Wenck File #B2759-0005-02
April 6, 2017

Interim Wildlife Monitoring Report
Palmer's Creek Wind Farm

Palmer's Creek Wind Farm, LLC.

Prepared for:

501 West Highway 212
Granite Falls, MN 56241

PALMER'S CREEK
Wind Farm

WENCK
ASSOCIATES

Responsive partner.
Exceptional outcomes.

Prepared by:

WENCK Associates, Inc.
301 1st Street NE, Suite 202
Mandan, ND 58554
Phone: 701-751-3370
Fax: 701-751-3372

Table of Contents

Table of Contents (Cont.)

APPENDICES

1.0 Introduction

1.1 PROJECT OVERVIEW

Palmer's Creek Wind Farm, LLC (Palmer's Creek) proposes to construct the Palmer's Creek Wind Energy Facility (Project or PCWF), a Large Wind Energy Conversion System (LWECS), with a 44.6-megawatt (MW) nameplate capacity in Chippewa County, Minnesota (**Figure 1**). Wenck Associates, Inc. (Wenck) and New Century Environmental (NCE) were contracted by Palmer's Creek to conduct and analyze a variety of pre-construction wildlife surveys prior to building and operation of the proposed facility.

The data from these studies were used to identify species, species groups or species of concern that are present in the project area and vicinity that may be at a higher risk of mortality and/or displacement. Data is presented in several categories, and highlight federally listed species and state listed species. This is an interim report that contains data collected up to February 24, 2017. A final report will be submitted once the avian surveys have been completed during the summer of 2017.

1.2 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

Spring and fall are migration periods for non-resident avian species. During the spring, birds move north from wintering grounds to summer breeding grounds. In the fall, birds move south to wintering grounds. Spring and fall are prime periods to conduct avian surveys on potential wind farm areas to observe migratory species and resident species.

Avian surveys focus on inventory and monitoring with specific objectives that include: 1) an inventory of bird species in a specific project area; 2) determining the relative abundance of species; and 3) monitoring seasonal changes in species composition and relative abundance (Whitworth et al. 2007). Diurnal fixed-point surveys are one of the most common methods used to determine avian composition and abundance. Point counts not only focus on visual cues but also on auditory cues to give the observer an advantage in rough terrain. For some species, vocal cues may be the only reliable means of detection (Whitworth et al. 2007).

Incidental avian surveys are used to obtain bird distribution and composition information between point count locations. Larger birds, such as game birds, raptors, and waterfowl, large flocks of smaller birds, and birds that are a rarity in the area are typically recorded during incidental surveys.

1.3 EAGLE USE SURVEYS

Following Stage 2 of the Eagle Conservation Plan Guidance (USFWS 2013), eagle point count surveys have been and will continue to be conducted to collect quantitative data on eagle presence that would allow estimation of eagle exposure rate, which forms the basis of a risk assessment model. Eagle use surveys focus exclusively on eagles and occur at the eight (8) point count locations (**Figure 2**) used for point count surveys in 2016-2017. The objective of the eagle use survey is to document eagle movements and behavior within and adjacent to the study area in all four seasons to assess risk to eagles (primarily bald eagles). Eagle surveys are conducted by a qualified biologist and will continue for one calendar year to capture temporal variation in eagle use of the study area.

1.4 RAPTOR AND EAGLE NESTS

Raptors and eagles spend much of their time hunting and soaring within elevation ranges that correspond to the wind turbine rotor-sweep area (RSA), making them susceptible to turbine blades (Erickson et al. 2002). Because raptors and eagles are long-lived species with low reproduction rates, potential impacts from collision-related mortality are of concern (Erickson et al. 2002). Although specific studies are lacking, adults and recently fledged young could be at particular risk of collision with turbines because of their higher use of areas near nest sites. After young raptors and eagles fledge, fledglings often spend significant amounts of time flying and roosting near nest locations until they become capable flyers and hunters. Additionally, construction activities near active nests during the breeding season may potentially result in disturbance or abandonment of nest sites.

In 2007, the bald eagle (State Special Concern) was delisted from its federally threatened status in the lower 48 states, but it is still federally protected under the Bald and Golden Eagle Protection Act ("BGEPA"). It was also delisted in Minnesota in 2013.

Bald eagles associate with distinct geographic areas and landscape features, including nest sites, foraging areas, communal roost sites, migration corridors and migration stopover sites (USFWS 2013). They are typically found near water bodies, natural and manmade, due to the presence of fish. They prefer to nest, perch, and roost in old-growth or mature stands of trees, and they usually select a nesting tree that is the tallest among those in its vicinity to provide visibility. Nesting trees are usually situated near a water body that supports fish, their main preferred prey.

1.5 ACOUSTIC BAT SURVEYS

There are seven bat species known to occur in Minnesota – big brown bat (*Eptesicus fuscus*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), little brown bat (*Myotis lucifugus*), northern long-eared bat (*Myotis septentrionalis*) and tri-colored bat (eastern pipistrelle, *Perimyotis subflavus*) (MNDNR 2016). The northern long-eared bat (*Myotis septentrionalis*), tricolored bat (*Perimyotis subflavus*), big brown bat (*Eptesicus fuscus*), and little brown bat (*Myotis lucifugus*) are all state-listed species of special concern.

NCE initiated acoustic monitoring surveys to capture the diversity/abundance of bat species within the proposed Palmer's Creek Wind Farm (project area) and to meet due diligence with regulatory agencies (NCE 2017).

2.0 Methodology

2.1 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

2.1.1 Fixed-point Surveys

Avian point count (PC) surveys were conducted in summer 2016 through summer 2017 to capture migrating and resident species at the project site (**Table 1**). Survey data was used to evaluate avian use, behavior, and species composition during migration and determine resident avian species. Diurnal fixed-point count surveys were conducted at eight (8) circular plots (**Figure 2**). Point count locations were selected to capture a diverse range of habitats and locations with the best possible view shed.

Table 1: Palmer's Creek Point Count Dates

Summer 2016		Fall 2016		Winter 2016-2017		Spring 2017		Summer 2016	
Survey Number	*Survey Week*	*Survey Number*	*Survey Week*	*Survey Number*	*Survey Week*	*Survey Number*	*Survey Week*	*Survey Number*	*Survey Week*
1	6/27/2016	6	9/5/2016	18	12/12/2016	24	2/27/2017	34	5/15/2017
2	7/11/2016	7	9/19/2016	19	12/26/2016	25	3/6/2017	35	5/29/2017
3	7/25/2016	8	9/26/2016	20	1/9/2017	26	3/13/2017	36	6/12/2017
4	8/8/2016	9	10/3/2016	21	1/23/2017	27	3/20/2017		
5	8/22/2016	10	10/10/2016	22	2/6/2017	28	3/27/2017		
		11	10/17/2016	23	2/20/2017	29	4/3/2017		
		12	10/24/2016			30	4/10/2017		
		13	10/31/2016			31	4/17/2017		
		14	11/7/2016			32	4/24/2017		
		15	11/14/2016			33	5/1/2017		
		16	11/21/2016						
		17	11/28/2016						

All observations within an 800-meter radius at each point count were recorded; any observations outside the 800-meter radius were considered incidental. Each PC survey lasted for 20 minutes; all audio and visual observations were recorded. Surveys were conducted by an experience ornithologist. Surveys were rotated to cover all daylight hours to ensure each PC was surveyed at various times of the day. Data recorded for each observation included species, number of individuals, time, and height above ground, behavior, and flight direction. A range finder and topographic maps were used as references to determine bird distances to the observer and flight heights. Birds not easily identifiable due to low light conditions and distance were identified to the lowest taxonomic level possible.

The data collected from these surveys can be used to estimate the potential effects of wind turbines on avian species in the project area. The survey protocol estimates avian use throughout the day and captures a variety of bird species. Songbirds are most active in the morning during the breeding season and can be difficult to detect during the afternoon,

compared to raptors which become more active as the sunlight heats the air and creates thermals, which individuals use for soaring.

Twenty-minute survey periods provide adequate time to detect both raptors and non-raptors. Double counting may occur during the 20-minute survey because individuals may appear and disappear from view. Double-counting of birds is not problematic for this type of survey because the objective is to document use in terms of number of birds noted per 20-minute survey, not number of distinct individual birds.

The ability to detect all species within the 800-meter survey radius varies among species and potentially not all individuals within the survey area are counted. This variation in detectability results in an overestimate of mean use in conspicuous species and an underestimate of mean use in reclusive species (Thompson 2002).

This report presents and discusses the results of the avian point count surveys completed as of February 24, 2017.

2.1.2 Incidental Observations

Incidental observations included those occurring while traveling between PC locations, pre- and post-PC survey time period, and outside the 800-meter radius circular plot. These observations were recorded but not used in the formal analysis.

2.1.3 Species Groupings

The data is presented in two primary groups of interest: raptors and non-raptors. Raptors were defined as vultures, hawks, eagles, falcons, and owls. Non-raptors were defined as all other avian species.

2.1.4 Mean Avian Use

Mean use was calculated by dividing the total number of birds per species observed by the total number of surveys conducted. Mean use was also calculated for each individual point count location to determine if there were areas with a higher mean use compared to other areas. The number of observations is also presented. This information helps depict whether a high mean use is driven by a single observation.

2.1.5 Flight Behavior

Flight behavior was evaluated by calculating the proportion of flying birds that were observed flying below, within, or above the turbine rotor sweep area (RSA). The Project is comprised of two (2) 2.3-MW and sixteen (16) 2.5-MW horizontal axis wind turbines. Each will have an anticipated hub height between 80 and 90 meters and a rotor diameter of approximately 116 meters. Therefore, an RSA between 22 and 148 meters above the ground was used.

2.1.6 Encounter Rate

The encounter rate is the rate at which a species was observed flying through the RSA during the avian point count surveys in the project area and suggests potential mortality risk from flight behavior.

To estimate the rate at which a species flies through the RSA, the following equation was applied to every species observed in the project area:
Encounter Rate = A*P*f*P*t*

- A is the mean use of birds/20 minutes for a given species
- P*f* is the proportion of all activity observations for a given species that were flying
- P*t* is the proportion of flying observations that were within the turbine RSA

The encounter rate index is relative to the observations of species during the surveys and within the study area and cannot be extrapolated to the species that may use the project area in the future. The encounter rate index from this study does not take into consideration behavior (e.g. foraging, courtship), habitat use, and turbine avoidance differences between species.

