundary

Transportation
(BTS 2013)

- Interstate Highway
- U.S. Highway
- State Highway
- Rail

0 2 4
Miles
Scale is 1:100,000 when printed at 22 x 34

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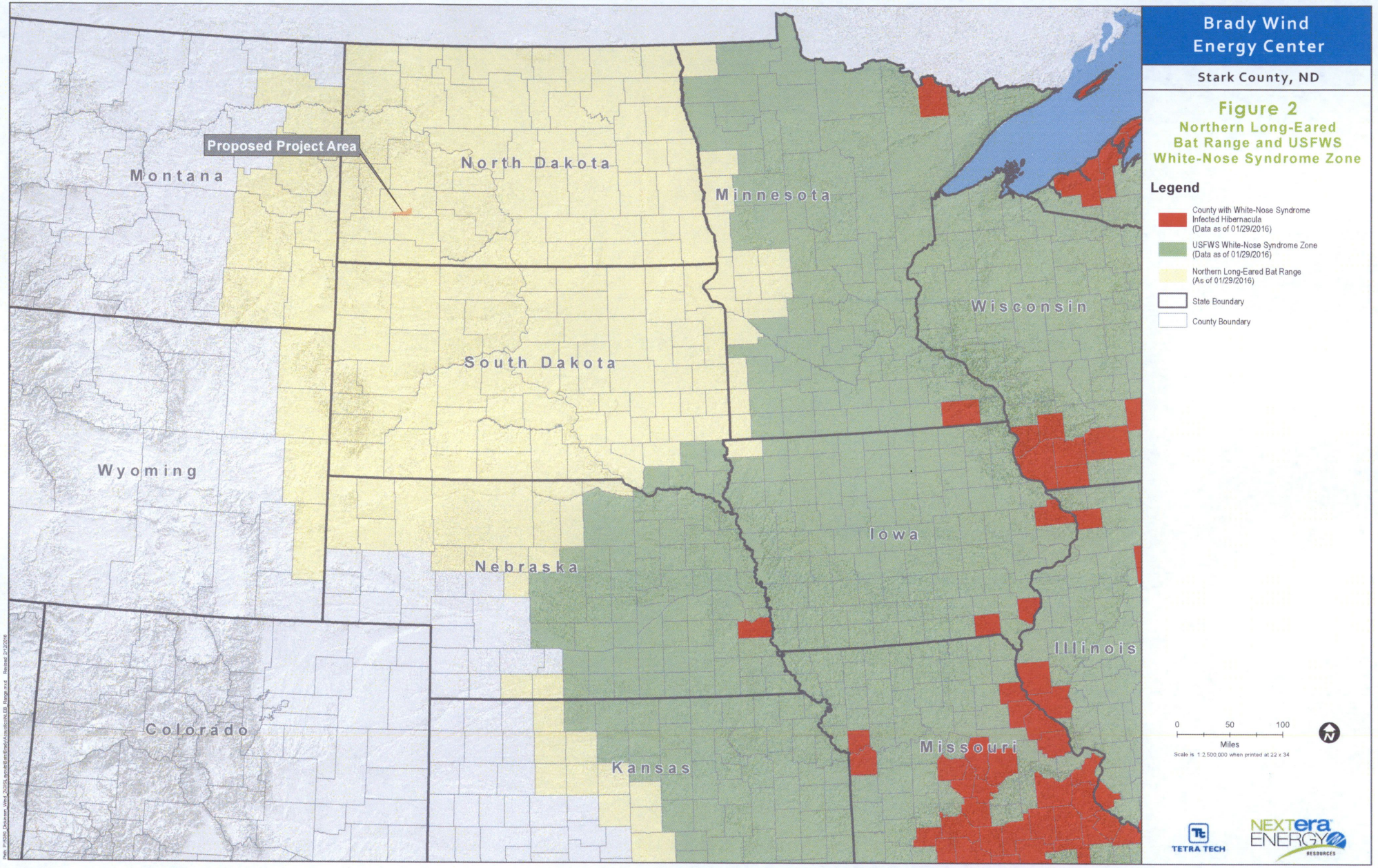
Proposed Project Area
Montana
North Dakota
Minnesota
South Dakota
Wisconsin
Wyoming
Iowa
Nebraska
Illinois
Colorado
Missouri
Kansas
Brady Wind Energy Center
Stark County, ND
Figure 2
Northern Long-Eared Bat Range and USFWS White-Nose Syndrome Zone
Legend
County with White-Nose Syndrome Infected Hibernacula (Data as of 01/29/2016)
USFWS White-Nose Syndrome Zone (Data as of 01/29/2016)
Northern Long-Eared Bat Range (As of 01/29/2016)
State Boundary
County Boundary
0
50
100
Miles
Scale is 1:2,500,000 when printed at 22 x 34
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3.0 ACOUSTIC MONITORING

3.1 Methods

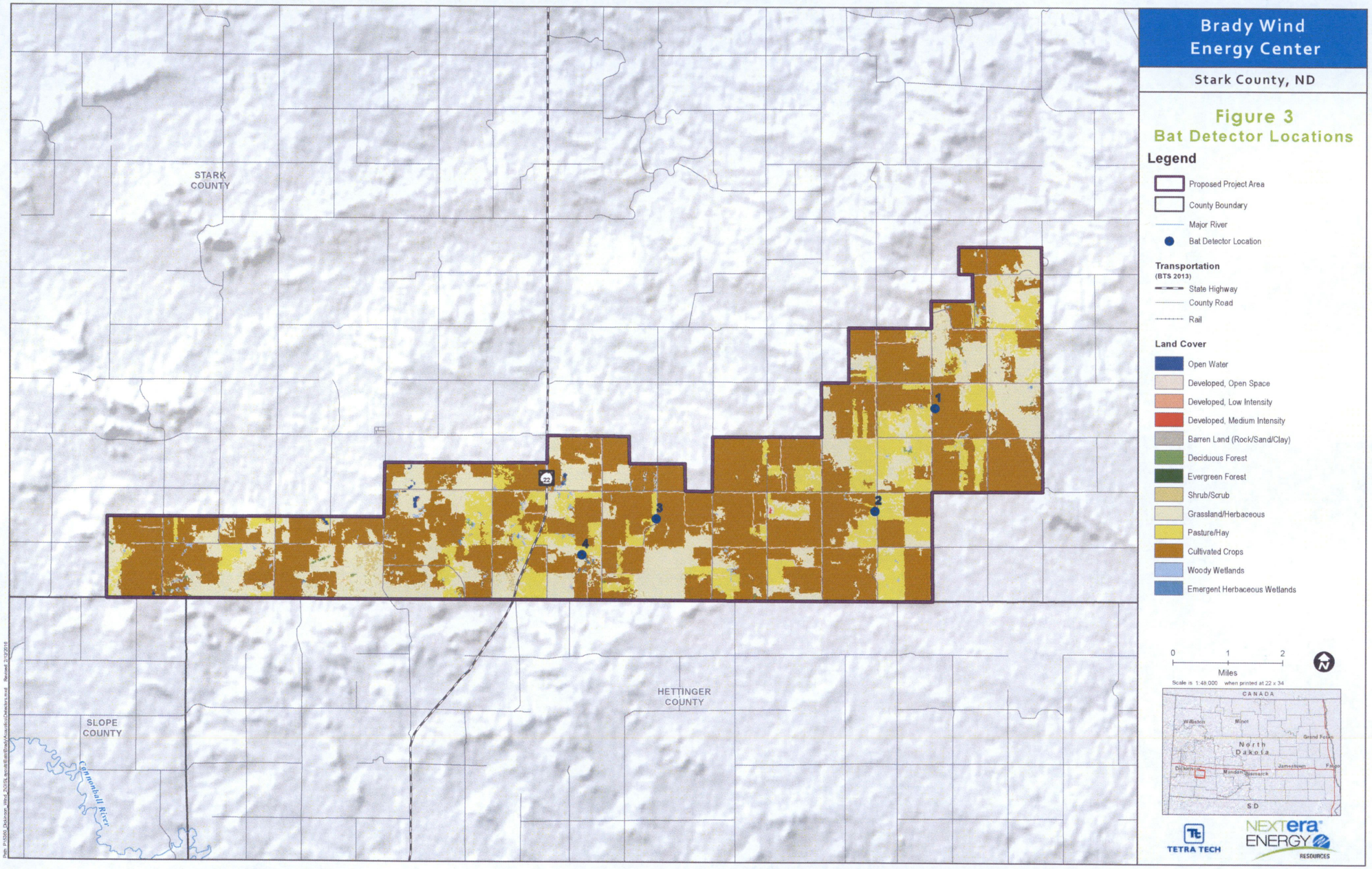
To supplement and refine the desktop assessment of bat likelihood of occurrence, Tetra Tech conducted acoustic bat monitoring in the Project Area in the summer and fall of 2015. The objective of acoustic monitoring was to assess bat use and occurrence of the Project Area by local and migratory bat species. Standardized protocols have been established for pre-construction passive acoustic surveys undertaken to evaluate bat species' risk from wind projects. Tetra Tech designed the acoustic monitoring surveys at the Project Area in accordance with the recommendations outlined within Tier 3 of the voluntary USFWS *Land Based Wind Energy Guidelines* (USFWS 2012) and the *2015 Range-wide Indiana/ Northern Long-eared Bat Summer Survey Guidelines* for Phase 2 presence/absence surveys (Guidelines; USFWS 2015c).