2.2 EAGLE USE SURVEYS

Eagle use data is collected in 1-minute intervals so that the data can be translated into eagle exposure minutes. The data recorded for each survey includes the count start and stop times, eagle species observed, numbers and age classes of eagles seen, minutes of eagle flight in two height categories based on the USFWS Eagle Conservation Plan Guidance (< 200 and > 200 meters [m] above ground), notes on flight and other behaviors, and an individual identifier for each flight observation allowing it to be linked to a flight map. Each eagle flight observed will be drawn on a topographic map or aerial image of the study area and digitized using a GIS so that eagle locations and behaviors can be overlaid with Project features. Each sampling point will consist of an 800-meter (0.5-mile) radius circle (0.77 square mile) that provides distant, unobstructed views and allows visual observations of eagles and other large birds at a 2 to 3-mile distance. Numerical data is collected within 800-m-radius plots, but flight lines will be documented across line-of-sight and are not limited to the 800-m-redius survey plot. Detailed protocol study-specific data sheets and a data management plan are being adhered to and are utilized in the field.

Surveys are being conducted once a month during the non-migration months (April-August), surveys are conducted at a minimum of twice a month during the migration months (September-March) starting July 2016 and concluding in June 2017. There will be 20 survey weeks in total. Individual surveys consist of a 1-hour observation period at each of the eight point-count locations during each week of the surveys, for a total of 160 hours of observations. (**Figure 2** and **Table 2**). Surveys occur in all weather conditions except when visibility is poor. These surveys are conducted outside of the 20-minute avian point count surveys.

Table 2: Palmer's Creek Eagle Use Survey Dates

Summer 2016		Fall 2016		Winter 2016-2017		Spring 2017		Summer 2016	
Survey Number	*Survey Week*	*Survey Number*	*Survey Week*	*Survey Number*	*Survey Week*	*Survey Number*	*Survey Week*	*Survey Number*	*Survey Week*
1	7/25/2016	3	9/5/2016	10	12/12/2016	16	3/6/2017	19	5/15/2017
2	8/22/2016	4	9/19/2016	11	12/26/2016	17	3/20/2017	20	6/12/2017
		5	10/3/2016	12	1/9/2017	18	4/11/2017		
		6	10/17/2016	13	1/23/2017				
		7	10/31/2016	14	2/6/2017				
		8	11/14/2016	15	2/20/2017				
		9	11/28/2016						

2.3 RAPTOR AND EAGLE NEST SURVEYS

A raptor nest survey will be conducted to locate raptor nests and determine nest activity status and the species using those nests during the spring of 2017. The initial surveys will be conducted before trees leaf out, to locate nests and to identify early breeding species. The project area and a 1-mile buffer area will be surveyed from a vehicle using binoculars and spotting scopes. All raptor nest locations will be documented with Global Positioning System (GPS) coordinates. Raptor species, height of nest, nest activity status, nest condition, substrate, and other relevant data will be recorded for each nest. An additional visit will be conducted if nests are found to document the activity status of nests located during the initial survey and to identify nesting attempts by late nesting raptors such as Swainson's hawks. Raptors may use nests intermittently among years as well as re-nest after a nest failure; therefore, early- and late-season nest surveys allow for a more accurate summary of breeding raptors.

A review of historical eagle nest data (MNDNR 2016) within one mile of the Project was completed at the request of Fagen, Inc. (Fagen). A bald eagle (*Haliaeetus leucocephalus*) nest has been documented in T116N R40W Section 11 just outside of the project area boundary. This nest was active when checked in 2000, 2001, and 2005. It is unknown whether the nest is still active or whether there are additional nests in the area.

An additional nest was located the spring of 2016 by Fagen, this nest was active in 2016 and is in T116N R39W Section 20, immediately outside of the project area boundary. Fagen staff have been monitoring nest use data in 2016 and will continue monitoring from April through August 15, 2017 or until all eaglets have fledged (Michael Rutledge, Fagen, Inc., Personal Communication, March 7, 2017).

2.4 ACOUSTIC BAT SURVEYS

Fagen deployed five separate Anabat systems (Anabat® SD-2 ultrasonic detectors) to record bat activity throughout the study area. The first deployment was done with two of the Anabat recorders during the fall of 2015 and continued through October 15, 2016. Three additional Anabat recorders were launched on August 3, 2016. Refer to **Figure 3** below.

3.0 Results

3.1 DIURNAL FIXED-POINT AND INCIDENTAL AVIAN USE SURVEYS

Of the approximate 6,150 acres that comprise the Palmer's Creek project area, approximately 3,970 acres were surveyed during PC surveys. Eight-point count locations were established and surveyed in the project area (**Figure 2**). A total of 36 surveys will be conducted over four seasons with seasons defined as summer (June 27, 2016–August 31, 2016 and May 14, 2017-June 17, 2017 [8-point count surveys]), fall (September 1, 2016–November 30, 2016 [12-point count surveys]), winter (December 1, 2016–February 25, 2017 [6-point count surveys]), and spring (February 26, 2017–May 15, 2017 [10-point count surveys]), as provided in **Table 1** above. The data presented below encompasses surveys conducted from June 27, 2016 through February 24, 2017. A final report breaking the data down by season will be completed after the avian surveys have been completed during the summer of 2017.

3.1.1 Species Composition

Survey data gathered through February 24, 2017 identified 2,916 avian individuals (60 different species) that were recorded during the eight fixed-PC surveys (**Table 2**). The most frequently observed birds were European starling (*Sturnus vulgaris*), (15.02 percent of all birds observed/438 individuals), American crow (*Corvus brachyrnchos)*, (11.08 percent/323 individuals), red-winged blackbird (*Agelaius phoeniceus)*, (9.26 percent/270 individuals), brown-headed cowbird (*Molothrus bonariensis)*, (8.20 percent/203 individuals), and barn swallow (*Hirundo rustica)*, (6.17 percent/180 individuals (**Table 3**). The remaining 55 species comprised approximately 50.27 percent of the total birds observed.

3.1.2 Avian Use

Based on data gathered through February 24, 2017, the mean bird use was 15.85 birds/20 min (**Table 3**). The overall mean use by non-raptors was 15.52 birds/20 min; the highest mean use was European starling (2.38 birds/20 min), American crow (1.76 birds/20 min), red-winged blackbird (1.47 birds/20 min), brown-headed cowbird (1.30 birds/20 min), and barn swallow (0.98 birds/20 min) (**Table 3**).

For the species groups, overall mean use was highest for songbirds (11.34 birds/20 min) (**Table 3**).

Raptors are a group of special interest because of their propensity to fly at heights within a turbine RSA. The mean use for raptors/vultures/owls was 0.33 birds/20 minute. Seven raptor species were identified during the surveys: red-tailed hawk (*Buteo jamaicensis*) (0.15 birds/20 min), turkey vulture (*Cathartes aura*) (0.07 birds/20 min), Bald Eagle (*Haliaeetus leucocephalus)* (0.05 birds/20 min), Swainson's Hawk (*Buteo swainsoni*) (0.03 birds/20 min), Rough-legged Hawk (*Buteo lagopus*) (0.02 birds/20 min), Northern Harrier (*Circus cyaneus*) (0.01 birds/20 min), and American kestrel (*Falco sparverius*) (0.01 birds/20 min) (**Table 3**).

3.1.3 Frequency of Occurrence

Based on data gathered through February 24, 2017, the most common species present during the surveys is the field sparrow (*Spizella pusilla*) (17.93 percent of all surveys), which was widely distributed throughout the project area (**Table 3**). Other frequently occurring species included American goldfinch (*Spinus tristis*) (17.39 percent of all surveys), blue jay (*Cyanocitta cristata*) (17.39 percent of all surveys), and Red-winged Blackbird (14.67 percent of all surveys) (**Table 3**).

3.1.4 Flight Height and Encounter Rate

Based on data gathered through February 24, 2017, 77.64 percent of all individuals observed were flying (**Table 3**). Flight height and flight direction data was recorded for all the flying birds (**Table 3**). Approximately 43.65 percent of flying raptor species flew below the RSA, 30.90 percent flew within the RSA, and 25.45 percent flew above the RSA. For all other species, 91.18 percent flew below the RSA, 7.24 percent flew within the RSA, and 1.58 percent flew above the RSA (**Table 3**).

Unknown duck and unknown blackbird were the two highest non-raptors with encounter rates of 0.25 and 0.22 respectively (**Table 3**).

3.1.5 Sensitive Species Observations

Based on data gathered through February 24, 2017, two state special concern species (bald eagle and American white pelican (*Pelecanus erythrorhynchos*)) were observed during the avian surveys. Neither of these species are protected by the federal Endangered Species Act.

3.1.6 Flight Direction

Data gathered through February 24, 2017 indicated that birds were generally flying in variable directions (46.69 percent). Specific directions of flight and respective percentages are as follows: south (13.12 percent), southeast (8.83 percent), north (8.48 percent), southwest (7.07 percent), west (6.27 percent), east (4.20 percent), northwest (3.22 percent), and northeast (2.12 percent) (**Table 3**).

3.1.7 Incidental Surveys

Based on data gathered through February 24, 2017, staff documented six species and a total of 22 individual incidental observations. One species, a single northern pintail (*Anas acuta*), was detected during incidental surveys, but not during the point count surveys. See **Table 4** below.

Table 2: Palmer's Creek Incidental Observations

Species	Obs	Indv
Red-tailed Hawk	11	11
Turkey Vulture	4	6
Bald Eagle	2	2
Northern Harrier	1	1
Northern Pintail	1	1
American Kestrel	1	1
TOTAL	**20**	**22**

3.2 EAGLE USE SURVEYS

Surveys are being conducted once a month during the non-migration months (April-August), surveys are conducted at a minimum of twice a month during the migration months (September-March) starting July 2016 and concluding in June 2017. There will be 20 survey weeks in total. Individual surveys consist of a 1-hour observation period at each of the eight point-count locations during each week of the surveys, for a total of 160 hours of observations. Surveys occur in all weather conditions except when visibility is poor. These surveys are conducted outside of the 20-minute avian point count surveys.

Eagle use surveys, conducted through February 24, 2017, documented 11 bald eagles with 37 flight minutes, and 91 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River (Wenck 2017).

3.3 RAPTOR AND EAGLE NESTS

An aerial (fixed-wing) raptor/eagle nest survey will be conducted in April 2017 that will encompass a 10-mile buffer of the proposed wind farm. For any nests observed, the following will be recorded: GPS location, approximate nest height, nest substrate, nest size, actively used or non-use, and species using nest.

3.4 ACOUSTIC BAT SURVEYS

The data collected from Fagen was sent to NCE, who processed the data in zero-crossing through Kaleidoscope (Ver. 3.1.8) to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing estimates of species occurrences, distribution and relative abundance.