3.1.1 Acoustic Detectors

Tetra Tech used Wildlife Acoustics Song Meter SM3 Monitoring Systems (bat detectors) for the duration of the acoustic monitoring survey. Each bat detector station consisted of the acoustic detector, powered by a 25-50 watt solar panel and a 12-volt DC battery, encased in a waterproof housing. The SM3-U1 microphone was attached to the recording unit by a high-quality, low-loss 3 meter microphone cable. Each bat detector was manually checked by trained technicians approximately twice per month during the survey period.

Tetra Tech deployed four ground-based bat detectors within the Project Area in July 2015. Sampling sites were within representative habitats in the Project Area, areas with potential for high bat activity, and areas available for access under existing lease agreements (Figure 3). Site 1 was located adjacent to two ponds and a scrubby woodlot associated with an abandoned farmstead; Site 2 was located next to an open wetland amid pastures and cropland; Site 3 was located within a mature shelterbelt adjacent to a farmstead; and Site 4 was located adjacent to a forested patch near a stock yard and shed (See Appendix A for photographs of detector locations and habitat descriptions). The microphone height of each of the ground-based bat detectors was approximately 2.5 meters above ground level. To ensure that the greatest period of bat activity was surveyed, bat detectors were programmed to begin recording at sunset and stop recording approximately at sunrise each day.

The Project Area was continuously surveyed from July 22, 2015, to December 3, 2015, to sample the summer volancy period (when pups can fly, approximately three weeks after birth) and the complete fall migration periods for the majority of North American bat species, including NLEB. The four bat detectors remained in their designated locations throughout the study period.


STARK COUNTY
HETTINGER COUNTY
SLOPE COUNTY
Cannonball River
22
1
2
3
4
Brady Wind Energy Center
Stark County, ND
Figure 3
Bat Detector Locations
Legend
Proposed Project Area
County Boundary
Major River
Bat Detector Location
Transportation
(BTS 2013)
State Highway
County Road
Rail
Land Cover
Open Water
Developed, Open Space
Developed, Low Intensity
Developed, Medium Intensity
Barren Land (Rock/Sand/Clay)
Deciduous Forest
Evergreen Forest
Shrub/Scrub
Grassland/Herbaceous
Pasture/Hay
Cultivated Crops
Woody Wetlands
Emergent Herbaceous Wetlands
0
1
2
Miles
Scale is 1:48,000 when printed at 22 x 34
CANADA
Williston
Minot
Grand Forks
North Dakota
Dickinson
Mandan
Bismarck
Jamestown
Fargo
SD
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3.1.2 Data Quality Assurance and Control

Tetra Tech implemented quality assurance and quality control measures during all stages of data collection, analysis, and report preparation. Bat detector data were downloaded once every month. The incoming echolocation calls were recorded onto high-capacity SD data storage cards, which were then backed up to an external hard drive and sent to a Tetra Tech biologist for analysis. Field biologists submitted data within seven business days, and data were immediately reviewed by bat biologists to confirm the operational status of the bat detectors.

3.1.3 Data Analysis

Definitive identification of bat species by echolocations is a two-step process, whereby data are first analyzed using automated bat call identification software approved by the USFWS (see details below) and then manually reviewed to confirm species identification. The manual review process is particularly important for *Myotis* species, because frequency overlap can occur and incorrect classifications by automated software is more prevalent than for other species groups.

All recorded data files were filtered by software to identify data files containing potential bat calls[4]. Data were scrubbed and analyzed using Kaleidoscope Pro (Wildlife Acoustics, Inc.) version 3.1.5 and the classifier "Bats of North America 3.1.0" for species of bats in North Dakota. A sensitivity level of "-1 more sensitive/liberal" was used per Wildlife Acoustics and USFWS recommendations (USFWS 2015d). Signals of interest ranged from 8-120 kHz lasting 2–500 ms with a minimum of two call pulses. Full spectrum .wav files were converted to zero-crossing (ZC) using a division ratio of eight.

All calls classified as potential NLEB by the software were manually reviewed by Tetra Tech in full spectrum format using SonoBat 3.2.0 (SonoBat, Inc.) to confirm the automated classifications. During manual review, Tetra Tech considered a recording as suitable for species level identification if the individual call pulses within the call sequence exhibited the full spectrum of frequency modulation produced by a bat species. Calls that lacked detail to be identified at the species level (e.g., too far from the microphone or noise interference) were identified as "*Myotis* species" if the call pulses contained characteristics unique to *Myotis* (i.e., well defined toes) or as "High frequency species" if the frequency center was greater 40 kHz and call characteristics between eastern red bat and *Myotis* were ambiguous. As part of a third party review process, Biodiversity Research Institute (BRI) independently reviewed all calls classified as potential NLEB by the software.

SonoBat was chosen for manual review to cross-validate Kaleidoscope Pro classifications with an additional automated bat call ID software program. SonoBat software was used for this step because the consensus among bat professional bat biologists is that it has a superior spectrogram platform for reviewing full-spectrum calls.

[4] Each recorded event including a bat vocalization consists of individual "call pulses" that comprise a "bat call sequence" or "bat pass".

3.2 Results

During the 2015 survey, 540 detector-nights (number of nights multiplied by the number of detectors) were sampled over the course of 135 calendar nights between July 22 and December 3, 2015 (Table 1). All four of the detectors were fully operational during the deployment period (100% of available detector-nights). A total of 25,581 bat call sequences were recorded and identified to the species level, resulting in an overall mean activity rate of 47.4 bat calls/detector-night. Activity rates varied significantly across all detectors and ranged from 1.5 bat calls/detector-night to 159.4 bat calls/detector night. The highest rate occurred at Detector 1, which was adjacent to two ponds and a scrubby woodlot (Table 1).

Table 1. Summary of Acoustic Bat Monitoring Surveys at the Proposed Project

Detector	Level of Effort		Call Sequence Summary		
	Operational Period (2015)	Detector-Nights	Total # of Bat Calls	min, max	Mean Activity Rate (bat calls/detector night) (sd)
1	July 22 - December 3	135	21,516	0, 1561	159.4 (31)
2	July 22 - December 3	135	204	0, 57	1.5 (5.1)
3	July 22 - December 3	135	1,635	0, 125	12.1 (19.7)
4	July 22 - December 3	135	2,226	0, 250	16.5 (29.3)
Overall*		**540**	**25,581**	**0, 1561**	**47.4 (24.3)**

*Represents cumulative values for detector nights and total number of calls and the pooled range and activity rates across all detectors in the Project Area

3.2.1 Species Presence and Activity Rates

Bat call sequences identified at the species level included five species (Table 2). Little brown bat was the most commonly recorded species (86 percent of the total calls recorded), followed by eastern red bat (9 percent), silver-haired bat (3 percent), big brown bat (1 percent), and hoary bat (< 1 percent). During analysis of interim data collected through September, 140 call sequences were auto-classified as potential NLEB by Kaleidoscope Pro v. 3.1.4B. However, during the independent, manual review of call sequences identified as potential NLEB, Tetra Tech and BRI, determined that these sequences were either little brown bat, a *Myotis* species, or High Frequency bats. One of the auto-classified potential NLEB call sequences was classified as little brown bat by Tetra Tech and as potentially NLEB by BRI. The BRI reviewer noted that the maximum frequency was too low to provide an unequivocal identification as NLEB. Of the total 21,949 calls sequences auto-classified as *Myotis* species during this study, only 0.6 percent were classified as potential NLEB. This classification percentage is less than the baseline error rate assumed for

NLEB by the software program (Agranat 2012).Therefore, the call sequences auto classified as NLEB were false positives and verified as such during manual review.

Activity rates were also calculated for each species by detector. Little brown bats had the highest overall species activity rate with 40.5 calls/detector night (Table 2).

Table 2. Average Activity Rates (Bat Calls/Detector Night) Recorded per Species at Each Detector

Detector	Big brown bat	Eastern red bat	Hoary bat	Silver-haired bat	Little brown bat	Myotis Species	High frequency sp.	Site Total
1	0.3	10.7	0.1	0.8	147.3	0.1	0.2	159.4
2	0.0	0.2	0.1	0.2	1.0	0.0	0.0	1.5
3	1.1	1.5	0.2	3.4	5.9	0.1	0.0	12.1
4	0.8	5.1	0.5	1.9	8.1	0.1	0.0	16.5
Overall	**0.6**	**4.4**	**0.2**	**1.6**	**40.5**	**<0.1**	**0.1**	**47.4**

3.2.2 Timing of Activity

Following deployment on July 22, bat activity increased sharply at the start of August and remained steady throughout the month until an abrupt decline at the start of September. Elevated activity was observed from August 7 through August 30, with several spikes in activity throughout; including the greatest number of detections recorded on August 10 with 1,638 calls (Figure 4). Activity remained low through the month of September and nearly ceased after several hundred calls were recorded in the first week of October.

Little brown bat activity recorded during the survey was concentrated in the month of August and far exceeded that of any other group (Figure 5). Migratory tree bat (silver-haired, hoary, and eastern red bat) activity remained relatively low until an increase at the end of August into September and a pulse of activity on October 1 (Figure 5).