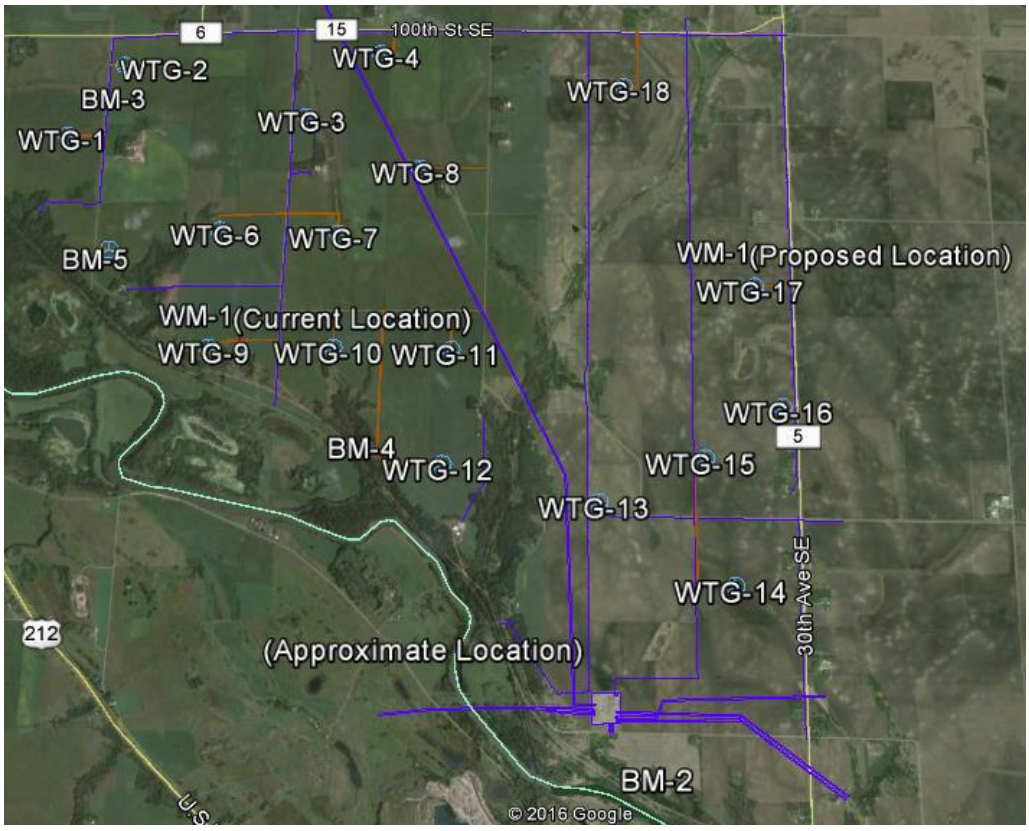


Figure 3. Bat Monitor (BM) Locations. BM-1 is not shown on the map but lies next to BM-2.

Bat Monitors (BM) 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May 2016. Monitors 3-5 were added in September 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016, then removed on October 15. Monitor 3, Monitor 4 and Monitor 5 were deployed on August 3, 2016 then removed on October 15, 2016. The monitors were deployed for 287 trap nights.

From the five (5) Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

There was a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The tricolored bat, also known as the eastern pipistrelle (*Pipistrellus sublavus*) was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for Monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study area. However no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six-species documented, the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus*

fuscus) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*). See **Appendix C** for the entire *Interim Acoustic Bat Summary Report.*

Bat acoustic surveys will continue through the 2017 season.

4.0 Discussion and Impact Assessment

4.1 DISCUSSION

The avian community currently detected within project area during the point count surveys is characterized by species associated with typical mid-western agricultural lands and mixed-grass prairie vegetation. The majority of project area and vicinity has been developed for agricultural use, specifically row crops such as corn, sunflower, and soybeans with additional developed lands devoted to pastureland. Within disturbed habitats such as these, the greatest potential impact of wind facilities to avian species is risk of collisions with turbines. Mean avian fatality rates estimated from wind facilities in the Midwest (NE, WI, MN, and IA) range from 0.44 to 11.83 birds/turbine/year (0.49 – 7.17 birds/MW/year; Tetra Tech 2012). Palmer's Creek bird fatalities are estimated to fall within this range.

4.2 RAPTOR USE AND ENCOUNTER RATE

Survey data gathered through February 24, 2017 totaled 60 individual raptors observed for a mean use of 0.33 raptors/20 minute (**Table 3**). This rate was compared to a study of 37 other wind energy facilities that implemented similar protocols. The raptor annual mean use at these wind-energy facilities ranged from 0.09 to 2.34 raptors/20 min survey. Based on the results from these wind energy facilities, as summarized by Derby et al. 2010, a ranking of seasonal raptor mean use was developed: low (0-0.5 raptors/20 min. survey); low to moderate (0.5-1.0 raptors/20 min); moderate (1.0-2.0 raptors/20 min); high (2.0-3.0 raptors/20 min); and very high (> 3.0 raptors/20 min). Under this ranking, the current mean raptor use in the project area is considered low.

Encounter rate analysis may also suggest which species may be at risk to become turbine casualties. The encounter rate is an index and only considers probability of exposure based on abundance, number of individuals flying, and flight height of each species within the RSA for turbines to be used at the wind-energy facility.

Raptor encounter rates in the project area are considered moderate, based on 17 of 60 individuals observed flying within the RSA/20 minute during the surveys (**Table 3**). Approximately 28.33 percent of all raptor observations were within the RSA. The highest raptor encounter rate was red-tailed hawk with 0.15 individuals flying within the RSA/20 min. Turkey vulture was second with an encounter rate of 0.07 individuals flying within the RSA/20 min, followed by bald eagle, 0.05 individuals flying within the RSA (**Table 3**).

High numbers of raptor fatalities have been documented at wind-energy facilities (e.g. Altamont Pass); however other studies at wind-energy facilities in the United States found that 3.2 percent of the total casualties were raptors (Erickson et al. 2001). Results from Altamont Pass in California suggest that species mortality is not all related to abundance (Orloff and Flanery 1992). Based on species occurrence/abundance and encounter rates within the Palmer's Creek project area during the surveys, turkey vultures, red-tailed hawks and bald eagles may be at highest collision risk with the Project.

High raptor use (greater than 2.0 birds/20 min) has been associated with high raptor fatality at wind farms (Strickland et al. 2011). Conversely, raptor fatality appears to be low when raptor use is low (less than 1.0 birds/20 min; Strickland et al. 2011), which is the

case for raptor use in the project area. Currently the project area has a raptor use of 0.33 birds/20 min (**Table 3**).

Turkey vultures and red-tailed hawks were the raptor species with the highest mean use and were also among the most frequently detected raptor species in the project area. Both species are commonly associated with agricultural and grassland habitats which provide opportunities for foraging, and activity associated with susceptibility to turbine-collisions (Thelander et al. 2003). In a recent study of raptor response to wind farms, red-tailed hawks were observed engaging in high-risk behaviors at operational wind facilities (Garvin et al. 2011). Results from post-construction fatality monitoring studies indicate that red-tailed hawks are frequently found as turbine-related fatalities (228 records of red-tailed hawk from 27 studies – Tetra Tech 2012; Jain 2005, Grodsky and Drake 2011, Johnson and Erickson 2011). However, Garvin et al. (2011) documented that red-tailed hawks, despite high-risk behavior, also demonstrated collision avoidance behavior (Garvin et al. 2011). Thus, risk of turbine-related fatalities in the project area exists for red-tailed hawks, but turbine-related fatalities would be expected to be low given the moderate level of use and no nests currently detected within the Palmer's Creek project area. Project-related fatalities of red-tailed hawk, should they occur, are unlikely to population-level impacts because red-tailed hawks are common nationwide (Sauer et al. 2011). Turkey vultures are also very common nationwide and Project-related fatalities, should they occur, would not have population-level impacts.

4.3 NON-RAPTOR USE AND ENCOUNTER RATE

Migratory bird species in the United States are protected by the Migratory Bird Treaty Act (MBTA). Passerine species have been the most abundant bird fatality at wind energy facilities outside California (Erickson et al. 2001 and Erickson et al. 2002), often comprising more than 80 percent of the bird fatalities. Both migrant and resident passerine fatalities have been observed (Erickson et al. 2001 and Erickson et al. 2002). Passerines make up a large proportion of the birds observed during the avian surveys in the project area and would be expected to make up the largest proportion of fatalities. Encounter rates indicate that the unknown duck (*Anatidae sp.*), unknown blackbird (*Turdus sp.),* red-winged blackbird, American crow, and ring-billed gull (*Larus delawarensis*) are likely to be exposed to collisions from wind turbines in the project area (**Table 3**). The red-winged blackbird is commonly found as a turbine-related fatality (more than 20 records of post-construction fatality from 27 studies; Tetra Tech 2012, Johnson et al. 2000, Howe et al. 2002, TRC Environmental 2008, Gruver et al 2009, BHE Environmental 2010, Jain et al. 2011, Grodsky and Drake 2011). Thus, risk of turbine-related fatalities of red-winged blackbird, and perhaps other at risk non-raptors in the project area, should they occur, are unlikely to have population-level impacts because collision fatalities appears to have little effect on North American land bird populations (Arnold and Zink 2011).

There were other species that flew through the RSA during the PC surveys, but their frequency of occurrence and overall numbers were not high enough to warrant significant collision exposure (**Table 3**).

4.4 LISTED AND SENSITIVE SPECIES RISK

The sensitive species observed in the project area are summarized in Section 3.6. No federally listed threatened, endangered or candidate species were observed during the surveys to date. Based on data gathered through February 24, 2017, two state special

concern species (bald eagle and American white pelican (*Pelecanus erythrorhynchos*)) were observed during the avian surveys. None of these species are protected by the federal Endangered Species Act.

As of February 24, 2017, eagle use surveys documented 11 bald eagles with 37 flight minutes, and 91 percent of the individuals were flying within the RSA. Most of these eagles have been observed within one mile of the Minnesota River (Wenck 2017). Monitoring of eagle activity will continue into summer 2017, the results of the survey will be analyzed once the surveys have been completed.

4.5 ACOUSTIC BAT SURVEYS

There was a total of six bat species documented throughout the course of the surveys (Fall 2015 and Fall 2016). Three species of concern in the state of Minnesota were observed during the acoustic bat monitoring (tricolored bat, big brown bat, and little brown bat). The northern long-eared bat is a federally threatened species with a species range that includes the majority of the eastern United States, extending west through Minnesota to the western borders of the Dakotas. No confirmed documentation of the northern long-eared bat in the project area was recorded during the Fall 2015 to Fall 2016 acoustic bat monitoring (see **Appendix C**).

Bats typically utilize farm buildings and dead and dying trees with cavities and loose bark as roosting and maternity habitat. Bats typically use forests, riparian corridors and wetlands as feeding habitats due to higher nocturnal insect densities in these areas. There is minimal native vegetation that serves as wildlife habitat within the project area near direct areas of Project impact. There are bats in the project area and some wind turbine collision bat mortality is likely to occur because of the Project. Compared to birds, less is known about bat populations and habitat preferences on a local, regional or national level. Bat mortality is likely to be greatest for migratory tree bat species, including hoary, eastern red and silver-haired bats during the fall migration period (Johnson 2005, Arnett et al. 2008).

5.0 Conclusions

It appeared that birds were using specific areas near the project site, especially along the Minnesota River. Strong associations with topographic features along the Minnesota River were noted for raptors or other large avian species. The Minnesota River appears to be a flyway or concentration area for migrating avian species.

Data collected through February 24, 2017 suggest an overall low impact in the project area on the local avian community as compared to other upper Midwest wind farms. The low mean-use rate in the project area is primarily due to few common residents and migratory species. Raptor use was low for each raptor species detected. Although there is potential for turbine-related fatalities of unknown ducks, unknown blackbirds, red-winged blackbirds, American crow, ring-billed gulls, red-tailed hawks, and turkey vultures, fatalities are not expected to have population-level impacts. If avian fatality rates are similar to other wind facilities within the region, it is estimated the Project would result in fatality rates between 0.44 – 11.83 birds/turbine/year (0.49 – 7.17birds/MW/year).

Assuming the general relationship between bat activity and bat mortality observed at other sites is broadly applicable to similar locations, levels of turbine-related bat mortality at the Palmer's Creek Wind Farm is estimated to be on the lower end of the spectrum, and similar with others in the region.

No federally-listed endangered, threatened, or candidate species were observed within the project area. However, two state special concern species (bald eagle and American white pelican) were observed during the avian surveys. No historical bald eagle nests are within the project area. All migratory avian species are protected by the Migratory Bird Treaty Act of 1918.

The data, information and conclusions presented in this report are considered preliminary findings. Once field surveys are completed for the Project, additional data and information will be incorporated into a final report. This will require updating conclusions and other information as currently presented.

6.0 References

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fieldler, B. I. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, R. D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. Journal of Wildlife Management. 72: 61-78.

Arnold, T.W., and R.M Zink. 2011. Collision mortality has no discernible effect on population trends of North American Birds. PLOS ONE 6: e24708. Doi:10.1371/journal.pone.0024708.

BHE Environmental., Inc. 2010. Post-Construction bird and Bat Mortality Study: Cedar Ridge Wind Farm, Fond Du Lac County, Wisconsin. Interim Report prepared for Wisconsin Power and Light, Madison, Wisconsin. Prepared by BHE Environmental, Inc. Cincinnati, Ohio. February 2010.

Derby, C., T. Thorn, K. Bay. 2010. Wildlife Baseline Studies for the Highmore Wind Resource Area, Hughes, Hyde and Hand Counties, South Dakota. Technical Report prepared by West, Inc. for NextEra Energy, Juno Beach, FL.

Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, K.J. Sernka, and R.E. Good. 2001. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to other Sources of Avian Collision Mortality in the United States. National Wind Coordination Committee Publication. http://www.national wind.org/pubs/default.htm

Erickson, W.P., G. Johnson, D. Young, D. Strickland, R. Good, M. Bourassa, K. Sernka. 2002. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared by WEST, Inc., for Bonneville Power Administration, Portland, Oregon.

Erickson, W.P., G.D. Johnson, and D.P. Young Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191.

Garvin, J.C., Jennelle, C.S., Drake, D. and Grodsky, S,M. (2011), Response of raptors to a windfarm. Journal of Applied Ecology, 48: 199-209.

Grodsky, S.M. and D. Drake. 2011. Assessing Bird and Bat Mortality at the Forward Energy Center. Final Report. Public Service Commission (PSC) of Wisconsin. PSC REF#:152052. Prepared for Forward Energy LLC. Prepared by Department of Forest and Wildlife Ecology, University of Wisconsin-Madison, Madison, Wisconsin. August 2011.

Gruver, J., M. Sonnenburg, K. Bay, and W. Erickson. 2009. Post-Construction Bat and Bird Fatality Study at the blue Sky Green Field Wind Energy Center, Fond Du Lac County, Wisconsin July 21 – October 31, 2008 and March 15 – June4, 2009. Unpublished

report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. December 17, 2009.

Howe, R.W., W. Evans, and A.T. Wolf. 2002. Effects of Wind Turbines on Birds and Bats in Northeastern Wisconsin. Prepared by University of Wisconsin-Green Bay, for Wisconsin Public Service Commission and Madison Gas and Electric Company, Madison, Wisconsin. November 21, 2002. 104 pp.

Jain, A.A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. Thesis submitted to Iowa State University, Ames IA. 133 pgs.

Jain, A.A., R.R. Koford, A.W. Hancock, and G.G. Zenner. 2011. Bat Mortality and Activity at a Northern Iowa Wind Resource Area. Am. Mid. Natur. 165: 185-200.

Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, and D.A. Shepherd. 2000. Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western Systems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp. http://www.west-inc.com.

Johnson, G.D., and W.P. Erickson. 2011. Avian Bat and Habitat Cumulative Impacts Associated with Wind Energy Development in the Columbia Plateau Ecoregion of Eastern Washington and Oregon. Prepared by WEST, Inc. for Klickitat County, Washington.

MNDNR. 2016. Natural Heritage Information System Correspondence #ERDB 20160322-0002, July 5, 2016.

New Century Environmental, LLC (NCE). 2017. Acoustic bat summary report; Palmer's Creek Wind Farm. *Interim* Technical Report prepared by NCE for Fagen, Inc.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2011. The North American Breeding Bird Survey, Results and Analysis 1966 – 2010. Version 12.07.2011 USGS Patuxent Wildlife Research Center, Laurel, MD.

Tetra Tech. 2012. Database of publicly available post-construction fatality rates and records of bird and bat fatality at North American wind projects. Unpublished report.

Thelander, C.G., K.S. Smallwood, and L. Rugge. 2003. Bird Risk Behaviors and Fatalities at the Altamont Pass Wind Resource Area: Period of Performance: March 1988-December 2000.

Thompson, W. L. 2002. Towards Reliable Bird Surveys: Accounting for Individuals Present but not Detected. Auk 119:18-25

TRC Environmental Corporation. 2008. Post-Construction Avian and Bat Fatality Monitoring and Grassland Displacement Surveys at the Judith Gap Wind Energy Project. 45 pgs.

U.S. Fish and Wildlife Service (USFWS). 2013. Eagle Conservation Plan Guidance: Land-based Wind Energy (Vers. 2). April 2013. Available online:

http://www.fws.gov/windenergy/PDF/Eagle%20Conservation%20Plan%20Guidance-Module%201.pdf.

Whitworth, D., S. H. Newman, T. Mundkur, and P. Harris. 2007. Wild Birds and Avian Influenza: an introduction to applied field research and disease sampling techniques. FAO Animal Production and Health Manual, No. 5. Rome. (also available at http://www.fao.org/docrep/010/a1521e/a1521e00.HTM)

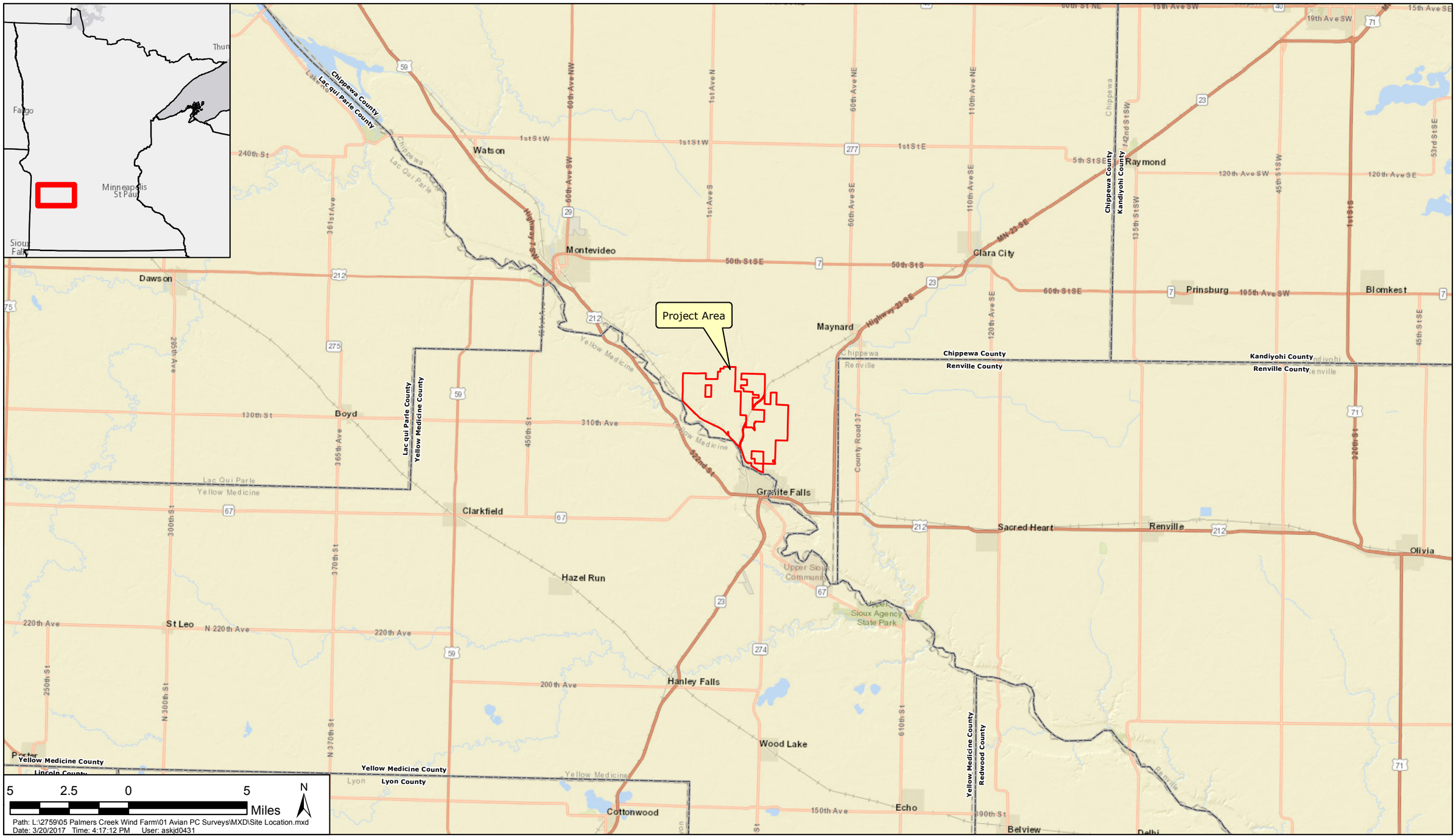
Wenck. 2017. Palmer's Creek Wind Farm, LLC.: Avian Point Count Survey Preliminary Results. February 24, 2017.