Figure 4. Total Number of Calls Recorded by Date at all Detectors

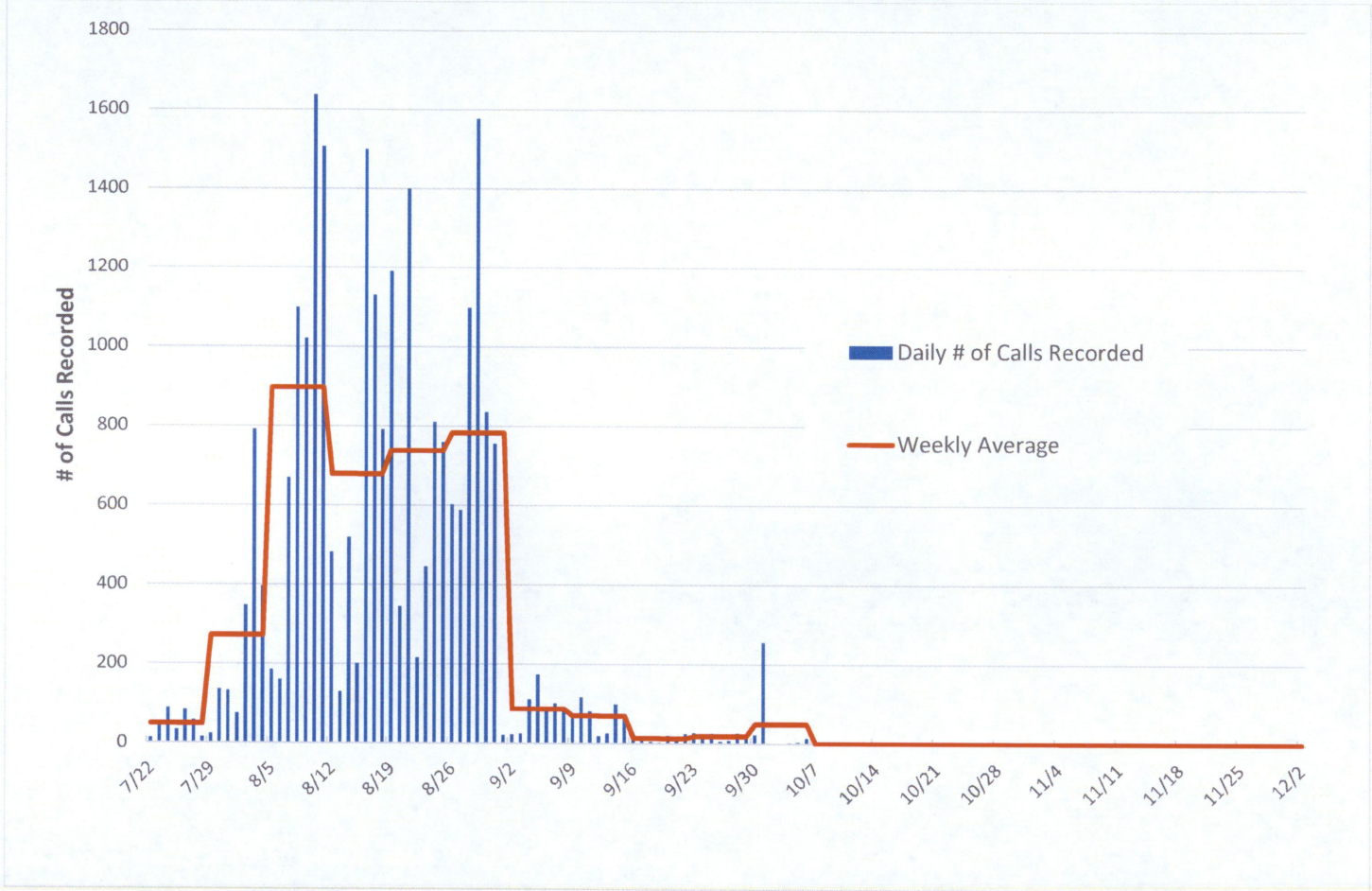
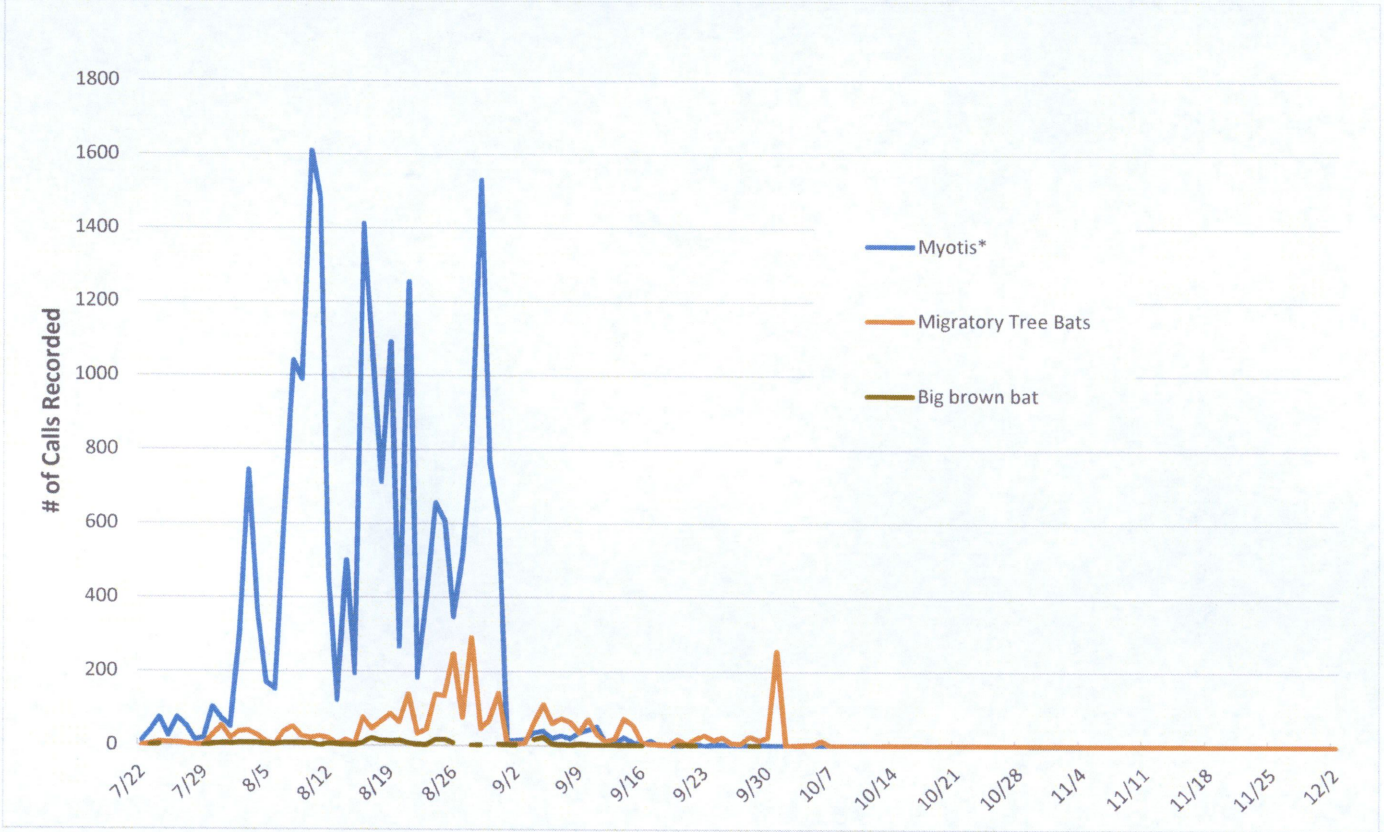