Appendix A-Tables

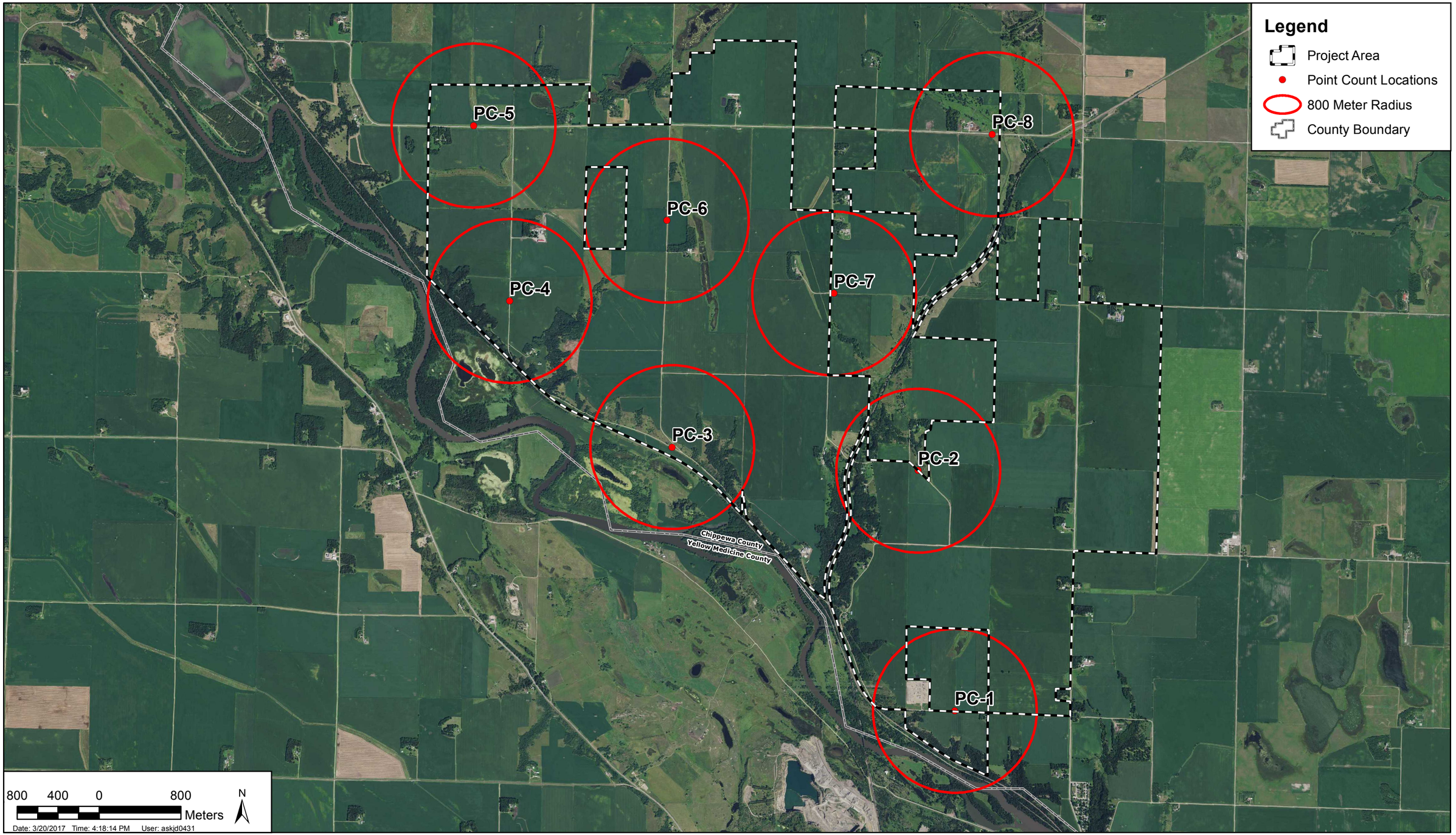
Table 3. Palmer's Creek Cumulative Point Count Data
Survey #1 (6/29/16) - Survey #23 (2/24/17)

Species	Group	Obs	Ind	Fly	Mean Use per 20 min	Percent Composition	No. Surveys Species Observed	Frequency (% Surveys)	Proportion Ind. Flying	Proportion Ind. Flying Below RSA	Proportion Ind. Flying Within RSA	Proportion Ind. Flying Above RSA	Encounter Rate	N	NE	E	SE	S	SW	W	NW	Var
European Starling	SB	15	438	384	2.38	15.02%	5	2.72%	87.7%	100.0%	0.0%	0.0%	0.00	8.1%	0.0%	0.0%	0.0%	11.5%	0.0%	0.0%	0.0%	80.5%
American Crow	C	44	323	127	1.76	11.08%	25	13.59%	39.3%	81.9%	18.1%	0.0%	0.13	22.8%	2.4%	0.0%	15.7%	11.8%	7.9%	0.8%	13.4%	25.2%
Red-winged Blackbird	SB	27	270	258	1.47	9.26%	27	14.67%	95.6%	89.9%	10.1%	0.0%	0.14	0.4%	1.6%	0.0%	20.9%	19.0%	14.7%	0.4%	0.0%	43.0%
Brown-headed Cowbird	SB	20	239	203	1.30	8.20%	19	10.33%	84.9%	100.0%	0.0%	0.0%	0.00	5.9%	0.0%	0.5%	7.4%	9.4%	26.1%	23.6%	6.9%	20.2%
Barn Swallow	SB	22	180	180	0.98	6.17%	22	11.96%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	98.9%
American Goldfinch	SB	34	132	132	0.72	4.53%	32	17.39%	100.0%	98.5%	1.5%	0.0%	0.01	9.8%	1.5%	34.8%	11.4%	18.9%	6.1%	2.3%	0.8%	14.4%
Blue Jay	SB	41	114	66	0.62	3.91%	32	17.39%	57.9%	100.0%	0.0%	0.0%	0.00	9.1%	15.2%	16.7%	6.1%	12.1%	10.6%	15.2%	6.1%	9.1%
Snow Bunting	SB	6	109	109	0.59	3.74%	0	0.00%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	15.6%	0.0%	0.0%	15.6%	0.0%	18.3%	0.0%	50.5%
Rock Pigeon	PD	28	105	105	0.57	3.60%	18	9.78%	100.0%	98.1%	1.9%	0.0%	0.01	22.9%	0.0%	11.4%	0.0%	1.9%	0.0%	11.4%	13.3%	39.0%
Wild Turkey	GB	5	93	0	0.51	3.19%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Field Sparrow	SB	33	84	51	0.46	2.88%	33	17.93%	60.7%	100.0%	0.0%	0.0%	0.00	7.8%	0.0%	3.9%	0.0%	3.9%	3.9%	2.0%	0.0%	78.4%
Canada Goose	WF	8	71	65	0.39	2.43%	7	3.80%	91.5%	46.2%	0.0%	53.8%	0.00	1.5%	0.0%	0.0%	13.8%	56.9%	27.7%	0.0%	0.0%	0.0%
Dark-eyed Junco	SB	9	70	70	0.38	2.40%	5	2.72%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	5.7%	7.1%	87.1%
Unknown Duck	WF	5	60	46	0.33	2.06%	3	1.63%	76.7%	0.0%	100.0%	0.0%	0.25	30.4%	0.0%	0.0%	69.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Black-capped Chickadee	SB	12	58	54	0.32	1.99%	7	3.80%	93.1%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	3.7%	0.0%	0.0%	14.8%	0.0%	0.0%	81.5%
Horned Lark	SB	11	57	50	0.31	1.95%	10	5.43%	87.7%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	30.0%	0.0%	50.0%	0.0%	20.0%
Unknown Blackbird	SB	1	40	40	0.22	1.37%	1	0.54%	100.0%	0.0%	100.0%	0.0%	0.22	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unidentified Sparrow	SB	4	35	34	0.19	1.20%	0	0.00%	97.1%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	97.1%
Common Grackle	SB	7	32	32	0.17	1.10%	7	3.80%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	12.5%	3.1%	6.3%	59.4%	15.6%	0.0%	3.1%	0.0%
American Robin	SB	16	29	17	0.16	0.99%	16	8.70%	58.6%	100.0%	0.0%	0.0%	0.00	11.8%	0.0%	5.9%	23.5%	11.8%	11.8%	0.0%	17.6%	17.6%
Red-tailed Hawk	RVO	24	27	25	0.15	0.93%	17	9.24%	92.6%	56.0%	24.0%	20.0%	0.03	16.0%	0.0%	4.0%	24.0%	24.0%	12.0%	8.0%	4.0%	8.0%
Mourning Dove	PD	15	25	19	0.14	0.86%	15	8.15%	76.0%	100.0%	0.0%	0.0%	0.00	42.1%	0.0%	15.8%	0.0%	5.3%	5.3%	31.6%	0.0%	0.0%
Ring-billed Gull	GT	6	25	25	0.14	0.86%	6	3.26%	100.0%	32.0%	68.0%	0.0%	0.09	0.0%	0.0%	0.0%	4.0%	8.0%	0.0%	8.0%	12.0%	68.0%
Common Yellowthroat	SB	12	22	0	0.12	0.75%	12	6.52%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Cedar Waxwing	SB	6	21	19	0.11	0.72%	6	3.26%	90.5%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	42.1%	36.8%	21.1%	0.0%	0.0%	0.0%	0.0%
Yellow Warbler	SB	4	20	13	0.11	0.69%	3	1.63%	65.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Ring-necked Pheasant	GB	10	19	6	0.10	0.65%	6	3.26%	31.6%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American Tree Sparrow	SB	2	19	18	0.10	0.65%	2	1.09%	94.7%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Clay-colored Sparrow	SB	12	16	0	0.09	0.55%	12	6.52%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Northern Flicker	WP	6	15	15	0.08	0.51%	6	3.26%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	26.7%	0.0%	20.0%	33.3%	20.0%	0.0%	0.0%	0.0%
Western Meadowlark	SB	3	14	14	0.08	0.48%	3	1.63%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	50.0%	35.7%	0.0%	14.3%	0.0%	0.0%
Turkey Vulture	RVO	9	12	12	0.07	0.41%	9	4.89%	100.0%	33.3%	50.0%	16.7%	0.03	0.0%	0.0%	25.0%	33.3%	8.3%	0.0%	16.7%	0.0%	16.7%
Tree Swallow	SB	5	12	12	0.07	0.41%	5	2.72%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Bank Swallow	SB	1	12	12	0.07	0.41%	1	0.54%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Downy Woodpecker	WP	11	11	8	0.06	0.38%	9	4.89%	72.7%	100.0%	0.0%	0.0%	0.00	12.5%	0.0%	12.5%	25.0%	12.5%	12.5%	25.0%	0.0%	0.0%
Killdeer	SH	7	10	5	0.05	0.34%	7	3.80%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Vesper Sparrow	SB	6	10	0	0.05	0.34%	6	3.26%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bald Eagle	RVO	8	10	9	0.05	0.34%	6	3.26%	90.0%	11.1%	33.3%	55.6%	0.02	0.0%	33.3%	0.0%	44.4%	11.1%	0.0%	0.0%	0.0%	11.1%
Savannah Sparrow	SB	1	8	0	0.04	0.27%	0	0.00%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Chipping Sparrow	SB	7	8	4	0.04	0.27%	7	3.80%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Song Sparrow	SB	5	7	0	0.04	0.24%	5	2.72%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Eastern Bluebird	SB	2	6	6	0.03	0.21%	2	1.09%	100.0%	100.0%	0.0%	0.0%	0.00	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	83.3%	0.0%
Swainson's Hawk	RVO	4	5	3	0.03	0.17%	3	1.63%	60.0%	66.7%	33.3%	0.0%	0.01	0.0%	0.0%	0.0%	33.3%	33.3%	33.3%	0.0%	0.0%	0.0%
Mallard	WF	2	5	0	0.03	0.17%	2	1.09%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Least Flycatcher	SB	4	5	1	0.03	0.17%	4	2.17%	20.0%	100.0%	0.0%	0.0%	0.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sedge Wren	SB	5	5	0	0.03	0.17%	5	2.72%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American White Pelican	WB	1	4	4	0.02	0.14%	1	0.54%	100.0%	0.0%	100.0%	0.0%	0.02	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
Rough-legged Hawk	RVO	3	4	4	0.02	0.14%	2	1.09%	100.0%	25.0%	25.0%	50.0%	0.01	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Eastern Wood-Pewee	SB	3	3	0	0.02	0.10%	3	1.63%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Eastern Kingbird	SB	2	3	1	0.02	0.10%	2	1.09%	33.3%	100.0%	0.0%	0.0%	0.00	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Belted Kingfisher	SB	2	2	1	0.01	0.07%	2	1.09%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Snow Goose	WF	1	2	2	0.01	0.07%	1	0.54%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%
Grasshopper Sparrow	SB	2	2	0	0.01	0.07%	2	1.09%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Yellow-headed Blackbird	SB	2	2	1	0.01	0.07%	2	1.09%	50.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Northern Harrier	RVO	1	1	1	0.01	0.03%	0	0.00%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
American Kestrel	RVO	1	1	1	0.01	0.03%	1	0.54%	100.0%	100.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%
Wilson's Snipe	SH	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bobolink	SB	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Willow Flycatcher	SB	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Marsh Wren	SB	1	1	0	0.01	0.03%	1	0.54%	0.0%	0.0%	0.0%	0.0%	0.00	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
		547	**2,916**	**2,264**	**15.85**	**100.0%**			**77.6%**				**0.96**	**8.48%**	**2.12%**	**4.20%**	**8.83%**	**13.12%**	**7.07%**	**6.27%**	**3.22%**	**46.69%**

Appendix B-Figures



FAGEN ENGINEERING	WENCK ASSOCIATES Responsive partner. Exceptional outcomes.	MAR 2017
Site Location Map		Figure 1



Path: L:\2759\05 Palmers Creek Wind Farm\01 Avian PC Surveys\MXD\Point Count Locations.mxd

FAGEN ENGINEERING

Point Count Locations

WENCK ASSOCIATES

Responsive partner. Exceptional outcomes.

MAR 2017

Figure 2

Appendix C- Interim Acoustic Bat Summary Report

FAGEN, INC.

GRANITE FALLS, MINNESOTA

Palmer's Creek Wind Farm

Acoustic Bat Summary Report

2017

NEW CENTURY ENVIRONMENTAL LLC

Environmental Compliance and Stewardship made Cost Effective

NEW CENTURY ENVIRONMENTAL LLC, COLUMBUS, NE

Table of Contents

List of figures

Palmer's Creek WRA Acoustic Bat Monitoring Study
Fagen, Inc.
Granite Falls, Minnesota

Prepared By
New Century Environmental, LLC.
Columbus, Nebraska

Executive Summary

In early summer of 2016, Mike Rutledge of Fagen Engineering contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies, which was done through acoustic monitoring. The client proposed to develop a wind farm within the study area of Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. Staff of Fagen Engineering deployed five separate ANABAT systems to record bat activity throughout the study area, the first deployment was done with two of the ANABAT recorders during the fall of 2015 and continued through 15 October 2016. Three more ANABAT recorders were launched on 03 August, 2016. The data collected from Fagen Engineering was sent to NCE via Procore Portal. NCE then took the data and processed in zero-crossing through Kaleidoscope version 3.1.8 to confirm presence diversity and abundance of bat species. The software uses a presence/absent indicator by giving each species of bat a p-value. The lower the p-value, the more likely the species of bat is present. Bat presence, in the form of vocalization, was detected, identified by species, and catalogued, thereby allowing us to estimate species occurrences, distribution and relative abundance.

Introduction

In early summer of 2016, Mike Rutledge of Fagen Engineering, LLC contacted Mike Gutzmer of New Century Environmental, LLC (NCE) to aid in the effort of completing a bat report that would capture the diversity/abundance of bat species within the study area of Palmer's Creek to meet due diligence with regulatory agencies. The client proposed to develop a wind farm in Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). Bat fatalities result from wind turbine strikes as they feed on insects at night. The heat from the wind turbines attract insects and therefore bring the bats close to the wind turbine. With decreasing bat populations, the gathering of necessary bat data is crucial for this proposed site. Threatened and Endangered bat species become at risk in wind farm areas. Populations of bat species are experiencing long-term declines, due in part to habitat loss and fragmentation, invasive species, and numerous anthropogenic impacts, increasing the concern over the potential effects of energy development. All studies of bat impacts have demonstrated that fatalities peak in late summer and early fall, coinciding with the migration of many species (Johnson 2005; Kunz et al. 2007a; Arnett et al. 2008). A smaller spike in bat fatalities occurs during spring migration for some species at some facilities (Arnett et al. 2008). However, the seasonal fatality peaks noted above may change as more facilities are developed and studied.

Study Area

The study area is located within Chippewa County, Minnesota (just north across the Minnesota River from Granite Falls). The study area lies within the Des Moines Lobe Western Corn Belt Plains (47b) ecoregion of Minnesota. This ecoregion consists of fast fertile plain of deep soils dominated by row crops. The boundaries of the Minnesota River Prairie Subsection coincide with large till plains flanking the Minnesota River. The unit is bounded to the southwest by the Prairie Coteau. A series of moraines define the eastern boundary, the Alexandria Moraine to the northeast and the Bemis moraine to the southeast (Minnesota 2016).

The Minnesota River Prairie is a large subsection that includes part of northwestern Iowa and spreads across southwestern Minnesota into eastern South Dakota. The Minnesota River forms a broad valley, dividing the area in half. This valley once had a continuous band of floodplain forest that extended upstream as far as Lac Qui Parle, with highly unique bedrock exposures. There are 150 lakes larger than 160 acres in the subsection, most of which are shallow. Before settlement by people of European descent, the predominant vegetation was tallgrass prairie and wetlands. Fire was once a common natural disturbance and critical to maintaining native prairie communities (Minnesota, 2016).

Today, row-crop agriculture is the predominant land use, and prairie remnants and floodplain forests are rare. A major concern is impacts on water quality from intensive agricultural activities, including use of fertilizers and pesticides, expanding use of pattern tiling, and ditching and draining of small wetlands. Continued loss of the small amount of native upland habitat and over-intensive grazing remain a concern (Minnesota, 2016).

Figure 1: Vicinity map of study area. Chippewa county is located in southwestern Minnesota.

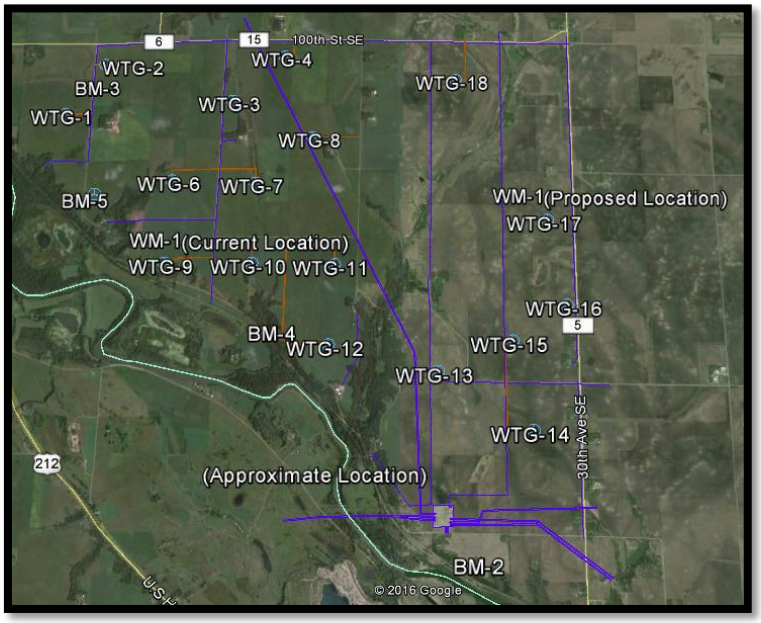


Figure 2: Project location along with bat monitor (BM) locations. BM-1 is not shown on the map but lies next to BM-2.

Methods

Data was gathered in the field by Fagen Engineering, LLC within the study area from five different Anabat acoustic recorders (map in Study Area section shows locations of monitors). Monitors 1 & 2 gathered data throughout the fall of 2015 and were deployed again in May of 2016. Monitors 3-5 were added in September of 2016.

Monitors 1 & 2 were deployed on September 13, 2015 and removed on October 11, 2015. They were deployed again on April 12, 2016 then removed on October 15. Monitor 3, monitor 4 and monitor 5 were deployed on August 3rd, 2016 then removed on October 15th, 2016. The monitors were deployed for 287 trap nights

The data was uploaded through the Procore portal where New Century Environmental staff could access the data to download and process through a program called Kaleidoscope Pro version 3.1.8. The Kaleidoscope classifier uses a source library of user submitted reference calls to compare to recordings. It accepts and displays full-spectrum signals, to match with the calls known bat species. The software uses a presence/absence indicator by giving each species of bat a p-Value of 0 to 1. The lower the P-Value, the more likely the species is present. Variability in the quality of recordings and variations in calls among individual bats creates challenges to acoustic bat classification.

Kaleidoscope Pro has been approved by the U.S. Fish & Wildlife Service for use for presence/absence analysis for Indiana bats (*Myotis sodalis*). Similarly, the approved programs may also be used for presence/absence analysis for northern long-eared bats (*Myotis septentrionalis*). The U.S Geological Survey also tested acoustic matching programs and Kaleidoscope Pro passed their standard validation process (USFWS 2016).

Results

From the five Anabat recording systems, 232,116 sound files were recorded. Visual examination and filtering of files to eliminate extraneous noise (e.g., wind, insects, etc.) resulted in a total of 14,442 bat detections.