Figure 5. Total Number of Calls Recorded by Date and Species at all Detectors



*Includes all calls identified as little brown bat (n=21,889) and as Myotis species (n=26). Calls identified as High Frequency (Myotis or Eastern red bat; n =29) are not included on chart.

4.0 DISCUSSION

Summary of NLEB Findings at the Project. The bat habitat screening in accordance with Phase 1 of the Guidelines indicated that the likelihood of occurrence of NLEB in the Project Area is low. Acoustic surveys were then conducted in accordance with phase two of the Guidelines, and no NLEB call sequences were identified, suggesting NLEB is not present in the Project Area. The Project Area is generally lacking in suitable habitat, and more suitable patches of foraging and roosting habitat may be available near the Heart River, which is beyond distances NLEB are known to travel during foraging forays (less than 1 mile; USFWS 2015a). The NLEB roosts and forages in forested areas (USFWS 2015a) and the lack of forest cover is likely the limiting factor in the distribution of NLEB in the vicinity of the Project Area.

When compared to the *Key to the Northern Long-eared Bat Final 4(d) Rule for Non-federal Actions* (Key; USFWS 2016c) results of bat surveys at the Project indicate that the species is not a concern at the Project. The questions in the Key are considered and answered in order in the paragraph below.

1. Will the Activity Purposefully Take Northern Long-eared Bats?

   No.

2. Is the Activity Located Outside the White-nose Syndrome Zone?

   Yes, North Dakota is completely outside the white-nose syndrome zone.

3. Will the Activity Take Place Within a Cave or Mine Where Northern Long-eared Bats Hibernate (i.e., hibernaculum) or Could it Alter the Entrance or the Environment (physical or other alteration) of a Hibernaculum?

   No, there are no known hibernacula within Stark County.

4. Will the Activity Involve Tree Removal?

   Yes, limited numbers of trees may need to be removed.

5. Is the Activity Removing Hazardous Trees?

   No.

6. Will the Tree Removal Activities Include One or Both of the Following: a) Removing a NLEB Known Occupied Maternity Roost Tree or any Trees within 150 Feet of a Known Occupied Maternity Roost tree from June 1 Through July 31; or b) Removing any Trees Within 0.25 Miles of a NLEB Hibernaculum at any Time of Year?