Monitor 1 recorded 3,181 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 62% of total detections. The big brown bat was the second most common being 13% of total detections. The federally threatened northern long-eared myotis was detected 4 times (0.001%), but had a P-value of 1 which almost certainly means it was nonexistent at this site. The eastern pipistrelle had a total of 55 (2%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1971
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	427
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	347
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	158
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	219
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	4
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	55

Figure 3: Summary of species diversity and abundance for monitor 1.

Monitor 2 recorded 3,004 files that Kaleidoscope Pro was able to classify as bat passes. The silver haired bat was the most common species at this site being 57% of total detections. The second most common was the hoary bat at 30% of detections. The federally threatened northern long eared myotis only had a total of 2 (0.0007%) detections but had a P-value of 1. The eastern pipistrelle had a total of 14 (0.005%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	1717
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	167
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	887
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	165
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0.14	52
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	2
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0.01	14

Figure 4: Summary of species abundance and diversity for monitor 2

Monitor 3 recorded 4,870 files that Kaleidoscope Pro was able to classify as bat passes. The hoary bat was the most common species at this site being 75% of total detections. The second most common was the silver haired bat being 8% of total detections. The northern long eared bat had only 1 (0.0002%) detections with a p-value of 1. The eastern pipistrelle had a total of 64 (1%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0.34	401
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	263
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	3672
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	306
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	163
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	1
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	64

Figure 5: Summary of species diversity and abundance for monitor 3

Monitor 4 recorded 1,512 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver-haired bat being 46% of total detections. The second most common was the hoary bat being 26% of total detections. The northern long-eared myotis was not recorded at this site. The eastern pipistrelle had a total of 59 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	688
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	143
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	390
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	129
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	103
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	0
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	59

Figure 6: Summary of species diversity and abundance for monitor 4

Monitor 5 recorded 1,875 files Kaleidoscope Pro classified as bat passes. The most common species at this site was the silver haired bat being 46% of total detections. The second most common was the hoary bat with being 21%) of total detections. The northern long-eared myotis had a total of 2 (0.001%) detections. The eastern pipistrelle had a total of 70 (4%) detections.

Code	Common name	Scientific Name	Conservation status	P-Value	# of passes
LANO	Silver-Haired Bat	*Lasionycteris noctivagans*	Least concern	0	871
EPFU	Big-Brown Bat	*Eptesicus fuscus*	Least concern	0	316
LACI	Hoary Bat	*Lasiurus cinereus*	Least concern	0	403
LABO	Eastern Red Bat	*Lasiurus borealis*	Least concern	0	138
MYLU	Little Brown Bat	*Myotis lucificus*	Least concern	0	75
MYSE	Northern long-eared myotis	*Myotis septentrionalis*	Federally threatened	1	2
PESU	Eastern pipistrelle	*Perimyotis subflavus*	MN species of concern	0	70

Figure 7: Summary of species diversity and abundance for monitor 5.

Discussion

There are seven species of bats that occur regularly in Minnesota; our most common species, the little brown myotis, occurs over most of North America. Along with the Northern myotis and big brown bat, it hibernates in Minnesota caves and mines. In summer, they roost in caves, mines, hollow trees, and buildings. Large groups of these bats hang upside-down in caves. The eastern pipistrelle is the smallest species, weighing only two-tenths of an ounce. It is found in the same Minnesota caves and mines, though it is less common and in fewer numbers.

The silver-haired bat and Eastern red bad are forest dwellers that usually live near water and feed among the trees. Usually a red bat pair will repeatedly fly the same route in search of food. Another woodland species is the hoary bat. It is the largest Minnesota bat, weighing an ounce or more. All three species are somewhat solitary, roost in trees, and migrate south for the winter (Minnesota, 2016).

In early July 2016, a species previously not known to be native to Minnesota, the evening bat, was discovered. Researchers from the DNR Nongame Wildlife Program and Central Lakes College were conducting a survey as part of a project to study summer breeding habits of the state's forest bats. The bat was captured at the Minnesota Army National Guard's Training Site in Arden Hills.

All seven bat species that occur in Minnesota may be found throughout the state.

Common name	Scientific Name	State Status	Federal Status
Northern long-eared myotis	*Myotis septentrionalis*	Threatened	Threatened
Eastern Pipistrelle	*Pipistrellus subflavus*	MN species concern	Not listed
Little brown bat	*Myotis lucifugus*	Not listed	Not listed
Big brown bat	*Eptesicus fuscus*	Not listed	Not listed
Silver-haired bat	*Lasionycteris noctivagans*	Not listed	Not listed
Eastern red bat	*Lasiurus borealis*	Not listed	Not listed
Hoary bat	*Lasiurus cinereus*	Not listed	Not listed
Evening bat	*Nycticeius humeralis*	Newly discovered	Not listed

Figure 8: Bat species found in Minnesota with federal and state conservation status.

There were a total of six bat species documented throughout the course of the study (September-October 2015 and 2016). The eastern pipistrelle (*Pipistrellus sublavus)* was documented at this site and is listed as a species of concern in the state of Minnesota. It was detected in small numbers but was found at every monitor except for monitor 1. The northern long-eared myotis (*Myotis septentrionalis*) is a federally threatened species whose home range lies within the study site. However no confirmed documentation was recorded here. Even though a total of five clicks of which Kaleidoscope classified as MYSE (northern long-eared myotis) the P-value was given a 1 for every monitor indicating the likelihood of presence is near non-existent. All other species documented are of least concern. Of the six species documented the silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*) and big brown bat (*Eptesicus fuscus*) were among the most common followed by the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*).

References

Arnett, E. B., W. K. Brown, W. P. Erickson, J. K. Fiedler, B. I. Hamilton, T. H. Henry, A. Jain, G. D. Johnson, J. Kerns, R. R. Koford, C. P. Nicholson, T. J. O'Connell, M. D. Piorkowski, R. D. Tankersley Jr. 2008. Patterns of Bat Fatalities at Wind Energy Facilities in North America. *Journal of Wildlife Management*. 72: 61-78.

Johnson, G.D. 2005. A review of bat mortality at wind-energy developments in the United States. *Bat Research News*. 46: 45-49.

Kunz, T. H., E. B. Arnett, W. P. Erickson, A. R. Hoar, G. D. Johnson, R. P. Larkin, M. D. Strickland, R. W. Thresher, and M. D. Tuttle. 2007a. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology & the Environment*. 5: 315–324.

Minnesota Department of Natural Resources, 2006. Tomorrow's Habitat for the Wild and Rare: An Action Plan for Minnesota Wildlife, Comprehensive Wildlife Conservation Strategy. Division of Ecological Services, Minnesota Department of Natural Resources.

US Fish and Wildlife Service. 2016. Endangered Species Midwest Region. Accessed on 7 November 2016 at <https://www.fws.gov/midwest/Endangered/mammals/inba/surveys/inbaAcousticSoftware.html>.

Appendix

Summary Graphs

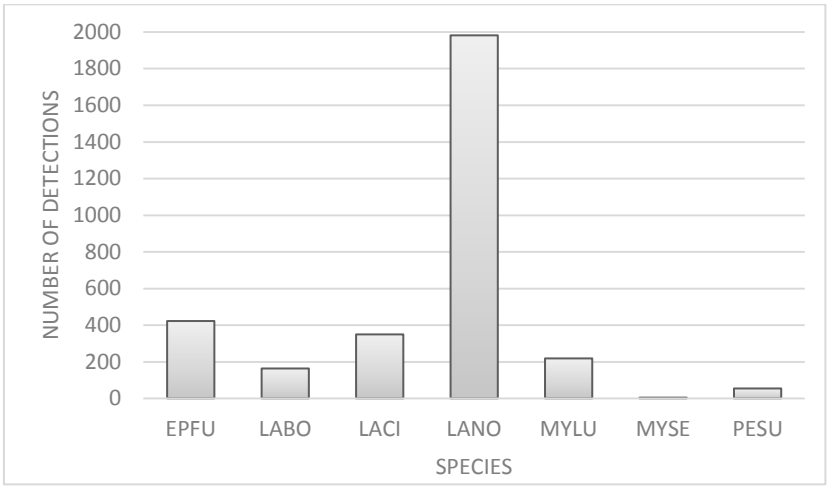


Figure 9.1: Total number of bat detections by species for monitor 1

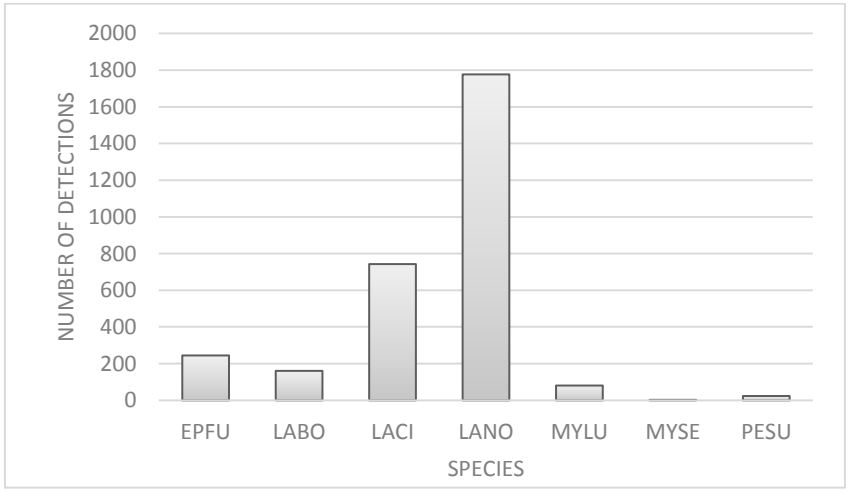


Figure 9.2: Total number of bat detections by species for monitor 2

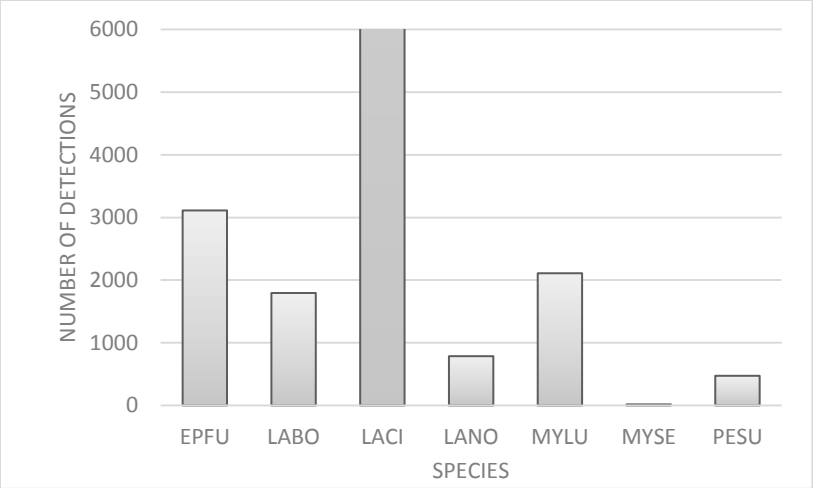


Figure 9.3: Total number of bat detections by species for monitor 3

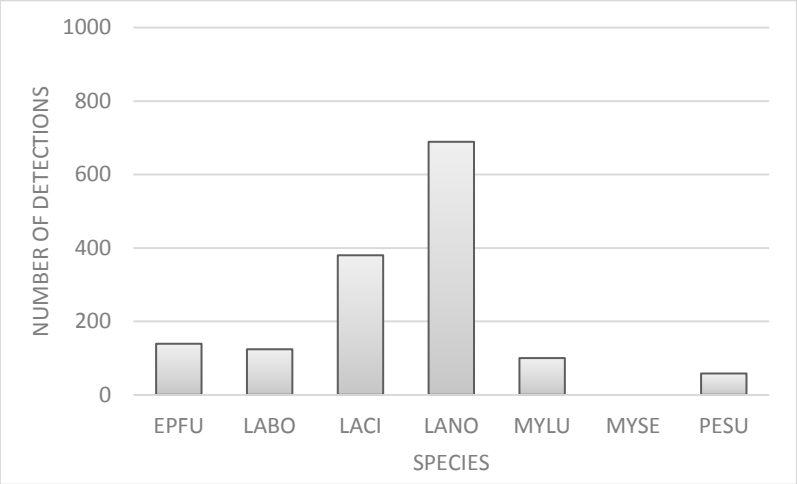


Figure 9.4: Total number of bat detections by species for monitor 4

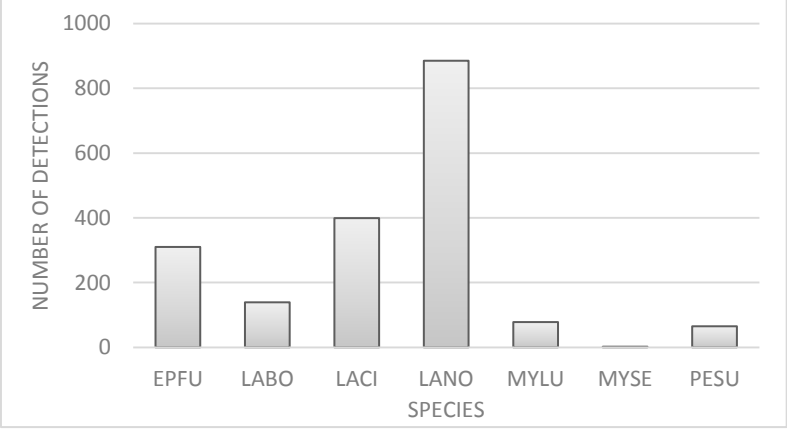


Figure 9.5: Total number of bat detections by species for monitor 5

Kaleidoscope Data

KALEIDOSCOPE 3.1.8

Bats of North America 3.1.0 S/A:+1

Monitor 1			
	Species	Detections	Presence p-value
Fall 2015	EPFU	123	0.95
	LABO	41	0
	LACI	144	0
	LANO	725	0
	MYLU	45	0
	MYSE	0	1
	PESU	10	0
5/28/2016	EPFU	118	0.77
	LABO	34	0
	LACI	104	0
	LANO	670	0
	MYLU	39	0
	MYSE	0	1
	PESU	8	0
9/2/2016	EPFU	91	0
	LABO	46	0
	LACI	53	0
	LANO	194	0
	MYLU	96	0
	MYSE	2	1
	PESU	23	0
10/7/2016	EPFU	92	0
	LABO	34	0
	LACI	38	0
	LANO	377	0
	MYLU	39	0
	MYSE	0	1
	PESU	14	0
10/15/2016	EPFU	3	0.33
	LABO	3	0
	LACI	8	0
	LANO	5	0.46
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 2			
	Species	Detections	Presence p-value
Fall 2015	EPFU	33	0.22
	LABO	31	0
	LACI	38	0
	LANO	148	0
	MYLU	15	0
	MYSE	1	1
	PESU	0	1
5/28/2016	EPFU	9	1
	LABO	8	0
	LACI	29	0
	LANO	167	0
	MYLU	9	0
	MYSE	0	1
	PESU	2	0.08
9/2/2016	EPFU	108	1
	LABO	84	0
	LACI	631	0
	LANO	1085	0
	MYLU	20	0
	MYSE	1	1
	PESU	9	0.01
10/7/2016	EPFU	17	1
	LABO	41	0
	LACI	189	0
	LANO	313	0
	MYLU	8	0.14
	MYSE	0	1
	PESU	3	0.33
10/15/2016	EPFU	0	1
	LABO	1	0.10
	LACI	0	1
	LANO	4	0
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0 S/A:+1

Monitor 3			
	Species	Detections	Presence p-value
9/2/2016	EPFU	2	1
	LABO	0	1
	LACI	208	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	0	0
10/7/2016	EPFU	260	0
	LABO	303	0
	LACI	3463	0
	LANO	399	1
	MYLU	163	0
	MYSE	1	1
	PESU	69	0
10/15/2016	EPFU	1	0.77
	LABO	3	0
	LACI	1	0.09
	LANO	2	0.34
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

Monitor 4			
	Species	Detections	Presence p-value
9/2/2016	EPFU	96	0
	LABO	82	0
	LACI	309	0
	LANO	289	0
	MYLU	85	0
	MYSE	0	1
	PESU	34	0
10/7/2016	EPFU	46	1
	LABO	47	0
	LACI	84	0
	LANO	397	0
	MYLU	18	0
	MYSE	0	1
	PESU	25	0
10/15/2016	EPFU	1	0.69
	LABO	0	1
	LACI	0	1
	LANO	2	0.16
	MYLU	0	1
	MYSE	0	1
	PESU	0	1

KALEIDOSCOPE 3.1.8
Bats of North America 3.1.0 S/A:+1

Monitor 5			
	Species	Detections	Presence p-value
9/2/2016	EPFU	130	0
	LABO	79	0
	LACI	162	0
	LANO	427	0
	MYLU	58	0
	MYSE	2	1
	PESU	40	0
10/7/2016	EPFU	186	0
	LABO	58	0
	LACI	239	0
	LANO	444	0
	MYLU	17	0
	MYSE	0	1
	PESU	27	0
10/15/2016	EPFU	1	1
	LABO	0	0.61
	LACI	2	0
	LANO	0	1
	MYLU	0	1
	MYSE	0	1
	PESU	3	0

Species Descriptions

Silver Haired Bat

The silver-haired bat (*Lasionycteris noctivagans*) is a solitary migratory species and the only member of the genus *Lasionycteris*. They are found in Bermuda, Canada, Mexico and the United States. They often roost in tree cavities or in bark crevices on tree trunks, especially during migration. This medium-sized bat is mostly black (including the wings, ears, interfemoral membrane, and fur) with white-tipped hairs. The basal upper half of its tail membrane is densely furred. This gives the bat a frosted appearance for which it is named. This species has a flattened skull with a broad rostrum. This species weighs around 8–12 g, has a total length of ~100 mm, a tail length of 40 mm, and a forearm length of 37–44 mm. Silver-haired bats consume primarily soft-bodied insects, such as moths, but will also take spiders and harvestmen. This species will forage low, over both still and running water, and also in forest openings. Silver-haired bats are slow but maneuverable flyers that typically detect prey only a short distance away. In addition to the hoary bat (*Lasiurus cinereus*) and eastern red bat (*Lasiurus borealis*), the silver-haired bat is one of the three tree bat species most commonly killed at wind energy facilities (over 75% of the mortalities).

Big Brown Bat

The big brown bat (*Eptesicus fuscus*) is native to North America, Central America, the Caribbean, and extreme northern South America. This medium-sized bat ranges from 10–13 cm in body length, with a wingspan 28-33, and weighs between 14-16 g. The fur is moderately long and shiny brown. The wing membranes, ears, feet, and face are dark brown to blackish in color. Big brown bats roost during the day in hollow trees, beneath loose tree bark, in the crevices of rocks, or in man-made structures such as attics, barns, old buildings, eaves and window shutters. Big brown bats are insectivorous, eating many kinds of night-flying insects including moths, beetles, and wasps.

Hoary Bat

The hoary bat (*Lasiurus cinereus*) is a species of bat in the vesper bat family, Vespertilionidae. It occurs throughout most of North America and much of South America. The hoary bat averages 13-14.5 cm long with a 40 cm wingspan and a weight of 26 g. Its coat is dark brown and the hairs on the back are frosted with silver. The body is covered in fur except for the undersides of the wings. This species normally roosts alone on trees, hidden in the foliage, but on occasion has been seen in caves with other bats. It prefers woodland, mainly coniferous forests, but hunts over open areas or lakes. It hunts alone and its main food source is moths. The bat is migratory and may travel from Canada as far south as the southern United States or Bermuda.

Eastern Red Bat

The eastern red bat (*Lasiurus borealis*) is widespread across eastern North America, with additional records in Bermuda. This is a medium-sized bat, averaging weights of 9.5-14 g and measurements of 112.3 mm in total length. Adults are usually dimorphic: males have red hair while females are chestnut-colored with whitish frosting on the tips of the fur. Moths form the majority of the diet, but red bats also prey on beetles, flies, and other insects.

Eastern Pipistrelle

The Eastern Pipistrelle (*Perimyotis subflavus*) is found commonly in the eastern portion of the United States, but extends into southeastern Nebraska. This reddish, yellowish and brownish bat is one of the smallest bats in the eastern part of the US. The forearms are orange to red while the wing membrane is black. Adults weigh between 4-10g and reach a forearm length of 30-35mm. These bats feed on small insects on the edges of forested areas, rivers, streams or open water.

Little Brown Bat

The Little Brown Bat (Myotis lucifigus) is found throughout much of North America. It is most common in the northern half of the continental United States and Southern Canada. The bat's fur is dark brown and glossy on the back with slightly paler, greyish fur underneath. Wing membranes are dark brown on a typical wingspan of 22–27 cm. Ears are small and black with a short, rounded tragus. Adult bats are typically 6–10 cm long and weigh 5–14g. Since many of their preferred meals are insects with an aquatic life stage, such as mosquitoes, they prefer to roost and forage near water.

Responsive partner.
Exceptional outcomes.

Toll Free: 800-472-2232 **Email: wenckmp@wenck.com** **Web: wenck.com**

	MINNESOTA		COLORADO	GEORGIA	NORTH DAKOTA	SOUTH DAKOTA	WYOMING
Maple Plain	Golden Valley	New Hope	Denver	Roswell	Fargo	Pierre	Cheyenne
763-479-4200	763-252-6800	800-368-8831	602-370-7420	678-987-5840	701-297-9600	605-222-1826	307-634-7848
	Windom	Woodbury	Ft. Collins		Mandan		Sheridan
	507-831-2703	651-294-4580	970-223-4705		701-751-3370		307-675-1148
					Dickinson		
					877-810-3248		