   No, there are no known hibernacula or maternity roost trees within the Project Area.

Based on the answers to the questions, the Key indicates that construction and operations may proceed without contacting the USFWS with respect to the species.

Bat Community at the Project. Acoustic monitoring provides a relative index of bat activity and provides a list of species that occur within a project area, particularly when used in a study design that chooses sites containing bat attractants. To date, no empirical evidence suggests a correlation between pre-construction bat activity (as measured by acoustic monitoring) and post-construction bat mortality (Hein et al. 2013, USFWS 2016a).

The bat species detected during the acoustic surveys at the site are common species in the Central U.S. The highest levels of overall bat activity appeared to be concentrated near forested patches with open water sources nearby (e.g., Site 1). Several factors influence the relationship between roosts and foraging areas and include variables such as roost type, the availability of roosts, food and water, and species morphology. Small bats, such as little brown bats, typically travel less than several kilometers between roost and foraging sites (Kunz and Lumsden 2003). By far, the greatest activity was recorded at Site 1, located near an abandoned farmstead with two ponds that provide approximately three-quarters of an acre of open water. An abandoned barn, which has the potential to serve as a day roost, was also located at Site 1. Little brown bats are known to inhabit buildings in the summer and have a preference for foraging over open water (Harvey et al. 2011). The presence of both features at Site 1 may have contributed to the high volume of little brown bat calls recorded at this location. Fewer calls were recorded at Sites 3 and 4, which were located near small forest patches surrounded by cropland and pasture. Lowest activity was recorded at Site 2 where open water was available but trees were lacking. The majority of the Project Area is similar to Site 2 and is comprised of marginal bat habitat (i.e., croplands, pasture, and prairie) and lacks forest cover (Tetra Tech 2015). Significant waterways and treed riparian zones within the Project Area are absent; the nearest is the Heart River, located approximately 10 miles to the north.

The 2015 acoustic surveys indicate that the Project Area is used by migrant and resident bats. The acoustic survey data suggest that bats reside or migrate through the Project Area in August through September and most bats have migrated to local hibernacula or out of region by early October. The spike in activity by migratory tree bats on October 1 is suggestive of a migratory event. These findings are consistent with known migration patterns of tree bats in the northern plains (Cryan 2003). Bat migration within the temperate zone of the United States is common and the period of summer activity becomes more condensed with increasing latitudes due to prey availability and time spent in migration. Migration patterns, which vary based on species life history characteristics, can be grouped into three basic categories including sedentary (Big brown bat), regional (*Myotis* species), and long distance (eastern red, silver-haired, and hoary bats) migrants (Fleming et al. 2003). High levels of little brown bat activity were recorded through the

month of August and were likely due to favorable foraging conditions (i.e., high temperatures and low wind speeds).

Three species of migratory, tree-roosting bats (silver-haired bat, eastern red bat, and hoary bat) and one primary resident species (little brown bat) were detected throughout the summer period. Pulses in activity by silver-haired and hoary bats in August and September, and by eastern red bats on October 1, suggest that these species may be migrating through the Project Area in brief, episodic movements. The hoary bat, silver-haired bat, and eastern red bat have been documented as fatalities at wind projects across North America, most frequently in later summer and early fall during migratory periods (Arnett et al. 2008, Strickland et al. 2011). Little brown bat was recorded consistently throughout July and August, which suggests that it is a summer resident species. Elevated numbers of observations are likely due to the availability of open water, treed areas, and buildings, which are preferred foraging and roosting habitats of little brown bat (Lacki et al. 2007). Fatalities of summer resident species, including little brown bat, have usually been low at wind projects, with the exception of two sites in Canada and Iowa where little brown bats accounted for approximately 25 percent of fatalities (Arnett et al. 2008). Bat fatalities at the Project are likely to be reflective of the bat community composition in the vicinity and similar to those observed at other wind energy facilities in the region.

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Appendix A – Site Photographs

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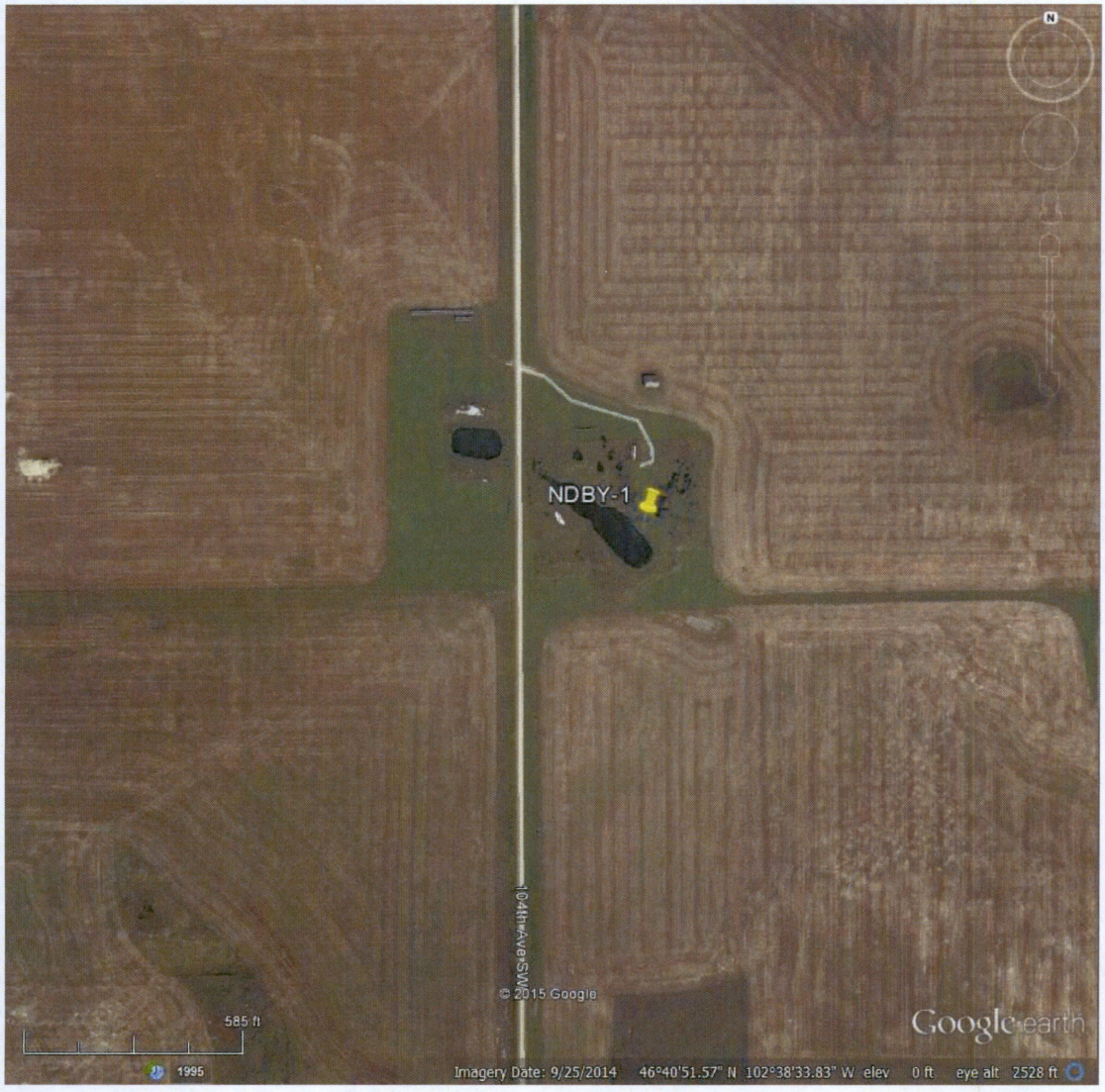
Location: Site 1

Site 1 was established adjacent to a pond near a small woodlot associated with an abandoned farmstead. Both open ponds offer ideal foraging habitat for bats and there is potential roosting habitat in the mid-successional trees and abandoned buildings on site. Four woodlots and farmsteads within half to one mile are present in all directions, which could potentially be a source for bats feeding or drinking at the ponds at Site 1.

1) Detector setup and microphone oriented south overlooking a pond. July 22, 2015.

2) Old barn located approximately 400 feet north of the detector. July 22, 2015. View north.



3) Overview of habitat surrounding Site 1.

Location: Site 2

Site 2 was established adjacent to a small open water wetland surrounding by cultivated land and grasslands. Woodlots associated with farmsteads were located a half mile away to the northwest and southwest.

4) The detector setup oriented north over an open water wetland. July 22, 2015.

5) The detector is located in the center of frame. The surrounding area is entirely pasture and crop land. July 22, 2015. View west.

6) Overview of habitat surrounding Site 2.

Location: Site 3

Site 3 was located in a shelter belt adjacent to a farmstead. Ample snags within the shelterbelt and a dilapidated barn 450 feet to the south offer potential roosting locations.

7) Detector set up with microphone oriented west within the shelterbelt. July 22, 2015.

8) Dilapidated barn located 450 feet south of detector location. The barn could serve as potential roosting habitat for big or little brown bats. July 22, 2015. View south

9) Overview of habitat surrounding Site 3.

Location: Site 4

Site 4 was located adjacent to a forested patch near a stock yard and shed. A small, half-acre stock pond is located a quarter mile to the southeast. The site is surrounded by pasture and cropland.

10) Detector was positioned on edge of the forested patch with the microphone oriented north along the edge.

9) Overview of habitat surrounding Site 4.